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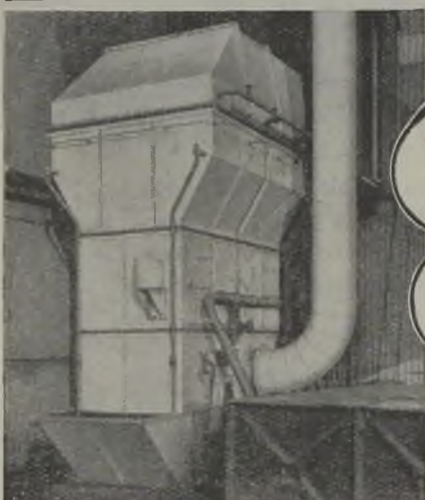

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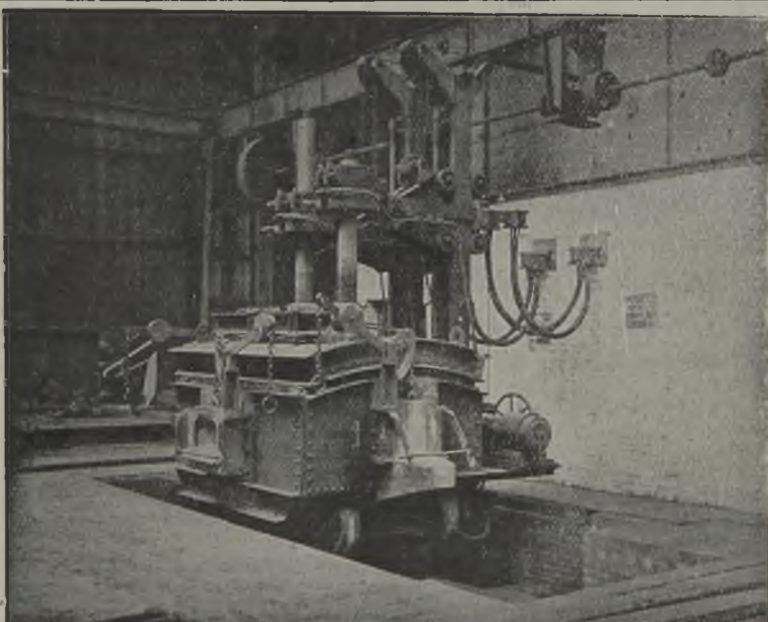

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The fact that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export

FOUNDRY TRADE JOURNAL
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Vol. 74 Thursday, October 5, 1944 No. 1468

"Metamorphobia"

This is a new type of bacillus which is ravaging many sections of the foundry industry. Its cause is attributable to the progress which the Allies are making against the enemy, and can best be described as a persistent itch for many changes. Manufacturers are fed up manufacturing austerity equipment which nobody neither likes nor wants. They learn of model houses carrying well-finished, vitreous enamelled fitments of all kinds, whilst they are largely tied down to black equipment. This was imposed by Government order to save a few man-hours of manufacturing time whilst wasting many weeks yearly in maintenance and simultaneously wasting fuel through the loss of insulating properties. There is an itch to find one really competent authority which can give an "O.K." for worth-while schemes for such obviously urgent problems of rehabilitating London's battered suburbs, and so to change this constant reference to so many departments. There is a feeling abroad that standardisation is delaying rather than accelerating output in the production of builders' castings, as the volume of repair work is so pressing, as it includes spare parts for making good existing models of every type of household equipment.

As to the shortage of man-power, it is common gossip that many sections of armament industry are only working at half pressure, and many workers could be usefully transferred to the foundries needing labour for re-equipping damaged property. Moreover, we doubt if the essential raw materials are in short supply, except fuel. Being what is to our mind first priority after the needs of the fighting forces have been supplied, fuel should be made available for this purpose. Put plainly, any builder, builders' merchant or foundry concern which can make a contribution to the rapid repair of houses or their re-equipment with stoves, cookers, boilers, gas or electric irons, and sanitary equipment, should be given every facility to get on with the job. Improvisation was necessary after Dunkirk to put our armaments in some sort of order, standardisation and mass-production came later. A similar state of affairs exists to-day in so far as housing is concerned. This is well realised by every foundry owner, and that is why they are suffering from "Metamorphobia"—the itch to change the present chaotic conditions.

U.S.A. TO IMPORT SOUTH AFRICAN CORUNDUM

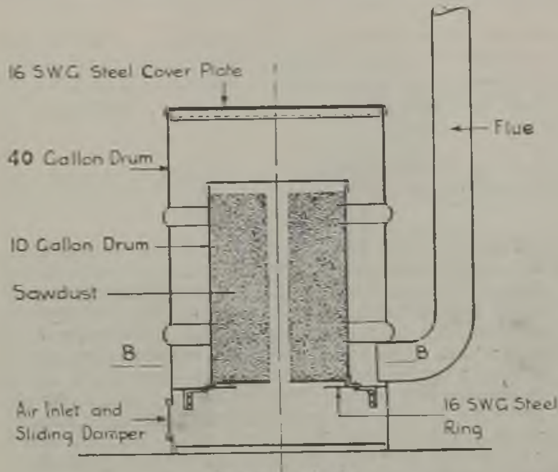
The American War Production Board reports plans to increase tonnages of corundum from South Africa. Recent investigations in the South African area indicated that present production levels for the abrasive material can be raised only by new prospecting campaigns and improved mining and concentrating operations. Average monthly shipments from South Africa during the first half of 1944 did not increase materially and were consistently inadequate for industry's requirements. The Foreign Economic Administration has a programme designed to obtain increased production, and is sending an engineer to South Africa to assist in carrying out its plans.

Consumption figures for primary corundum grains were presented. These showed the reduced percentage consumed by the grinding wheel industry, and the increased percentage of usage by the optical industry. Short stocks of grinding wheel grain have not permitted the granting of all requests for allocations. Total superfine flour stocks indicate an apparently easy position. However, a breakdown of these stocks into three size groups shows that the medium sizes, in greatest demand by the optical industry, continue to be in relatively short supply. A relatively easy position exists only with respect to those sizes not in great demand. Garnet fines continued to afford relief in the field of superfine flour. Approximately 7 per cent. of industry's requirements are being supplied in the form of garnet fines.

Contents

IRONFOUNDRY FUEL NEWS—XXIII

A few months ago reference was made in one of these articles to a heating stove designed to burn sawdust. As the supply position of coal is not likely to be any better this winter than previously, and coke may well be distinctly in shorter supply, it is believed that founders may be interested in more details about a stove which consumes a fuel which is readily obtainable by many firms. Fig. 1 illustrates the two-drum



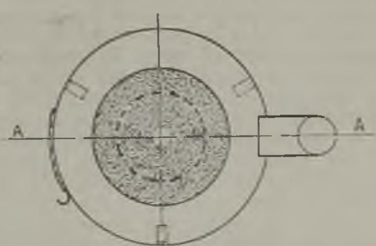


FIG. 1.—TWO-DRUM SAWDUST STOVE.

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sawdust stove which, it will be seen, consists chiefly of two empty oil drums. The smaller removable drum, with the top cut out and a 2-in. hole cut in the centre of the base, rests on a supporting ring inside the larger drum which is fitted with a removable cover. This cover plate has an asbestos gasket, and should be capable of being fixed or held down firmly. An adjustable air inlet below the supporting ring and a stove pipe just above it complete the stove.

(*Continued at foot of next column.*)

INSTITUTE CALENDAR

MEETINGS FOR OCTOBER

Lincoln Section and East Midlands Branch.—Visit to the Works of Ruston & Hornsby, Limited, Lincoln. Presidential Address by A. Weightman. "Some Aspects of Modern Foundry Practice," by R. C. Shepherd. At the canteen of Ruston & Hornsby, Limited, Lincoln, October 7, at 6 p.m.

Scottish Branch.—Presidential Address by T. Tyrie, B.Sc. "Wartime Calls on Women to Make Aluminium Air-Cooled Cylinder Heads." Sound film by M. J. Gregory. At the Royal Technical College, George Street, Glasgow, October 14, at 3 p.m.

West Riding of Yorkshire Branch.—Presidential Address by J. Blakiston, A.M.I.Mech.E. "Mechanical Aids to Core Production," by J. Blakiston. At the Technical College, Bradford, October 14, at 6.30 p.m.

Sheffield Branch.—Presidential Address by E. Barron, entitled "Foundry Mindedness," followed by a discussion. At the Royal Victoria Hotel, Sheffield, October 23, at 7 p.m.

Falkirk Section.—"Methods and Problems Indigenous to a General Engineering Foundry," by Wm. Montgomery and J. Doig, Junr. At the Smoke Room, Temperance Café, Falkirk, October 27, at 7 p.m.

INDUSTRIAL BLACKOUT

We are anxious to receive from readers, either for publication or for our personal information only, their observations as to how local authorities are dealing with the question of industrial blackout. While it is difficult to achieve uniformity in this matter, readers' views would be appreciated.

(*Continued from previous column.*)

To prepare for lighting, a wooden rod or metal pipe, 2 in. dia., is held in the centre of the small drum which is then packed tightly with green sawdust. (An inch or two of dry sawdust in the bottom may facilitate lighting.) The rod is then removed and the drum stood on its supporting ring. The stove is lit by paper, shavings or paraffin rag, inserted through the air inlet, and burning quickly spreads to the whole inside surface of the hole. As the sawdust burns away the ash (a good fertiliser!) falls into the ashpit and the hole gradually increases in diameter. The stove gives out a considerable amount of heat, and will burn for about eight hours on one charge. If a spare inner drum is available it can, of course, be charged ready for the next day.

For those not wishing to make their own stoves, well-designed proprietary articles are obtainable. Names of suppliers will be given, on request, by the Fuel Officer, Ironfounding Industry Fuel Committee, Alvechurch, Birmingham.

SOME USEFUL WARTIME DEVELOPMENTS IN WHITEHEART MALLEABLE IRON*

Foundry problems in the production of whiteheart malleable castings

By G. R. WEBSTER, A.M.I.Mech.E., A.M.I.Mar.E.

The national emergency beginning in 1939 immediately created unusual demands for materials possessing properties akin to cast or forged steels, in quantities which could not be met at that time by the steel industry, either because of insufficient capacity or lack of certain raw materials. As the war ebbed and flowed for the Allies, and the armament demands became even greater, the problem of obtaining certain raw materials became more difficult.

The steel scrap, pig-irons, iron ore and core binders, to mention but a few, all caused their tribulations. It was surprising, nevertheless, how quickly solutions were found. The manufacture of various types of tank castings in considerable quantities from malleable iron kept a large part of the industry occupied.

* Paper read at the Forty-first Annual Meeting of the Institute of British Foundrymen.

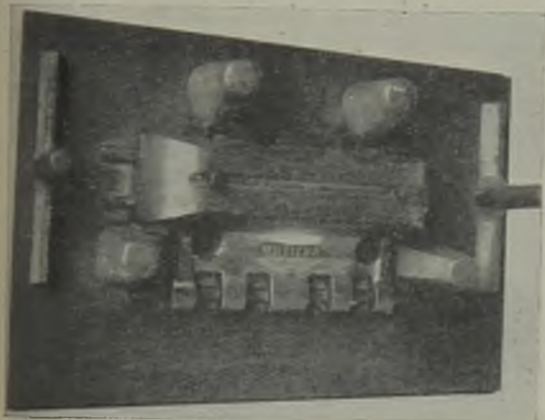

FIG. 1.—PATTERN PLATE FOR TRACK LINK.

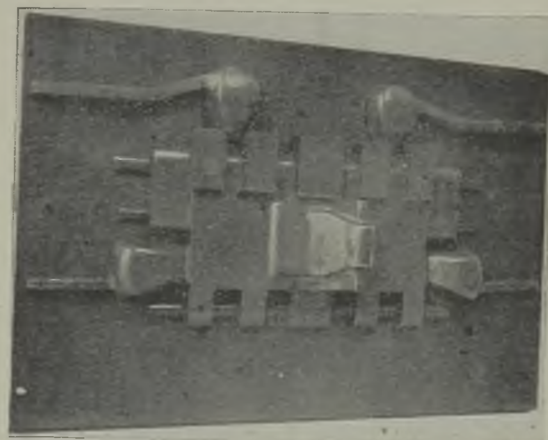

FIG. 2.—PATTERN PLATE FOR TRACK LINK.

FIG. 3.—DRAG MOULD FOR TRACK LINK.

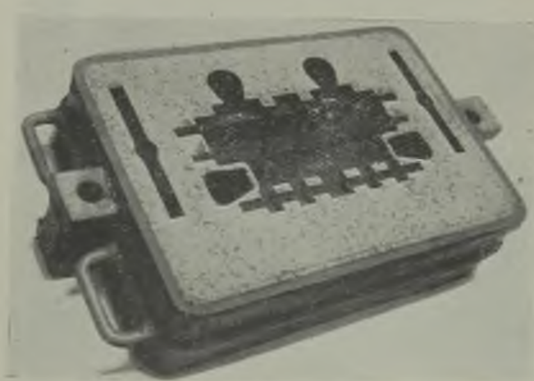

FIG. 4.—COPE MOULD FOR TRACK LINK.

FOUNDRY

The foundry problems in the production of whiteheart malleable track links are similar to those of other whiteheart malleable castings, the main difference being that whereas a large percentage of ordinary malleable castings are usually machined, the track links are not machined at all, with the exception of reamering out the pinholes. For this reason it is essential that the track links' dimensions do not vary except within very small limits, particularly the pitch distance (distance between pinholes) and the width of the male lugs and female lug recesses, so as to conform with the close tolerances required on the vehicles. The close control of the pitch distance is a most important factor for ensuring the correct length of the track on the wrap test, and finally on the vehicle.

Patterns and Coreboxes

For the above reasons, it has been deemed essential to produce very accurate patterns and coreboxes. All patterns and coreboxes have, therefore, been completely machined to a tolerance of $\pm$ 0.004 in., particularly those core prints which control the pitch distance. Patterns have been made in phosphor bronze, and the coreboxes in cast iron or mild steel.

As can be seen in Figs. 1 and 2, showing the pattern plates, the spaces between the female lugs were completely cored out and the core prints were extended over the casting so as to ensure that no flashes would occur in between any of the lugs, in order to reduce as much as possible the amount of fettling after annealing on those places. Each pattern half is mounted on a cast-iron plate with fixed dowel pins for the location of moulding boxes. Figs. 3 and 4 show both mould parts with the cores in position.

As Figs. 5, 7, 8 and 9 showing the various links complete with runners illustrate, the fins and flashes in each case occur away from the casting, leaving the

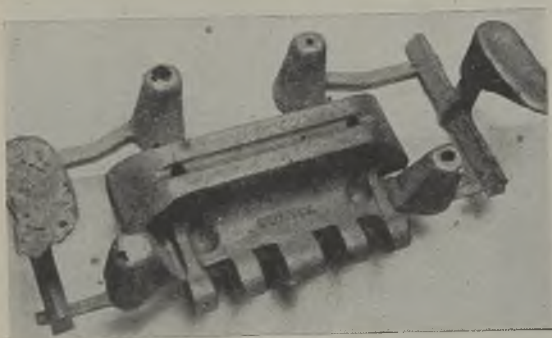

Fig. 5.—Track Link Complete with Runners.

Fig. 6.—Sectioned Track Link Showing Wall Thicknesses.

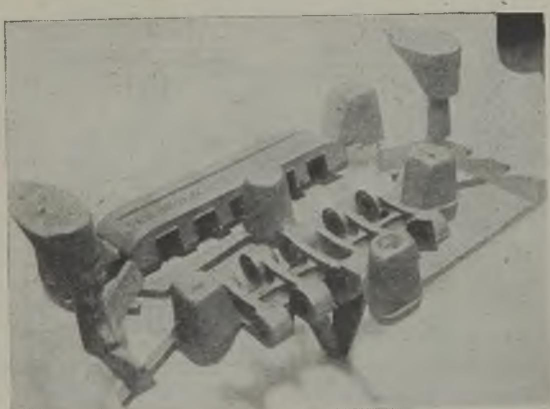

Fig. 7.—Another Type Track Casting.

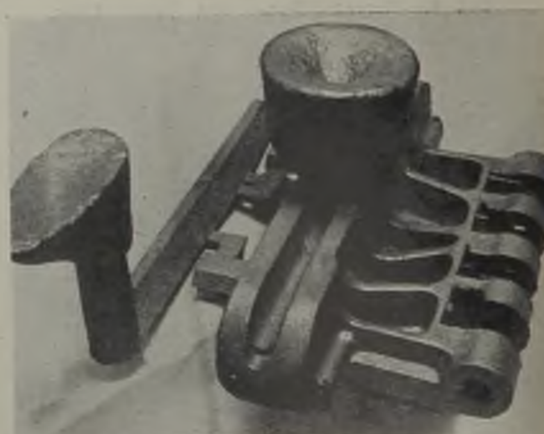

Fig. 8.—A Third Type of Casting.

spaces between the lugs clean. Fig. 5 shows the casting complete with runners. Fig. 6 is of the same casting sectioned, showing the wall thickness. The yield of castings to the total metal in the moulding box of the various links, as shown in Figs. 5, 7, 8 and 9, is as follows:—No. 5, 47.7; No. 7, 42.8; No. 8, 53.9, and No. 9, 44.6 per cent.

Moulding

The moulding of the track links is carried out on Nicholls jolt and squeeze moulding machines, two machines working in a team, and two moulders and one core setter per team. The core setter is also responsible for the assembly of the cope and drag parts of the moulds. The Nicholls jolt and squeeze moulding machines have been found ideal for the production of these various track links. Castings produced on these machines are very accurate, and the output per machine is very satisfactory. The machines are operated by compressed air of 80 lbs. per sq. in. pressure. Rolled steel moulding boxes are used.

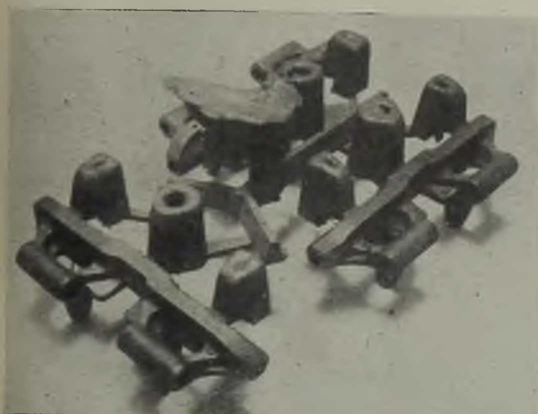

FIG. 9.—A FOURTH EXAMPLE OF TRACK CASTING.

FIG. 11.—A COMPLETE CORE SET ON ITS CARRIER.

Core Making

The majority of the cores for the various types of track links are made on blowing machines, with the exception of the cores for the guide horns for links in Figs. 7, 8 and 9, where it was found that hand-making of these cores was cheaper and almost as fast as blowing. For the majority of the blown cores, no core driers were essential, they were usually put on a flat steel plate standing on the core prints, for example, the cores produced from the corebox shown in Fig. 10.

The most difficult core for blowing was the main centre core, shown in Fig. 11, for the track link (Fig. 5). This corebox was made in four parts, as shown in Fig. 12.

For blowing, the part forming the spud was left off, which was subsequently pressed in the blown cores by

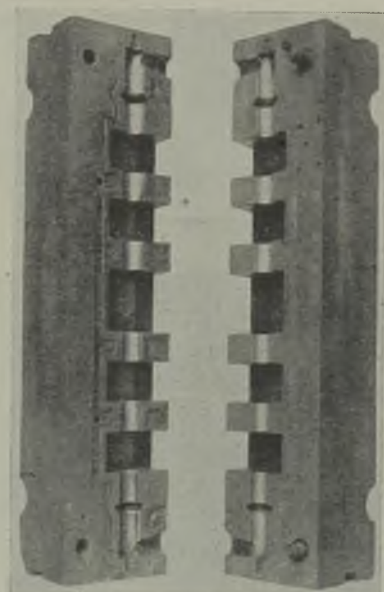

FIG. 10.—TYPICAL COREBOX IN USE.

FIG. 12.—A FOUR-PART COREBOX USED FOR MAKING THE CORE SHOWN IN FIG. 11.

Whiteheart Malleable Iron

lightly hammering in the plate. (Shown at the bottom right of Fig. 12.) These cores were dried on a core drier, as shown in Figs. 11 and 13.

Since almost the whole core is surrounded by metal, it was found essential to use coarse-grained silica sand with a high permeability in order to prevent blowholes. However, even this was not entirely satisfactory, and subsequently two small cylindrical cores (which can be seen in Fig. 3) were used through the spud connecting the main centre core with the mould, in a successful endeavour to provide an escape for the gases.

Cleaning of Links.—All links are shot-blasted on airless Wizard table type machines. With proper maintenance and operation these machines have been found very satisfactory, and give a considerably higher output than similar machines operated with compressed air.

FIG. 13.—CORE CARRIER.

FIG. 14.—TOWN'S GAS FIRED TUNNEL ANNEALING FURNACE.

Foundry Inspection.—After cleaning all links are first rough-fettled, that is, any flashes are removed. Subsequently the links are inspected, and only satisfactory castings are sent to be annealed. Daily, a percentage of links from each pattern are broken into small pieces in order to detect any shrinkage cavities.

Melting

The metal is melted in cupolas which are equipped with stationary receivers. The metal temperature (uncorrected, measured with an optical pyrometer) taken at the receiver spout, is between 1,400 and 1,430 deg. C. The chemical composition of the molten metal is controlled within the following limits:—T.C, 2.9 to 3.1; Si, 0.55 to 0.7; Mn, 0.25 to 0.3; S, 0.16 to 0.2, and P, 0.1 per cent. maximum. A typical cupola charge is as follows:—68 per cent. back scrap from foundry; 10 per cent. hematite or refined pig-iron; 1 per cent. ferro-silicon (13 per cent. Si), and 21 per cent. steel scrap.

Grinding.—All "flashes" are removed by grinding in the hard, unannealed state, whereas the runners and risers are ground after annealing.

FIG. 15.—ANNEALING OVEN PYROMETER CONTROL ROOM.

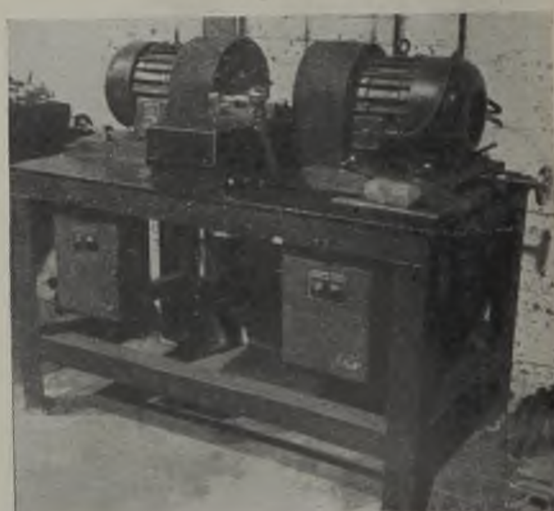

FIG. 16.—TYPE OF GRINDING MACHINE USED FOR ONE TYPE OF LINK.

Annealing

Fig. 14 shows a town's gas fired tunnel annealing oven, in which the various castings manufactured have been malleablised. The advantages of a tunnel type oven are manifold, particularly may be stressed, excellent uniformity and control, and low fuel consumption. The annealing is carried out at a temperature of 980 deg. C., and usually maintained for 80 to 100 hrs. at this temperature, according to the section of the castings. The ore ratio is varied between 1 to 5 and 1 to 8, again, according to casting section.

Fig. 15 is of the annealing oven pyrometer control room. In the control room are housed, on the left-hand side of the picture, Cambridge instruments, consisting of electrically operated "waste gas" drum chart CO_2 recorder. At the bottom centre is the several point recorder, each point recording on the chart in a different colour, with a small numbered and coloured dial, indicating which thermocouple is in circuit at any moment.

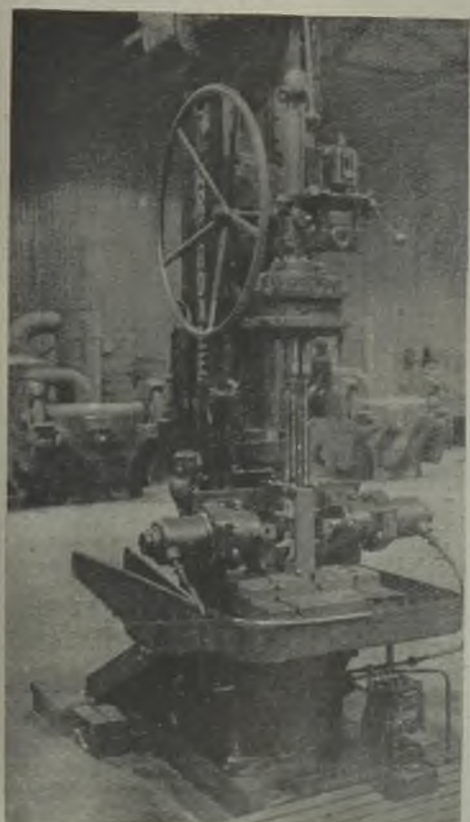

Fig. 17.—Air-operated Chucks are Used for Drilling Pinholes.

To the left and right of the above instruments are two multi-point indicators, incorporating a multi-point hand-operated switch for a series of thermocouples situated at different positions in the tunnel oven. On the right-hand side of the picture are seen "Kent curved tube manometers" indicating the flow of air and gas to each side of the oven. Above the manometers are situated Cambridge dial gauges for the air and gas pressures.

Grinding to Length

Fig. 16 shows the method that was finally adopted to grind one type of track link to the correct length. The casting is placed on a centring fixture mounted on a rack-operated table and the whole pushed between the two cup grinding wheels direct mounted on to two electric motors. By a slight backwards and forwards movement of the handle situated at the right of the casting fixture, the casting passes between the two cup wheels, grinding them to the exact length. This has

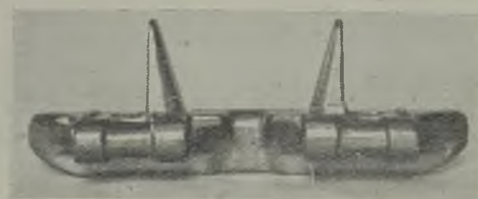

Fig. 18.—Casting which is Drilled Using Air Chucks.

Fig. 19.—A Second Example Where Air Chucks are Used for Drilling.

been found to be a quick and accurate method of controlling the length of the castings for the subsequent riveting operation.

Drilling Pinholes.—The pinholes are drilled out to give a good, free bearing surface for the pins; also, this ensures a regular flow of castings to the same accurate pitch. In Fig. 17, the air-operated chucks are seen on the table, open, on a multi-spindle head vertical machine with two castings of the type shown in Figs. 9, 18 and 19. The chucks are actuated by the air feed valve, foot operated.

(*To be continued.*)

DEVELOPMENTS IN AN AMERICAN FOUNDRY

The Crane Company, of Chicago, operates a steel-foundry and, like all other concerns, has been working at high pressure during the war period. Its activities have been described in "Steel" by Mr. E. F. Ross, the Chicago editor of that magazine. The steel turnings to be used in the basic electric steel furnace plant are graded, and the containers are given a definite colour in line with the material from which they came. After being ground, stringy turnings are placed in wire baskets which are spun at high speed to remove the oil. Each month thousands of gallons are thereby recovered.

For melting there are two 6-ton, a three and a ton capacity furnaces, which are top charged after swinging away the roof. An innovation is the use of water-cooled skimmers for freeing the bath from slag. A second one is the use of a pneumatic tube system for rapidly despatching bath samples to the laboratory and for receiving the test results.

THE FOUNDRIES OF H. J. MAYBREY & CO.

(*Continued from page* 94.)

foundry is concerned with the manufacture of sand castings. This foundry had to be installed on a bombed laundry site, and the conversion presented no small problem of reconstruction. A few months, however, saw a remarkable transformation, and with the assistance of many up-to-date mechanical devices, the foundry was launched on a greatly increased programme. While retaining its flair for coping with individual customer's requirements, the foundry is in a position to handle bulk production on a large scale.

Adjacent to the foundry is a pattern shop, the layout of which has been favourably commented upon by visitors. With the equipment on hand, any type of wood or metal pattern can be produced, often at extremely short notice. A Fordath mixer is in use for the preparation of core sand, while compressed air core sprayers are laid on at convenient points. The drying of cores is carried out in a battery of gas-fired batch-type ovens.

With the sand foundry at its present high level of production there exists, quite naturally, a healthy spirit of rivalry between the main foundries. This is encouraged by the management, and as a stimulus to general interest a graph, showing each foundry's monthly output, is issued for the employees' information.

Though by no means a wartime concern, the firm recognises the strong influence of present-day conditions, and accumulating experience will have a direct effect on their post-war enterprise. Trends and developments in the application of aluminium castings are carefully observed, and all the signs point to an ever widening market in which the management is confident their declared policy of "quality plus production" will stand them in good stead.

EQUIPMENT OF NORTHOLT DEMONSTRATION HOUSES

Several new features of interest to the light iron castings industry are incorporated in demonstration houses which have been erected at Northolt, Middlesex. Of the two brick terraced houses, one is an all-gas house and the other combines gas and coke. In the living room of the latter there is an open coke grate, which when banked up and the damper closed, is said to burn only 1 lb. of coke per hr., and last 6 hrs. without refuelling. When full out it consumes $1\frac{1}{4}$ lbs. per hr., and needs making up about every three hours. A gas poker for initial lighting is provided.

In the kitchen there is a coke boiler, which heats the annexe, and supplies hot water to the sink, bath and lavatory basin. Connected to this boiler is a gas circulator, for use in summer, when the coke boiler is not lighted. There is also a gas cooker with a hot plate fitted beside the cooker; a small instantaneous gas water heater on the sink for emergency use; a portable gas wash-boiler, to which a wringer can be attached, and a plug-in arrangement for a gas smoothing iron.

In the hall there is a recess and gas heater for background heating. The main bedroom has a hearth gas fire, and the two smaller ones panel gas fires. A plug-in point is provided for a gas boiling ring. In the all-gas house an innovation is a gas-heated linen cupboard. There are several other types of houses on exhibition, including two built with basic foam slag; two of the steel frame type; two from no fines concrete, and two using expanded clay.

NOTES FROM THE BRANCHES

Scottish Branch, Falkirk Section.—The new session opened on Friday last, at the Temperance Café, Lint Riggs, Falkirk, with the new president, Mr. Ronald R. Taylor, of Robt. Taylor & Company (Ironfounders), Limited, Larbert, in the chair. Mr. Arthur Grounds, B.Sc., presented a Paper on "Plastics and Their Possible Use as a Substitute for Cast Iron." Other Papers scheduled to take place before the end of the year are "Methods and Problems Indigenous to a General Engineering Foundry," by Mr. Wm. Montgomery and Mr. John Doig, Junr., of Levin, and "The Design and Testing of Space Heaters," by Mr. J. S. Hales, of the British Coal Utilisation Research Association.

CATALOGUE RECEIVED

Machining Qualities of Copper. The Enfield Rolling Mills, Limited, of Brimsdown, Enfield, Middlesex, have issued a 4-page leaflet to detail the properties of E.R.M. copper, especially as to its rapid machinability, whether as wrought material or as castings. Full technical data, illustrated by tables and a graph, are given to substantiate the claims made.

THE FOUNDRIES OF H. J. MAYBREY & COMPANY

Catering for individual needs and bulk production

Recently a party of some 30 representatives of the light alloys foundry trade made a tour of the works of H. J. Maybrey & Company, Limited. Many of the visitors were already acquainted with the type of aluminium castings produced, though perhaps previously unaware of the company's versatility. Others, to whom this concern was a comparatively new name, found the firm had actually been established for some 15 years.

The tour of inspection served to stress that everything possible was being done to ensure the maintenance of the highest quality of castings. A first-class casting is to be expected from a speciality foundry, where experiment and research are confined to a limited field, but it is another matter to maintain this standard when a wide variety of work is undertaken.

Two years ago, all manufacturing was carried out under one roof, but conditions were such that there was a continual striving to maintain its principles under ever-growing pressure of work. It was clear that the choice lay between expansion and explosion, and preference was given to the former. Thus a second foundry came into being, followed by a third, and each of these developed distinct characteristics. The original foundry, known as No. 1, is now reserved for gravity die-castings, the sand foundry having been transferred to one of the branch foundries. Each is, to a large extent, self-contained, though No. 1 includes the head offices, heat-treatment plant and X-ray apparatus.

The die foundry consists of a large central shop with more than 30 gravity dies in operation, fed by gas-fired furnaces. The expansion scheme gave the die foundry its long awaited "elbow room," and apart from increasing the production capacity, it provided an opportunity for a symmetrical layout, thereby adding to the operatives' comfort. Much attention has been paid to ventilation, with the result that very reasonable working conditions have been achieved.

Beyond the die foundry are the viewing and trimming shops, each divided by low brick-built walls to ensure that shift production is neatly segregated. A well planned system of fluorescent strip lighting

FIG. 1.—FRONT OF OFFICES.

FIG. 2.—THE PATTERN SHOP.

H. J. Maybrey & Company

enables the viewers and trimmers to work to the best advantage at all hours. At the rear of the building are situated the A.I.D. inspection, heat-treatment bay, X-ray department, and a well equipped metallurgical laboratory.

The heat-treatment section consists of a battery of standard EFCO cylindrical jet-type resistance furnaces, which, together with a Controlled Heat & Air Company installation, are sufficient to cope with all present heat-treatment requirements, at the same time allowing a margin for possible increase. While the X-ray plays a large part in routine examination, this is by no means considered its sole purpose of installation. Every high grade alloy casting has its "teething stages," and it is here that the assistance of X-ray photography has proved of the greatest value. The soundness of a casting can be judged immediately—virtually a while-you-wait service, invaluable to foundry technique and an undisputed time saver.

This section also houses the usual machinery for the testing of materials, among which is an Avery machine for recording the tensile and elongation properties of test-bars. Alongside the main building are situated the tool room, drawing office, maintenance department and canteen. The tool room has all the equipment necessary to turn out any type of gravity die, and undertakes the repair of those dies already in use.

A Special Training Centre

The various foundries are linked together by a regular van service. No. 2 foundry is close at hand, and comprises a small, compact building, devoted mainly to the training of new employees, who are eventually transferred to either the sand or die foundry as semi-skilled workers. When the lack of skilled operatives became acute, it was realised that both the type of worker obtainable and the firm itself, would benefit by the introduction of a training scheme, and with this object, No. 2 foundry came into being. It is best described as a foundry in miniature, containing its own melting furnaces, dies, core ovens, boxes, etc., and the trainees undergo instruction in all aspects of foundry practice relating to aluminium products.

An interesting feature of No. 2 is the power-driven, drum-type riddle used for the treatment of dross and skimmings derived from the main factories. The riddle was designed by Mr. R. White, the general manager, whose prototype has already been marketed by Molineux (Foundry Equipment), Limited. The No. 3

(*Continued on page* 92, *column* 1.)

FIG. 3.—SECTION OF THE DIE FOUNDRY.

FIG. 4.—THE X-RAY DEPARTMENT.

SPEED OF ROTATION IN THE CENTRIFUGAL CASTING PROCESS*

Review of conditions of rotational speed in various types of centrifugal casting processes

By J. E. HURST, D.Met.

The term "centrifugal casting" is understood to refer to those processes in which the castings produced are subjected to rotation during the time that they solidify. A more precise classification has been suggested by Briggs,[1] Research Director of the Steel Founders' Society of America, as follows:—(*a*) True centrifugal casting; (*b*) semi-centrifugal or profiled centrifugal casting; (*c*) pressure casting. True centrifugal casting is performed by pouring the molten metal into rotating moulds. A number of different processes are in commercial operation involving rotation about the vertical, inclined, or horizontal axis, and utilising permanent (usually metal) or sand moulds. In general, in such castings solidification takes place from the outside towards the inside surface of the casting. The classification "semi-centrifugal or profiled casting" embraces those processes used for the production of castings not formed by centrifugal force alone. For example, castings in which the inner surfaces are formed by cores. The moulds and cores used may be either metal or sand and, as in true centrifugal casting, the axes of rotation may be either vertical, inclined or horizontal. The third classification of pressure casting refers to the methods used for the production of asymmetrical castings which cannot be spun about their own axis. The moulds, which may be either permanent or sand, are arranged to allow of metal being introduced into a gate at the centre of rotation, ingates being provided to distribute the molten metal to the mould cavities. In this method centrifugal action is relied upon to force the molten metal into the moulds and, as in the previous cases, the process may operate about any axis.

These classifications cover quite a wide variety of commercially-developed processes operating in the production of castings in cast irons, steels and non-ferrous metals and alloys. In each process the rotational speed is of first importance in its effect upon the efficiency of operation, the quality of the casting, and the design and construction of the casting machine.

Early Rotational Speed Records

It is probably true to say of each individual process in commercial operation that the rotational speed or range of speeds adopted have been determined experimentally, having regard to the particular requirements of the process. The records of the work done in this field during the XIXth century are to be found mostly in the Patent Journals, and the first direction as to speed of rotation appears to be that in the Provisional Specification[2] No. 1968, dated August 23, 1856, and relates to a process which would be classified as true centrifugal casting, producing tubes and hollow axles as steel castings (also steel wheels). This patent application in the name of a French foundry of Jackson Bros., Petin Gaudet & Company, directs that the moulds during the time of filling or running into them the molten metal should revolve at speeds of 500 to 1,000 r.p.m. The earliest patent in connection with the centrifugal casting process dated 1809 in the name of Eckhard[3] gives no directions as to speed of rotation, but speeds of a similar order of magnitude to the 1856 patent are to be found in several other British patent applications during this period. An interesting reference to speed of rotation is to be found in the British Patent No. 28144 of 1902 in the name of a Belgian Comte Paul de Hemptinne.[4]

In this invention, the mould is required to be rotated without vibration at a very high speed of 750 to 1,000 r.p.m. about the horizontal axis. It is stated that "it is well known that in order to obtain a suitable density or compactness of liquid steel projected upon the walls of the inside of the mould, it is necessary to apply to the said metal a tangential force equivalent to about sixty times its own weight; that is to say, in order to obtain a layer of metal of a thickness of 15 mms. within a mould whose internal diameter is 160 mms. it is necessary to impart a rotary movement to the said mould at the rate of 600 revolutions per min." This is approximately equal to a peripheral velocity of 1,000 ft. per min. Peripheral velocities still higher than this, of the order of 3,000 to 4,000 ft. per min., were probably envisaged by Farnum in 1892[5] in his process for the casting of steel wheels and tyres.

The description of the method of casting locomotive wheel centres at the Crewe works of the L.N.W.R. in 1882[6] illustrates a method in which the dry sand moulds are mounted on rotating turntables, and the mould filled with metal rotated about its vertical axis. This process might be claimed as an early example of semi-centrifugal or profiled centrifugal casting. It was claimed that rotation of these moulds at speeds as low as 40 to 50 r.p.m. assisted a good deal in the production of "sound clean castings."

It is evident from these early records that substantially high speeds of rotation were found necessary of the order of 500 to 1,000 r.p.m. The processes described by these early workers all fall within the classification of true centrifugal casting, and it would appear that the notion of the importance of speed had developed into the form of a practical quantitative recommendation that the tangential force should be

* Paper read at the Forty-first Annual Meeting of the Institute of British Foundrymen.

Centrifugal Casting Process

of the order of 60 times the weight of the metal. Where the calculation is possible, it is evident that rotational velocities within the range of 1,000 to 3,000 ft. per min. were used.

Acceleration of Liquid Metal During Casting

Before considering the speeds adopted in the variety of modern processes, it is helpful to remember that the rotational velocity of the mould assists in the acceleration of the molten metal, and changing its direction of motion to that of the mould cavity. This function of rotational velocity is of prime importance in many of the processes of casting.

When molten metal is poured on to the surface of a rotating mould, rotational velocity is imparted to it by virtue of the friction between the liquid metal and the mould, the internal friction between the layers of metal and also by virtue of the initial velocity of the stream of molten metal itself. In the rotation of liquid metals to produce castings (true centrifugal castings) in view of the shortness of time in which the molten metal can be maintained, and its constantly increasing viscosity during solidification, it is essential that rotational velocity shall be acquired in the shortest possible time. In many processes and many types of casting the even distribution of the liquid metal is dependent upon the amount of time available whilst the metal is still liquid and under the influence of the forces due to its rotational velocity.

The forces which induce rotation in molten metal introduced into a rotating container are tangential forces arising out of several conditions. The friction between the rotating container and the molten metal surface in actual contact with the container, and the internal friction or viscosity of the liquid metal, are two of the conditions which give rise to these tangential forces. The magnitude of the force due to friction between liquid and solid surfaces varies as the square of the velocity of movement and directly as the area of the "wetted" surface. In the case of molten metals which do not exactly "wet" the surfaces, it is possible that the magnitude of these forces is not large, and they may be considered to increase as the square of the velocity and the area of contact between the liquid metal and the container. The condition of the surface of the container or mould will exert an influence in this direction also and practical experiment provides ample evidence of such influence.

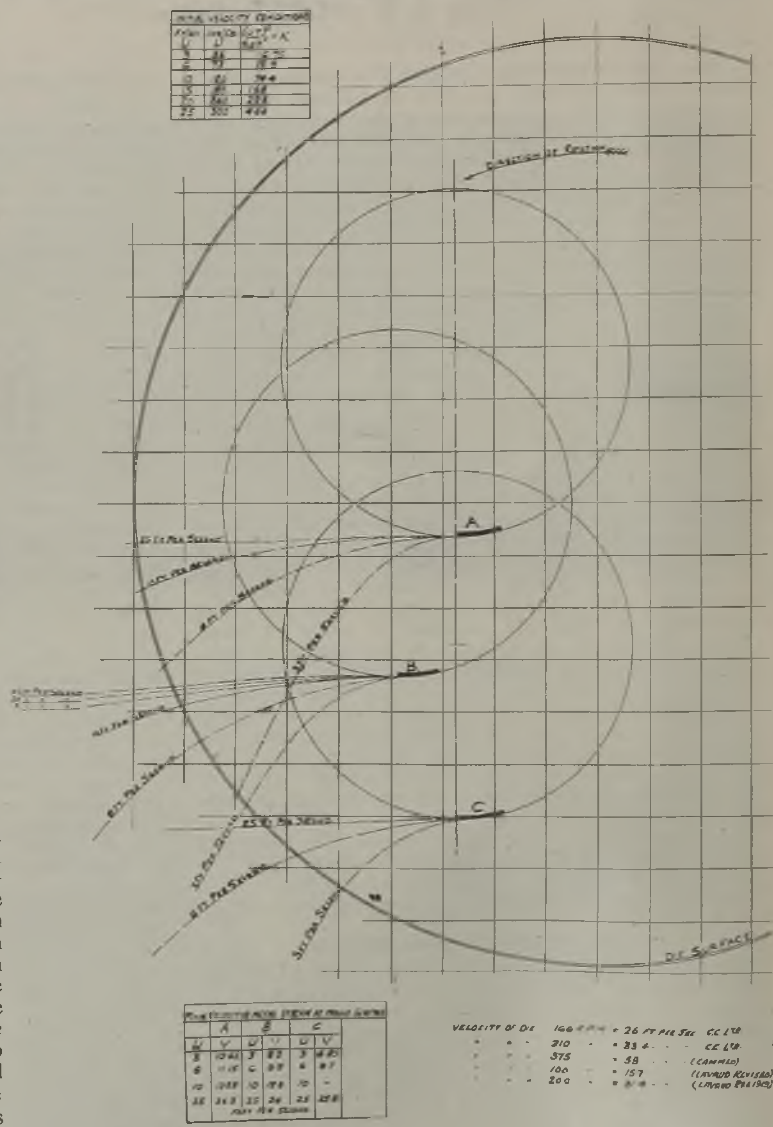

Fig. 1.—Pouring Positions and Velocity Curves. 36 in. Outside Dia. S. & F. Pipe.

The device of roughening the surface of the mould referred to in some patent specifications, *e.g.*, Chester Clark[7], is probably designed to increase this surface friction.

The acceleration of the liquid metal is influenced also by the forces due to the viscosity of the liquid. In the case of alloy metals, the viscosity of the liquid metal cooling down to the solidification point increases rapidly and this effect is probably of great importance in determining the rapid acceleration of molten metals in commercial centrifugal casting processes. Abundant evidence of this is encountered in practice. In the production of castings of substantial radial wall thickness by rotation about the horizontal axis, where considerable time is necessary for the complete solidification of the metal, a demonstration of this effect can be obtained readily. When a large volume of metal is poured into the mould rotating at constant speed, the whole of the metal is not picked up immediately. As time elapses and the temperature of the molten metal falls, more and more of the liquid steadily acquires the rotational velocity. By slow pouring or the use of low casting temperatures it is often possible to produce castings of exceptional radial wall thickness at speeds lower than would be necessary with hotter metal. In one of the Lavaud patents,[8] a metal mould built up in laminated sections is described to obtain more effective cooling. It is stated that with the normal mould construction for the production of a 6-in. dia. pipe a speed of 1,200 r.p.m. was necessary; the more effectively cooled mould enabled this to be reduced by half to 600 r.p.m. The nature of the mould material, apart from its surface character, can exert an influence on the speed conditions required for acceleration by reason of its thermal conductivity through its effect in cooling the metal. Metal moulds for this reason may enable acceleration to be brought about more effectively at lower speeds than sand moulds.

In all centrifugal casting processes, the molten metal introduced into the mould has a certain initial velocity. Obviously, if this velocity at the point of application to the mould is identical in magnitude and direction with that of the mould itself, then the previous considerations of surface friction and viscosity vanish. This condition can never be quite secured in those cases where molten metal is allowed to issue in a continuous stream from a pourer spout on to the internal surface of a rotating mould. For example, in the case of rotation about the horizontal axis, the metal stream issuing from the pourer spout describes a parabolic path. For the condition of identity in direction of the mould velocity and stream velocity, it is necessary for the tangent to the parabolic path to coincide with that of the circle representing the surface of the mould at the point of meeting. This condition cannot be met exactly with any parabolic path inside the circular path of the mould surface (see Fig. 1). The shape of the parabolic path, and the point at which it meets the mould surface for any given position of pourer spout, are determined by the initial velocity of the metal stream. The relationship of these and the final velocity at the point of impingement on the mould surface is connected by the well-known equations,

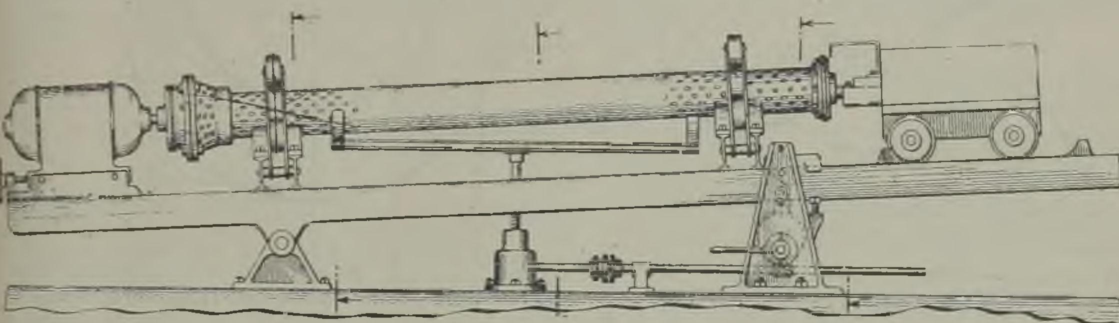

FIG. 2.—EARLY DESIGN OF CENTRIFUGAL CASTING MACHINE DUE TO W. D. MOORE.

$$S = ut + \tfrac{1}{2}gt^2$$
$$V^2 = u^2 + 2gS.$$

Where u = initial stream velocity.
g = acceleration due to gravity.
t = time in seconds.
V = final stream velocity.
S = length of parabolic path.

Fig. 1 illustrates the effect of initial stream velocity on the shape of the parabolic path, the meeting point of the metal stream and the rotating mould surface, and the final stream velocity at this point for various positions of pourer spout in a 36-in. dia. mould rotating about the horizontal axis.

The importance of these considerations on the velocity of the stream of metal is sufficiently illustrated by this diagram. The further considerations, such as shock losses and turbulence arising out of this, are more properly considered in connection with pouring methods. They are of interest in connection with any discussion of rotational speeds in that they in

Centrifugal Casting Process

part determine the desirability of centrifuging after filling or the adoption of low starting speeds in certain of the various types of centrifugal casting processes. Centrifuging after filling the mould is often practised in some of the processes of semi-centrifugal or pressure centrifugal casting.

In the case of true centrifugal castings, it is more difficult, but the introduction of all the molten metal

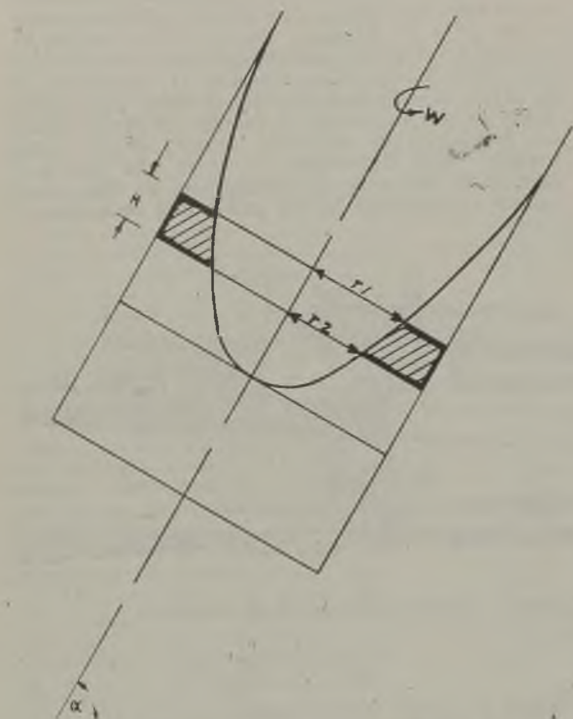

FIG. 3.—ROTATION ABOUT THE VERTICAL AND INCLINED AXIS.

into the mould whilst stationary or rotating at very slow speeds followed by acceleration to the predetermined final speed, is a method of obtaining close similarity between the molten metal and the rotating mould velocities. Obviously, the practical difficulties in adopting this method are least in rotating about the vertical axis and become greatest in rotation about the horizontal axis.

An example of a process of this type is to be found in the early sand-spun machine of W. D. Moore.[9] This machine, illustrated diagrammatically in Fig. 2, shows the mould arranged initially in a slightly inclined position. An inclination of about ½ in. to the foot was recommended. Provision was made for this mould to be lowered gradually to a horizontal position during casting or spinning the molten metal. In operation the whole of the molten metal could be introduced into the mould either with the mould revolving or stationary, and at the same time the metal caused to distribute itself uniformly over the mould surface with a minimum amount of surge by lowering the mould to the horizontal position and accelerating the rotational speeds. In one description of this machine,[10]

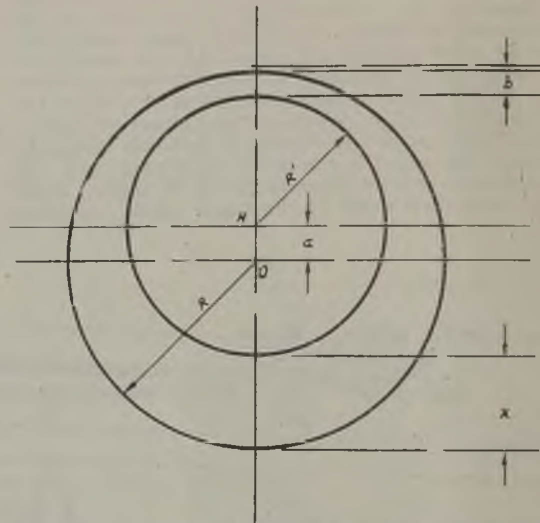

FIG. 4.—ROTATION ABOUT THE HORIZONTAL AXIS.

it was recommended that rotation was commenced at 50 r.p.m. during the pour. The time taken in lowering to the horizontal position should be about 20 to 25 secs. On attaining the horizontal position, the speed was increased to 1,250 r.p.m., this being maintained for a period of 2 min., after which the speed was reduced to 900 r.p.m. for a further 3 min. prior to stopping and removing the mould. These figures refer to the casting of standard spigot and socket cast-iron pipe.

The foregoing remarks draw attention to the factors concerned with acceleration which have an influence on the rotational speeds. The manner in which the molten stream is applied to the mould, the character of the mould surface and material whether metal or sand, all are of importance in determining the time required to accelerate the molten metal to the rotational velocity of the mould. For example, in sand moulds or in moulds which are maintained at high temperatures, the period required for the solidification of the molten metal is prolonged. In these cases the allowable time limit for the acceleration of the liquid metal is likewise prolonged.

Rotational Speed and Velocity of the Metal During Casting

The external form of castings produced by rotation of moulds about their own axes is governed by the shape of the mould walls. The internal form and the distribution of pressure within the liquid metal are determined by the rotational velocity or the speed and the angle of inclination of the axis of rotation. The shape of the internal liquid surface when rotation is performed about the horizontal axis is cylindrical. and rotation about axes inclined to the horizontal or vertical results in an inner surface of paraboloidal shape. The derivation of the relationships between rotational velocity, angle of inclination, and internal form has been dealt with previously by the Author.[11] Reference can be made to this, and several other treatments of this subject as for example Cammen[12] and Wood.[13]

In the case of rotation about the vertical or inclined axis and referring to the diagram, Fig. 3, for rotation the dimensional relationships in terms of speed of rotation N (r.p.m.) are related by the equations 1 and 2.

$$N = 423 \text{ (approx.)} \sqrt{\frac{1}{r_1^2 - r_2^2}} \times \sqrt{H \sin \alpha}$$

Metric units (cms.) ....(1)

$$N = 76{\cdot}25 \text{ (approx.)} \sqrt{\frac{1}{r_1^2 - r_2^2}} \times \sqrt{H \sin \alpha}$$

English units (feet) ....(2)

The speed of rotation and dimensional relationships are independent of the weight of the molten metal, and they vary with the sine of the angle of inclination to the horizontal. For the same internal surface dimensions the inclined axis enables a lower speed of rotation to be used than the vertical axis.

The corresponding relations for the case of rotation about the horizontal axis in reference to Fig. 4 are given in equations 3 and 4.

$$N = 54 \sqrt{\frac{1}{R - R_1}} \quad \text{English Units (feet) .... (3)}$$

$$N = 300 \sqrt{\frac{1}{R - R_1}} \quad \text{Metric Units (cms.) .... (4)}$$

The centrifugal force acting on unit volume of liquid metal is "mw^2r," where "m" is the mass of unit volume of metal, "w" the angular velocity (in radians), and "r" the distance of the unit from the axis of rotation. In a uniformly rotating mass of liquid metal. as for example a cylindrical mass, the pressure due to centrifugal force at any point within the mass, is thus

$$\int_{r_1}^{r} m\, w^2\, r\, dr$$

where r_1 is the internal radius of the cylinder. Integrating the pressure at a distance r from the axis of rotation gives the relationship

$$P = \frac{m\, w^2}{2} \left(r^2 - r_1^2 \right) \text{ .... (5)}$$

For given conditions of angular velocity in a given casting the pressure due to centrifugal force is lowest at the internal surface r_1 and increases as the distance from the axis of rotation r to a maximum at the outside diameter of the given casting. A pressure gradient is thus established from the outside to the inside surface, radially across the radial wall thickness of the casting. Insoluble particles, *e.g.*, slag in liquid metals whose density (m) differs from that of the parent metal, are subject to a different pressure at a given velocity, a fact which accounts for the movement of these particles under centrifugal action. These are the factors which play such an important part in determining the soundness of castings produced by the centrifugal process.

The speeds of rotation used in various commercial processes have for the most part been derived by experiment. Such principles or rules that have been adopted have been fixed for the most part arbitrarily and their suitability confirmed by experiment. It is convenient to consider these under the separate headings of (1) true centrifugal castings, vertical axis and horizontal axis; (2) semi-centrifugal: and (3) pressure castings.

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[5] U.S. Patent No. 482405, Sept. 13, 1892. W. C. Farnum.
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[7] British Patent No. 120037, 1917, Chester Clark.
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[9] U.S. Patent No. 1,471,052, Oct. 16, 1923. W. D. Moore.
[10] British Patent No. 261112, Dec., 1926. Sand Spun Patents Corporation.
[11] Speed of Rotation in the Centrifugal Casting Process. J. E. Hurst. F.T.J., Sept. 3, 1931.
[12] Mathematics of Centrifugal Casting. L. Cammen. Amer. Soc. Mech. Engrs. May 8, 1922.
[13] Centrifugal Casting Calculations. R. F. Wood. Metal Industry (New York), Dec., 1925.

(*To be continued.*)

AMERICAN ALUMINIUM OUTPUT REDUCED

The U.S. War Production Board has ordered further reductions in output of the light metal, as there are ample supplies now available. The plants affected by this decision are the Government-owned facilities in Spokane, Wash.; Los Angeles, Cal.; Troutdale, Ore., and Jones Mills, Ark.

The total reduction in production as a result of the combined cut will amount to approximately 30,000,000 lbs. of aluminium ingot per month. Monthly production then will amount to slightly more than 90,000,000 lbs., as compared with the all-time record of approximately 188,000,000 lbs. a month, reached early last winter.

In announcing the domestic output cuts, officials of the W.P.B. said that scheduled imports of aluminium from Canada had been reduced sharply for the remainder of 1944, and that delivery of 250,000,000 lbs. of Canadian metal under contract had been postponed indefinitely.

INDUSTRIAL INJURY INSURANCE

GOVERNMENT'S NEW SCHEME

A new Industrial Injury Insurance Scheme to replace the present system of workmen's compensation is outlined in a White Paper (Cmd. 6551) published by the Government last week. Workmen's compensation will be treated in future not as part of the law of employer's liability, but as a social service. As, however, the new scheme departs from the general scheme of social insurance as regards rates of benefit, it will not be unified with the general scheme, but will remain separate.

A foreword to the White Paper points out that for nearly half a century the compensation of workmen for industrial injury has been a liability imposed by law upon their employer. Under the existing system it has been open to the employer, and in some cases obligatory on him, to insure himself against this liability; while it has been for the workman to make his claim and to take steps to enforce it, if challenged, in the Courts of Law. Inevitably compensation had thus become a disputable issue between the two parties or their representatives. The result has naturally been a growth in legal complexity and the emergence of certain unsatisfactory features; for example, the practice of paying, in full discharge of liability for what may prove to be a permanent or long continued loss of earnings, a lump sum which the employer may offer for the sake of simplicity and finality, and the workman may accept for the same reason. Henceforward the Government, as part of their extension and recasting of the social insurance system, propose that provision for disablement or loss of life from industrial injury shall become a social service, administered as a separate scheme but under the Minister of Social Insurance.

Flat Rates of Benefit

Benefits at special rates will be paid from a separate insurance fund, to which employer, workman, and the Exchequer will be contributors. Under the present system, benefits are related to the estimated loss of earning capacity. Under the Government's plan benefits will be paid at flat rates, with supplements for family responsibilities. In the earlier weeks, while the workman is incapacitated for work, there will be injury allowances at uniform rates. Afterwards, if disablement is prolonged, there will be industrial pensions based, not on loss of earning capacity, but upon the extent to which the workman has suffered disablement by the injury, by comparison with a normal healthy person of the same age and sex. The pension will not be affected by any subsequent earnings of the workman, and (except in some cases of minor disability) will not be replaced by a lump sum payment. There will be pensions for widows, parents, and certain other dependents of those who have died as the result of industrial injury.

The Government believe that the new plan will remove workmen's compensation from the atmosphere of controversy and conflict with which it has been surrounded and will establish it for the future on a happier and sounder foundation. It is their intention, if the scheme commends itself to Parliament, to introduce and pass the necessary legislation as soon as practicable with a view to bringing it into operation at the same time as the general scheme of social insurance.

The Scheme will be comprehensive in scope. It will cover, broadly speaking, all persons working under a contract of service or apprenticeship, except those under school-leaving age. It will not provide for " contracting out " schemes. It will apply to accidents arising out of and in the course of employment, and to specified industrial diseases. The liability, instead of being on the individual employer, will be placed upon a Central Fund out of which all benefits, both in disablement and fatal cases, and administrative charges will be paid. The fund will be maintained by weekly contributions from employers and workmen collected by stamp, with a contribution from the Exchequer. The weekly rates of contribution will be 6d. for adult men and 4d. for women, to be shared equally between the employer and workman. The rates for juveniles will be half these rates. Benefits will not depend on a contribution qualification. The contributions will not be payable when the workman is incapacitated for work or unemployed.

Weekly Allowances

An incapacitated workman will be paid an industrial injury allowance of 35s. a week for up to 13 weeks, with allowances of 8s. 9d. for a wife and 5s. for the first child. Other children will receive family allowances at 5s. each. Where the disablement is likely to be permanent or prolonged it will be replaced by an industrial pension assessed according to the degree of disablement. The pension for 100 per cent. disablement will be 40s. a week. In addition, with the maximum pension, 10s. a week will be paid for a wife and 7s. 6d. a week for a first child. If the pensioner is virtually unemployable his pension will be supplemented by a personal supplement of 10s. a week; and if he needs constant attendance a special allowance of 20s. a week will be payable. Where the pension is payable at less than the 100 per cent. rate allowances for a wife and first child will be proportionately reduced. If no wife's allowance is payable there will be an allowance at the same rate in respect of one dependent. The injury allowance of 35s. will be raised to the maximum pension rate of 40s. at the end of the 13 weeks if no pension rate has been previously assessed.

Once a final pension is awarded it cannot be altered and no account will be taken of any subsequent earnings.

MR. WILLIAM BENJAMIN HONEY, for the past 30 years foundry manager with Wm. Lodder, engineer and ironfounder, of Queenborough, Kent, died recently, aged 72. He had been connected with the foundry industry for 57 years. Mr. Honey was a foundryman of the highest order, and was well-known throughout the country in the glass bottle trade.

SCOTTISH INDUSTRY AFTER THE WAR

A SURVEY OF PROSPECTS

Forecasts of the possible post-war position of the heavy industries in the West of Scotland are contained in a report which has been prepared by a special committee of the Glasgow Chamber of Commerce in response to a *questionnaire* from Glasgow Corporation inviting the views of the Chamber on planning problems.

Subject to certain considerations, the report expresses the general view that there is no reason why the heavy industries in Glasgow and district should not be reasonably busy for some years after the war. Considerations which may modify or alter this opinion are:—The extent to which Government control will be continued during the post-war reconstruction period; the position of world shipping; the incidence of costs of production on the export industry, and the possibility of other countries heavily subsidising their industries; and the degree to which industry will have to bear the expense of extended social services and other costs which national and local policy may impose upon it.

It would appear that for some years all industrial output will be absorbed, states the report. Widespread saturation of markets is a distant possibility, but the West of Scotland's share will depend on ability to offer competitive prices. The Committee stresses the importance of harmonious relationships between employers and operatives.

Opinions of the Committee with regard to the post-war position of the major industries are as follow:—

Shipbuilding and marine engineering:—Probably a reasonably full programme.

Locomotive and railway wagon industry:—Steady demand for some time to make up the wastage and lack of maintenance during the war period in many countries.

Steel structural engineering:—A long run rebuilding devastated areas, replacing bridges, etc., and carrying out new work in reconstruction schemes.

Light-castings foundries:—Reasonably good prospects. The extensive use of substitute materials, however, may have an influence on output.

Medium and light engineering:—Likely to be larger after the war than in, say, 1937. There will be years of work required to replace and repair the many factories and installations destroyed at home and abroad. If engineering industries can turn over quickly from purely war production to the types of products needed for the development of peacetime industries and the building trade, there will be good opportunities for employment in them and in the basic and ancillary trades.

The Fisher Furnace Company, of Chicago, has purchased the Monarch Engineering & Manufacturing Company of the same city; the latter are well-known makers of crucible melting furnaces.

FOUNDRY EDUCATION IN LANCASHIRE

The Institute of British Foundrymen and the Manchester and District Ironfounders' Association have recently been instrumental in arranging classes in foundry subjects to be held at the Openshaw, Manchester, the Warrington, and the St. Helens technical colleges.

The most interesting feature of these schemes is that in all the cases employers have granted daytime release to their foundry apprentices with pay. While the extent of this release is not up to the standard which will be required by the enforcements of the Education Act, 1944, it does represent a most encouraging step forward upon which all the employers are to be congratulated, particularly in view of current industrial conditions.

At the Openshaw School, where about 50 apprentices have been enrolled for the 1944/45 session, employers have been given the option of sending their apprentices on Tuesdays, Wednesdays or Thursdays, and for those boys who are unable to attend for a whole day, an evening class is held on Mondays.

About 30 apprentices are attending the Warrington classes, which are held on Tuesday and Thursday afternoons and Friday evenings. In this case payment of wages for attendance at the day classes is conditional upon attendance at the evening session. The arrangements at St. Helens are similar.

In connection with the Openshaw scheme Mr. Leslie Mortlock, director of Hill & Son (Manchester), Limited, has generously offered to provide two prizes, which may be awarded to the two second year students who most merit the award. Any firm in these areas which is not participating in the scheme and wishes to do so should obtain particulars from the Principals of the colleges concerned, or the Institute of British Foundrymen, Saint John Street Chambers, Deansgate, Manchester, 3.

OBITUARY

MR. FRED WILDBLOOD, founder and chairman of Blythe Colour Works, Limited, Stoke-on-Trent, died last week, aged 88.

SIR THOMAS MILLER-JONES, chairman of Thomas Hill-Jones, Limited, foundry blacking manufacturers, London, E., died at his home at Horsham, Sussex, on September 15.

MR. WILLIAM STANLEY CROSIER, managing director of the Sarco Company, London, and a director of Sarco Thermostats, Limited, Cheltenham, died recently, at the age of 52.

MR. JOSEPH HULL, who died at Middlesbrough on September 17, at the age of 76, was for 42 years employed by Dorman, Long & Company, Limited, at their Britannia and Clarence works. He retired in 1930. Mr. Hull was manager of the steel plant at Clarence works when it was producing steel for the construction of Sydney Harbour bridge.

NEWS IN BRIEF

The engineering unions have put before the employers a claim for the adoption of a 40-hour working week as soon as the war is over, the weekly wage rates to remain the same.

Seven employees of the Richard Garrett Engineering Works, Limited, at Leiston, Suffolk, whose services with the firm total 392 years, have been presented with silver salvers and long-service certificates.

The Executive Council of the Amalgamated Engineering Union is seeking an interview with Mr. Bevin, Minister of Labour, to discuss the after-war redundancy problem in the engineering industry.

Keighley Association of Engineers are holding a ladies' night on October 13, at 7.30 p.m., at Devonshire Buildings, Devonshire Street, Keighley. Mr. Maurice Longbottom, curator of Keighley Museum, will speak on " Wild Nature about Keighley."

The British Fluorspar Producers' Association (hon. secretary, Mr. H. Hebblethwaite, 5-6, Hutton's Buildings, Sheffield, 1) have drawn up prices for standardised grades of fluorspar and these operate from October 1. This is the first standardisation of fluorspar. The grades have been agreed after negotiations with various Government departments interested.

Sir Walter Citrine, general secretary of the Trades Union Congress, speaking at Leeds, referred to the call for restrictions on combines and cartels, and said that he did not believe we could carry on international trade without some regulating body at some point. He did not say that monopolies always worked against the public interest, but he would prefer that all the governments concerned were a party to the agreements made and that they were brought forward into the full light of day.

It is reported that the Government has decided to erect in the development areas of South Wales, North-East England, Scotland, and Northern Ireland a number of standard factories of some 50,000 sq. ft. each. These factories will be available both for wartime production and later for peacetime use, and their location has been decided in relation to the labour resources available. Five factories have been allocated to South Wales, and they are to be erected at Swansea, Ammanford, Neath, Merthyr, and within the Blackwood-Abercarn-Tredegar area.

At Claridge's Hotel last Monday, a number of members of the technical Press assembled round the luncheon table to honour Mr. J. H. Van Deventer and Mr. B. Finney. The former is the editor of the " Iron Age," and the latter a director of the McGraw Hill Publishing Company. The function, which was organised by the proprietors of The Foundry Trade Journal, was presided over by Mr. Barrington Hooper, C.B.E. The guests were officially welcomed by Mr. Oliver Lyttelton, the Minister of Production. The necessity for post-war collaboration with America was emphasised by the Minister, the two guests, and Sir Ernest Benn.

PERSONAL

Mr. William James Fleming, founder and head of Fleming Bros., structural engineers, Port Dundas, Glasgow, has received a presentation from the works and office staffs on the occasion of his 70th birthday.

Mr. John Neill, a director and general manager of the North Eastern Marine Engineering Company (1938), Limited, has been re-elected chairman for 1944-45 of the National Association of Marine Enginebuilders.

Mr. J. A. T. Dawson, experimental officer, Armament Research Department, Ministry of Supply, and Mr. R. Hurst, experimental officer, Directorate of Scientific Research, Ministry of Supply, have each been awarded the George Medal "for sustained courage when engaged in hazardous operations."

Sir Archibald McKinstry, deputy chairman and managing director of Babcock & Wilcox, Limited, is retiring from the managing directorship at his own request on December 31. He will remain a member of the board and deputy chairman of the company. Mr. C. K. F. Hague, the deputy managing director, has been appointed to succeed him as managing director.

Sir Charles Craven, chairman of the English Steel Corporation, Limited, has decided to relinquish his office of managing director of the corporation, and Sir Alexander Dunbar has been appointed managing director in his place. Sir Arthur Winder, having expressed the desire to retire from business, has resigned his position as director and general manager of the English Steel Corporation, Limited, Darlington Forge, Limited, and Industrial Steels, Limited, and Mr. F. Pickworth, a director of these companies, becomes general manager. The changes took effect as from September 30.

COMPANY RESULTS

(Figures for previous year in brackets)

Vickers—Interim dividend of 4% (same).

Oxley Engineering—Dividend of 15% (same).

Braithwaite & Company Engineers—Final dividend of 3½%, making 6½% (6%).

Richard Johnson Clapham & Morris—Final dividend of 11¼%, making 15% (same).

Trianco—Net profit for 1943, £25,588 (£33,577); tax, £14,000 (£27,000); 6% preference dividend, £2,250; participating dividend of 1%, £375 (same); ordinary dividend of 10%, £3,750 (same); to general reserve, £5,000 (nil); forward, £9,685 (£9,472).

J. Blakeborough & Sons—Net profit for the year to June 30, after providing for depreciation, £157,083 (£163,721); taxation, war damage contributions, fees, and interest on and provision for redemption of 7% cumulative notes, £136,864 (£137,029); to general reserve, £5,000 (£10,000); ordinary dividend of 10% (same) and a bonus of 10% (same); forward, after preference dividend, £13,407 (£12,578).

Raw Material Markets

IRON AND STEEL

It is reported that a limited amount of work has been placed with the light-castings trade in connection with the housing programme in London and the South of England. Is it too soon to begin full-scale production of the domestic castings which will be needed in immense quantities for the repair of war-damaged homes and the provision of millions of post-war houses? Only the Government can decide; but a favourable decision would at once restore the light foundries to activity and give a new impetus to the demand for high-phosphorus iron, which at the moment is at a low ebb. Precise information regarding the tonnages in stock is lacking, but it is understood that there are no very large accumulations, and any substantial expansion of requirements would at once involve the relighting of blast furnaces at present standing idle. Consumption of low-phosphorus and refined iron has been maintained on a more even keel, and there is still scope for an increased output of hematite, the use of which has had to be severely restricted. Until a few weeks ago many foundries found it difficult to secure adequate supplies of scrap, but recently there has been a considerable improvement. However, cast-iron and steel scrap in foundry sizes is still finding a ready outlet.

The newly authorised price of Durham blast-furnace coke is 54s. per ton, f.o.t., which represents an immediate increase of 5s. 6d. per ton and a rise since the beginning of 1944 of 9s. 6d. Through the operation of the Prices Fund these increases have not been passed on to the consumers of iron and steel, but, when this "cushion" is withdrawn, as sooner or later it must be, high-cost fuel is going to be the most formidable burden imposed on the steel industry.

A fair trade in crown-quality bar iron has been done during the week, while the demand for best bars has been on a moderate scale, with wagon builders the principal outlet. There is a fairly steady demand for mild-steel bars of large diameters, while nut and bolt bars and bright-drawn bars are other reasonably busy departments. Orders already placed for small steel bars, strip and light structural sections for delivery within the compass of the fourth period will suffice to provide full employment for the re-rolling mills up to the end of the year. Hence there is no slackening in the heavy calls for billets, blooms, slabs, wire rods, etc., and already steelmakers are maintaining deliveries on a substantial scale. Re-rollers are prepared to accept defectives and, in fact, almost any class of material which can be adapted for use in the mills.

The recent improvement in the demand for plates has not been sufficient to restore the mills to the state of activity which prevailed earlier in the year. Most of the mills are still open to accept orders with the promise of reasonably early delivery. Shipbuilders' requirements are at present on a reduced scale, but strong support is forthcoming from the boiler shops, and locomotive and wagon works. No revival of interest in heavy joists and channels is indicated, but rail mills are provided with a steady volume of employment. Wire mills are also working to capacity and a slowing down in the flow of new orders for sheets has not as yet affected outputs, which are maintained at a high level for the fulfilment of uncompleted contracts.

NON-FERROUS METALS

The situation is rather colourless at the present time. In the copper market a question of interest is whether the Government intends to renew its contract with Empire suppliers on the same terms as before. The present contract is due to expire at the end of the year, but the Government had an option to renew on October 1. In view of the uncertainty of our copper requirements during the first few months of next year, it may be that the decision will be held over until a clearer appraisal of our needs is possible. With no indications of any upward trend in munitions production, the possibility of relaxation of the present restrictions on consumption may be much nearer than was at one time imagined.

Although at the moment tin is in reasonably good supply, it is probable that, with large amounts of metal required for the rehabilitation of Europe, and the possibility of the Eastern producers being temporarily out of the picture, there will continue to be a scarcity of tin for some time after the war. Since these sources of supply have been closed to us, requirements have been met mainly by Bolivian and African mines. It is reported from America that Bolivia is attempting to obtain higher prices for her tin supplies.


LININGS
for all Types of
FURNACES
GR

CURRENT PRICES OF IRON, STEEL AND NON-FERROUS METALS

(Delivered, unless otherwise stated)

Wednesday, October 4, 1944

PIG-IRON

Foundry Iron.—CLEVELAND No. 3: Middlesbrough, 128s.; Birmingham, 130s.; Falkirk, 128s.; Glasgow, 131s.; Manchester, 133s. DERBYSHIRE No. 3: Birmingham, 130s.; Manchester, 133s.; Sheffield, 127s. 6d. NORTHANTS No. 3: Birmingham, 127s. 6d.; Manchester, 131s. 6d. STAFFS No. 3: Birmingham, 130s.; Manchester, 133s. LINCOLNSHIRE No. 3: Sheffield, 127s. 6d.; Birmingham, 130s.

(*No. 1 foundry 3s. above No. 3. No. 4 forge 1s. below No. 3 for foundries, 3s. below for ironworks.*)

Hematite.—Si up to 3.00 per cent., S & P 0.03 to 0.05 per cent.; Scotland, N.-E.Coast and West Coast of England, 138s. 6d.; Sheffield, 144s.; Birmingham, 150s.; Wales (Welsh iron), 134s. East Coast No. 3 at Birmingham, 149s.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, 140s. 6d., delivered Birmingham.

Scotch Iron.—No. 3 foundry, 124s. 9d.; No. 1 foundry, 127s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, 174s.; South Zone, 176s. 6d.

Refined Malleable.—North Zone, 184s.; South Zone, 186s. 6d.

Cold Blast.—South Staffs, 227s. 6d.

(NOTE.—*Prices of hematite pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton.*)

FERRO-ALLOYS

(*Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.*)

Ferro-silicon (5-ton lots).—25 per cent., £21 5s.; 45 per cent., £25 10s.; 75 per cent., £39 10s. Briquettes, £30 per ton.

Ferro-vanadium.—35/50 per cent., 15s. 6d. per lb. of V.

Ferro-molybdenum.—70/75 per cent., carbon-free, 6s. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, 1s. 3½d. lb.

Ferro-tungsten.—80/85 per cent., 9s. 8d. lb.

Tungsten Metal Powder.—98/99 per cent., 9s. 9½d. lb.

Ferro-chrome.—4/8 per cent. C, £46 10s.; max. 2 per cent. C, 1s. 3¾d. lb.; max. 1 per cent. C, 1s. 4¼d. lb.; max. 0.5 per cent. C, 1s. 6d. lb.

Cobalt.—98/99 per cent., 8s. 9d. lb.

Metallic Chromium.—96/98 per cent., 4s. 9d. lb.

Ferro-manganese.—78/98 per cent., £18 10s.

Metallic Manganese.—94/96 per cent., carb.-free, 1s. 9d. lb.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.—BASIC: Soft, u.t., 100-ton lots, £12 5s.; tested, up to 0.25 per cent. C, £12 10s.; hard (0.42 to 0.60 per cent. C), £13 17s. 6d.; silico-manganese, £17 5s.; free-cutting, £14 10s. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £15 15s.; case-hardening, £16 12s. 6d.; silico-manganese, £17 5s.

Billets, Blooms and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £13 17s. 6d.; basic hard, 0.42 to 0.60 per cent. C, £14 10s.; acid, up to 0.25 per cent. C, £16 5s.

Sheet and Tinplate Bars.—£12 2s. 6d. 6-ton lots.

FINISHED STEEL

[*A rebate of 15s. per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.*]

Plates and Sections.—Plates, ship (N.-E. Coast), £16 3s.; boiler plates (N.-E. Coast), £17 0s. 6d.; chequer plates (N.-E. Coast), £17 13s.; angles, over 4 un. ins., £15 8s.; tees, over 4 un. ins., £16 8s.; joists, 3 in. × 3 in. and up, £15 8s.

Bars, Sheets, etc.—Rounds and squares, 3 in. to 5½ in., £16 18s.; rounds, under 3 in. to ⅝ in. (untested), £17 12s.; flats, over 5 in. wide, £15 13s.; flats, 5 in. wide and under, £17 12s.; rails, heavy, f.o.t., £14 10s. 6d.; hoops, £18 7s.; black sheets, 24 g. (4-ton lots), £22 15s.; galvanised corrugated sheets (4-ton lots), £26 2s. 6d.; galvanised fencing wire, 8 g. plain, £26 17s. 6d.

Tinplates.—I.C. cokes, 20 × 14 per box, 29s. 9d. f.o.t. makers' works, 30s. 9d., f.o.b.; C.W., 20 × 14, 27s. 9d., f.o.t., 28s. 6d., f.o.b.

NON-FERROUS METALS

Copper.—Electrolytic, £62; high-grade fire-refined, £61 10s.; fire-refined of not less than 99.7 per cent., £61; ditto, 99.2 per cent., £60 10s.; black hot-rolled wire rods, £65 15s.

Tin.—99 to under 99.75 per cent., £300; 99.75 to under 99.9 per cent., £301 10s.; min. 99.9 per cent., £303 10s.

Spelter.—G.O.B. (foreign) (duty paid), £25 15s.; ditto (domestic), £26 10s.; "Prime Western," £26 10s.; refined and electrolytic, £27 5s.; not less than 99.99 per cent., £28 15s.

Lead.—Good soft pig-lead (foreign) (duty paid), £25; ditto (Empire and domestic), £25; English, £26 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, ex works, £37 12s. 6d.; rolled zinc (boiler plates), ex works, £35 12s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £30 10s.

Other Metals.—Aluminium, ingots, £110; antimony, English, 99 per cent., £120; quicksilver, ex warehouse, £68 10s. to £69 15s.; nickel, £190 to £195.

Brass.—Solid-drawn tubes, 14d. per lb.; brazed tubes, 16s.; rods, drawn, 11⅜d.; rods, extruded or rolled, 9d.; sheets to 10 w.g., 11⅛d.; wire, 10⅞d.; rolled metal, 10½d.; yellow metal rods, 9d.

Copper Tubes, etc.—Solid-drawn tubes, 15¼d. per lb.; brazed tubes, 15¼d.; wire, 10d.

Phosphor Bronze.—Strip, 14¼d. per lb.; sheets to 10 w.g.; 15¼d.; wire, 16½d.; rods, 16½d.; tubes, 21½d.; castings, 20d., delivery 3 cwt. free. 10 per cent. phos. cop. £35 above B.S.; 15 per cent. phos. cop. £43 above B.S.; phosphor tin (5 per cent.) £40 above price of English ingots. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 10d. to 1s. 4d. per lb.; rolled to 9 in. wide, 1s. 4d. to 1s. 10d.; to 12 in. wide, 1s. 4¼d. to 1s. 10¼d.; to 15 in. wide, 1s. 4½d. to 1s. 10½d.; to 18 in. wide, 1s. 5d. to 1s. 11d.; to 21 in. wide, 1s. 5½d. to 1s. 11½d.; to 25 in. wide, 1s. 6d. to 2s. Ingots for spoons and forks, 10d. to 1s. 6½d. Ingots rolled to spoon size, 1s. 1d. to 1s. 9½d. Wire, round, to 10g., 1s. 7½d. to 2s. 2½d., with extras according to gauge. Special 5ths quality turning rods in straight lengths, 1s. 6½d. upwards.

NON-FERROUS SCRAP

Controlled Maximum Prices.—Bright untinned copper wire, in crucible form or in hanks, £57 10s.; No. 1 copper wire, £57; No. 2 copper wire, £55 10s.; copper firebox plates, cut up, £57 10s.; clean untinned copper, cut up, £56 10s.; braziery copper, £53 10s.; Q.F. process and shell-case brass, 70/30 quality, free from primers, £49; clean fired 303 S.A. cartridge cases, £47; 70/30 turnings, clean and baled, £43; brass swarf, clean, free from iron and commercially dry, £34 10s.; new brass rod ends, 60/40 quality, £38 10s.; hot stampings and fuse metal, 60/40 quality, £38 10s.; Admiralty gunmetal, 88-10-2, containing not more than ½ per cent. lead or 3 per cent. zinc, or less than 9¼ per cent. tin, £77, all per ton, ex works.

Returned Process Scrap.—(Issued by the N.F.M.C. as the basis of settlement for returned process scrap, week ended Sept. 30, where buyer and seller have not mutually agreed a price; net, per ton, ex-sellers' works, suitably packed):—

BRASS.—S.A.A. webbing, £48 10s.; S.A.A. defective cups and cases, £47 10s.; S.A.A. cut-offs and trimmings, £42 10s.; S.A.A. turnings (loose), £37; S.A.A. turnings (baled), £42 10s.; S.A.A. turnings (masticated), £42; Q.F. webbing, £49; defective Q.F. cups and cases, £49; Q.F. cut-offs, £47 10s.; Q.F. turnings, £38; other 70/30 process and manufacturing scrap, £46 10s.; process and manufacturing scrap containing over 62 per cent. and up to 68 per cent. Cu, £43 10s.; ditto, over 58 per cent. to 62 per cent. Cu, £38 10s.; 85/15 gilding metal webbing, £52 10s.; 85/15 gilding defective cups and envelopes before filling, £50 10s.; cap metal webbing, £54 10s.; 90/10 gilding webbing, £53 10s.; 90/10 gilding defective cups and envelopes before filling, £51 10s.

CUPRO NICKEL.—80/20 cupro-nickel webbing, £75 10s.; 80/20 defective cups and envelopes before filling, £70 10s.

NICKEL SILVER.—Process and manufacturing scrap; 10 per cent. nickel, £50; 15 per cent. nickel, £56; 18 per cent. nickel, £60; 20 per cent. nickel, £63.

COPPER.—Sheet cuttings and webbing, untinned, £54; shell-band plate scrap, £56 10s.; copper turnings, £48.

IRON AND STEEL SCRAP

(*Delivered free to consumers' works. Plus 3½ per cent. dealers' remuneration. 50 tons and upwards over three months, 2s. 6d. extra.*)

South Wales.—Short heavy steel, not ex. 24-in. lengths, 82s. to 84s. 6d.; heavy machinery cast iron, 87s.; ordinary heavy cast iron, 82s.; cast-iron railway chairs, 87s.; medium cast iron, 78s. 3d.; light cast iron, 73s. 6d.

Middlesbrough.—Short heavy steel, 79s. 9d. to 82s. 3d.; heavy machinery cast iron, 91s. 9d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 89s. 3d.; medium cast iron, 79s. 6d.; light cast iron, 74s. 6d.

Birmingham District.—Short heavy steel, 74s. 9d. to 77s. 3d.; heavy machinery cast iron, 92s. 3d.; ordinary heavy cast iron, 87s. 6d.; cast-iron railway chairs, 87s. 6d.; medium cast iron, 80s. 3d.; light cast iron, 75s. 3d.

Scotland.—Short heavy steel, 79s. 6d. to 82s.; heavy machinery cast iron, 94s. 3d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 94s. 3d.; medium cast iron, 77s. 3d.; light cast iron, 72s. 3d.

(NOTE.—*For deliveries of cast-iron scrap free to consumers' works in Scotland, the above prices less 3s. per ton, but plus actual cost of transport or 6s. per ton, whichever is the less.*)

SITUATIONS

TWO Associate Members of the Institute of British Foundrymen, having held executive positions for the past 13 years in Light Casting and Engineering Foundries, would consider making an investment and taking control of a Foundry engaged on like products, including R.W. and soil castings.—Reply in confidence to Box 700, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

WORKS MANAGER required for Cast Iron Foundry; capacity 250/300 tons per month; engineering and repetition casting; experienced in metallurgy, cupola control, machine and hand moulding; must be practical foundryman, knowledge of light steel constructional work an advantage; good salary for one with personality, initiative and administration ability.—Apply Box 696, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

WORKS MANAGER required for Light Castings Ironfoundry, in Midland area, producing castings in grey cast iron, with output of about 20 tons per day; state age, experience and salary desired; good scope for post-war development.—Box 692, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

FOUNDRY SUPERINTENDENT.—A vacancy caused by retirement will shortly occur in the Foundry of a well-known old-established Engineering Works in Leicestershire, with a weekly output of 60 tons grey iron, light and medium castings, of a semi-repetition nature, and 3 tons non-ferrous; a permanent post for a thoroughly qualified man between 35 and 45 years of age, competent to take full control; preference would be given to a man capable of introducing the production of malleable iron (blackheart) castings on a repetition basis; all applications will be treated with the strictest confidence.—Box 708, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

FOUNDRY SUPERINTENDENT required by Foundry (situated in West Bromwich) producing 40/50 tons of grey iron castings per week; must be fully experienced to take control of foundry, including melting plant and core department producing castings by moulding machines, plates and loose patterns; permanent post-war situation; applications are required from men between 30 and 40 years of age, capable of controlling mixed labour; forward full particulars of experience and where last employed, also salary required, which will be treated in strict confidence.—Box 676, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

HEAD FOUNDRY FOREMAN required by Midland Iron Foundry with practical experience malleable and grey iron; capable rate fixer; control of labour; general floor, hand and power moulding machines available; good post-war prospects; applicants should state age, experience and salary required.—Box 678, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

HEAD FOREMAN required for Centrifugal Foundry; must have very good knowledge of furnace operation.—Applications, stating age, experience, and salary required, to Box 706, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

SALES ENGINEER, preferably with some experience foundry practice, wanted to travel England selling and supervising Furnace Installations; must have initiative and energy; state age, experience, and salary required.—Box 698, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

CAPABLE Representative required for London and Southern Counties for Foundry Equipment and Refractories; one with sound connection preferred, but experienced Foundry Manager would be considered.—Box 702, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

REPRESENTATIVE required for Scotland, by old-established manufacturers; applicants should have sound connection with Foundries and should send full details of previous experiences, connections, age, and salary required, to Box 672, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

MACHINERY

WANTED. — Redundant Foundry Plant, Adaptable and Hand-Squeeze Moulding Machines. Cupola. Cupola Hoist, Sand Riddle, Core Mixer, Sand Blast, etc.; state lowest.—Box 680, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

PNEUMATIC MOULDING MACHINES.

Tabor (Macnab) Vert. turnover, table approx. 40 in. by 30 in.
Darling & Sellars turnover, table 64 in. by 20 in.
Adaptable Rollover Core - Making Machines, hand operated.
Mumford Type (Jackman) Swing Head-press, 13 in. by 15 in.
Mumford Pneumatic Core Jolters, tables 24 in. by 18 in.
Britannia No. 1 "Coventry" Turnover Jar Ram, table 30 in. by 28 in.
Universal Plain Jolt; 1-ton capacity; table 37½ in. square; one machine unused.
Sandblasting Plant; 50 Air Compressors; 500 Electric Motors, Dynamos, etc.

S. C. BILSBY,
CROSSWELLS ROAD, LANGLEY,
NR. BIRMINGHAM.
Broadwell 1359.

ONE FOUNDRY LADLE; 25 tons capacity; built 1938; very little used; with enclosed dustproof gears and oil bath to worm wheel; easily controlled by one man.
ONE SAND MILL, by Whittaker; pan 7 ft. dia.; rollers 48 in. diameter; renewable bottom, power raising and lowering gear, and "V"-rope drive; with or without 24 h.p., 220 volts, d.c. motor. Apply
FOSTER, YATES & THOM, LTD., BLACKBURN.

THOS. W. WARD LTD.
SOLE AGENTS FOR
"POLFORD" CORE SAND MIXERS, TILTING and CRUCIBLE FURNACES, MOULD DRYER RIDDLE, SCREEN, etc. WRITE FOR PRICES AND PARTICULARS.
ALBION WORKS, SHEFFIELD.
'Grams: "Forward." 'Phone: 26311 (15 lines).

"TILGHMANS" Sand Blast Outfit; complete with compressor; motorised, a.c., 400/3/50.—URQUHART, 1023, Garratt Lane, S.W.17.

SKLENAR Patent Melting Furnaces; coke- or oil-fired; capacity 2 tons, 1 ton, ½ ton, 500 lbs.—SKLENAR PATENT MELTING FURNACES, LTD., East Moors Road, Cardiff.

MISCELLANEOUS

AVAILABLE IMMEDIATELY.—Capacity for Grey, Malleable (Whiteheart) and Non-Ferrous, also Light Alloys Castings; repetition types; reasonable prices; good deliveries.—Box 682, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

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