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PRINCIPAL CONTENTS

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Dust Prevention and Ventilation of Foundries

Although there was not much new knowledge disclosed at the recent symposium on the heating, ventilation and lighting of foundries held under the auspices of the British Cast Iron Research Association, the opportunity was taken to review the existing "state of the art." It would appear that, so far as dust-collection is concerned, there is at the moment no yard-stick for measurement, let alone comparison. Thus foundrymen are left in the dark as to how much dust is removed and how much remains behind. Even if this were solved, there is no common denomination in foundry practice. It is almost true to state that, in the case of a jobbing foundry, where a high building is provided, there is no real dust problem, nor are there any obnoxious smells from the core-binders. These, however, do vitiate the atmosphere where whole moulds are built-up from oil-sand cores. Mr. Lawrie pointed out the main problem of dust is to be associated with the rapid working mechanised plants.

Too much attention is being directed towards Swedish foundry ventilation results and too little to say South African or Indian. We draw attention to this because our climate resembles neither. The hermetically-sealed foundries of Sweden are such—at least we should so imagine—that a barmaid's breath would intoxicate the whole staff! There is no need for air-conditioned foundries in our country. It is obvious nevertheless that dust needs arresting at its point of production; that research must continue so that the finest particles can be either eliminated or controlled and that heating is an individual problem—in more senses than one. For instance, people who have lived for many years in centrally-heated homes are uncomfortable in houses relying on open fires and *vice versa.*

It is also quite obvious that in the light of existing knowledge, such extremes as complete dust extraction which would involve the entire change of atmosphere in a foundry to the general discomfort of everybody in it are not practical. Thus, there must be a period of prolonged research into the problem—always bearing in mind that foundries vary from small workshops up to huge mass-production factories. Therefore, initially the question must be broken-down, if rational results are to be forthcoming. There are really two problems—one is minimising the risk of pulmonary diseases and the other the general improvement of working conditions. The former presents much more difficulty than the latter—where good housekeeping alone can make beneficial changes. Generally speaking, there is nothing much wrong with foundry lighting as the foundry industry was amongst the first to take up the matter seriously. It is reasonably certain that those who attended the conference have a much better appreciation of the over-all problems than ever before and no doubt will start experimenting in their own works.

Ironfoundry Quiz

On the stand of the Council of Ironfoundry Associations during the recent "foundry exhibition" at Olympia, there was a large frame containing 20 questions. By pressing buttons, the correctness or otherwise of postulated answers was revealed upon the frame by illumination. These questions are set out below and the correct answers on page 434.

(1) In which aircraft parts may cast iron be used—compressors, piston rings, valve guides, or brake drums?

(2) The Mersey Tunnel is built of cast-iron segments weighing—23,000, 56,000, 82,000, or 125,000 tons?

(3) The Worshipful Company of Founders dates back to the year—1365, 1485, 1588, or 1715?

(4) The approximate number of cast-iron parts in a typical modern light car is—30, 70, 100, or 125?

(5) The weight of decorative iron castings in the Tower Bridge, London, is—nil, 100 tons, 1,200 tons, or 2,600 tons?

(6) The highest specified strength of grey cast iron (B.S.1452—1.2 in. dia. bar) is—15, 20, 26, or 30 tons per sq. in.?

(7) The strength in tons per sq. in. of cast iron (treated) is limited to—30 to 35, 35 to 40, 45 to 50, or 50 to 60?

(8) The weight of castings in the 1851 Main Exhibition Building was—250, 2,500, 3,800, or 5,200 tons?

(9) The consumption of pig-iron by ironfoundries during 1950 was—1, 1½, 2, or 2½ million tons?

(10) The inventor of the ironfoundry cupola was—Henry Cort, John Wilkinson, Abraham Darby, or Dud Dudley?

(11) The number of British Standards referring to cast iron is—37, 62, 187, or 272?

(12) The British Cast Iron Research Association was formed in the year—1896, 1902, 1921, or 1930?

(13) Since 1945, iron castings production has increased by—10, 25, 50, or 75 per cent.?

(14) The world's first cast-iron bridge (over the River Severn) was erected in—1603, 1779, 1823, or 1888?

(15) Which county has most ironfoundries—Lancs, Lanarks, Yorks, or Warwicks?

(16) Iron castings in a modern council house weigh—0.1, 0.6, 2.0, or 10.0 tons?

(17) The number of ironfoundries in the United Kingdom is—500, 1,150, 2,250, or 4,520?

(18) The 1950 tonnage output of iron castings was—1½, 3½, 6, or 9½ million?

(19) Ironfoundries employ a labour force of—10,000, 15,000, 97,000, or 152,000?

(20) The tonnage of malleable-iron castings made in 1950 was—13,000, 26,000, 130,000, or 390,000?

Steel Export Control

To ensure the proper distribution of exports of finished steel during the rest of the year, the Board of Trade is revoking the current bulk licences valid for various destinations, and endorsing them so as to exclude most foreign countries from their scope. Destinations to which bulk licensing will continue will be the Commonwealth, Denmark, Finland, Norway, Portugal, Sweden, and Argentina.

Exporters desiring to export finished steel to other countries will be required to submit individual applications for licences. Holders of bulk licences will receive from the export licensing branch of the Board of Trade further information about the new arrangements.

Notes from the Branches

Bristol and West of England

Members of the Bristol branch of the Institute of British Foundrymen accompanied by their ladies travelled by coach to Tiverton on September 22 where they were joined by others from Exeter and district. The object was to visit the foundry and lace mills of John Heathcoat & Company, Limited.

After a very interesting tour of the mills and foundry, the former being especially appreciated by the ladies, the guests were entertained to luncheon by courtesy of the directors of the Company. The party was honoured by the presence of the Mayor and Mayoress of Tiverton. The luncheon was followed by a short talk on the history of the firm, given by Mr. F. Johnstone, managing director, who stressed what a fine relationship existed between the employees and employers. The Mayor, speaking afterwards, mentioned the good work carried on by Heathcoats in housing the employees and of the future prospects of increasing the number of houses to be erected during the ensuing year.

The presidential address was then given by Mr. D. Robertson, who dealt with the vast improvements made by the foundry industry during the past 25 years, and of how the enormous problems of to-day are being tackled.

After a brief interval, the party left Tiverton, travelling along the beautiful valley of the river Exe to Bickleigh Castle, the home of Colonel Henson. This gentleman then entertained the party by giving a most lucid description of its history and architecture. On the journey home, a surprise visit was paid to the works of Stenners of Tiverton, Limited, and Twose & Company. The party were conducted round the workshops by Mr. Authers, managing director, and members of his staff.

Visit to an Instrument Factory

Recently, our representative visited the works and laboratories of Nash & Thompson, Limited, Oakcroft Road, Tolworth, Surrey. This concern was founded in 1936 and then, until 1945, was responsible for the design and development of the well-known Frazer-Nash gun turret. Since 1945 it has undertaken research work for an important group of associated companies such as Ascot Heaters and Magnal Products. Now as scientific instrument makers, they have expanded to the actual manufacture of these, together with a general consulting service for industry. The works is nicely laid out and embraces a drawing office, pattern-shop, machine-shop, fitting-shop, physics, electronic and chemical laboratories, electrical assembly-shop and library. Of the instruments made, there are a colour comparator, a temperature recorder, a mounting press, a gloss meter, a flowmeter, an aeration test burn; a furnace controller and a flow-control switch. These are standard lines, but many other instruments are made for the paint and enamel industries and one for measuring the wear of pencils during writing. It is a very interesting establishment.

STEEL PRODUCTION in the United States in August was 8,722,000 tons, a record for the month. In the first eight months of the year output totalled nearly 69,700,000 tons, compared with 63,500,000 in the corresponding period of 1950. The target for the first quarter of 1952 is 28,000,000 tons, against the current quarterly rate of 26,600,000 tons.

The Process of Die-casting*

By J. A. de Kiewiet

Die-casting is the process of producing accurately-dimensioned parts by forcing molten metal under mechanical pressure into metal dies or moulds. In the United States the term " die-casting " does not apply to castings made in metal moulds either by gravity pouring or centrifugal action. These are termed " permanent mould " castings and in England as " gravity die-casting " or " centrifugal castings." Non-ferrous articles made in vice-action and plain presses are termed " hot pressings " and are not die-castings. In this process the metal is introduced into open dies in the form of a heated slug. It can be readily seen from these few definitions that the general term " die-castings " covers an enormous field and this Paper deals with " pressure die-casting," to use the English term.

Among the numerous advantages of a die-casting, perhaps the most significant is the rapid and economically repetitive production of large quantities. As a corollary to this, large quantities are required to offset the rather high initial die cost as compared to the cheaper pattern-plate and moulding-box of normal sand-casting procedure.

It is capable of production within remarkably close dimensional limits, often in complex shapes, which are difficult or impossible to machine. This obviously reduces subsequent machining and finishing operations to an absolute minimum. The surface finish of a die-casting is usually smooth and free of irregularities; also wall thickness can be made much thinner than is feasible in sand castings. As far as mechanical properties are concerned, due to pressure and rapid solidification, die-castings are far superior to corresponding alloys cast in sand-moulds. Inserts of other metals are more widely used in die-casting, as they can be cast in exact predetermined positions.

The definite and precise standards in die construction methods enable the die-caster to produce castings with a host of undercuts and cavities, which in sand-casting would involve intricate, slow and expensive core-work, quite apart from poor surface finish and subsequently expensive machining.

Principal Materials Used

Pressure die-casting is a process which is applied almost exclusively to non-ferrous alloys. These alloys are based on the following metals in order of commercial importance: zinc, aluminium, copper, magnesium, lead and tin. It is obvious that each metal has qualities and advantages peculiar to itself and that no die-casting alloy can be classed as first under all considerations. If this were so, there would be no reason for the existence of the other alloys on a commercial basis.

The primary considerations in the choice of a die-casting alloy are the flowability and ease of handling; melting temperature and its resultant effect on die life and injection cylinders; physical and chemical properties to meet the requirements of the application on hand; machining properties and applicability of commercial finishes, such as plating, polishing and pigmenting.

It is said that 85 per cent. of the total tonnage of die-castings produced in America are manufactured of a zinc-base alloy. This statement is borne out by the automobile industry, which uses large quantities of die-castings such as door-handles, carburettors, fuel pumps and practically all chrome-finished details on the radiator and instrument panel. Examples in household appliances include such articles as mixmasters, washing machines and refrigerator parts, movie cameras, projectors, time clocks, Zipp fasteners, etc.

High-temperature die-casting metals, *e.g.*, brass and aluminium, play havoc with even the best so-called " hot-die steel " and injection plungers and cylinders. It is therefore understandable that zinc-base die-castings have such a preference and popularity over all others. Speed, ease of operation and almost unlimited die life are the chief factors in the choice of zinc-base alloys.

Pressure Die-casting Practice

Die-casting is a comparatively new and rapidly expanding field and it is extremely unfair to compare or consider it in competition with sand foundry procedure, as each has its own application and field, which do not overlap to any considerable extent. The production of die-castings is the result of many skills: the designer, with his knowledge of draughtsmanship, die standards and design, with, of course, the subsequent die-casting application; the engineer, with his machine tools and ability to cut die cavities; the patternmaker, who constructs preliminary models and copy for use on die-sinking and pantograph machines; lastly, the foundryman, with his knowledge of metallurgy and casting technique.

Die-casting machines have been developed to meet the various problems which have arisen as die-casting advanced from stage to stage. In some instances, principally in the case of low-melting-point zinc-base alloys, a simple design of hand-operated machine will meet all practical requirements. In other instances, the nature of the alloys used, such as aluminium, brass and the larger quantities of castings required, necessitates the use of more highly-developed machines, with pneumatic or hydraulically-operated mechanisms.

The origin of the die-casting machine is not definitely known, but it is pretty certain that attempts in the early part of the 19th century were primarily concerned with the production of lead articles, such as type and bullets.

* Paper read before the South African branch of the Institute of British Foundrymen.

The Process of Die-casting

Modern die-casting machines fall into two main categories. These are known as " hot-chamber " or " pot injection " machines and " cold-chamber " machines, with either electrically or manually timed cycles of operation.

The " hot-chamber " machine, which is perhaps the more widely used type, casts only low-temperature alloys, such as zinc, lead and tin. (It should be noted that minute traces of lead and tin have such disastrous effects on zinc alloys that where zinc die-castings are made all work with lead and tin should be excluded.) The machine consists primarily of two platens, one fixed and one movable, mounted on accurate and rigid tie-bars. These are for mounting and operating the die halves.

A cast-iron melting pot, with submerged or integral gooseneck and injection nozzle in intimate contact with the fixed die half, supplies the molten metal. Due to the design of " hot chamber " machines, the metal enters the gooseneck through a point well below the surface of the metal in the pot, resulting in only clean, unoxidised metal entering the die cavity.

In the " hot-chamber " machine in Fig. 1, the

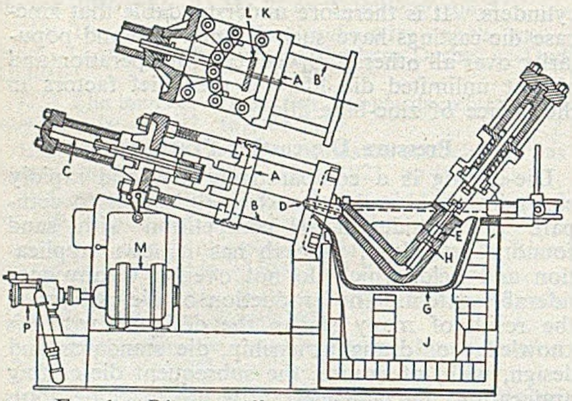

FIG. 1.—*Diagram Illustrating a Hot-chamber Die-casting Machine*

movable half of the die is attached to platen A and the stationary half is in contact with nozzle D. Platen A slides on the four tiebars B and is actuated to and from the fixed die and casting position through a toggle link mechanism. When a die is in the closed position, molten metal is forced through the nozzle D by the downward stroke of the plunger E. When the plunger is withdrawn molten metal flows from cast iron pot G through the port H into the gooseneck, from which the downward stroke of the plunger forces the metal into the die cavity. The dies are not shown in this illustration. It is general American practice to have the injection nozzle in permanent contact with the fixed die-half. In many British machines, however, the fixed die-half breaks away from the nozzle, at the opening of the die halves, by about a quarter of an inch. The furnace is arranged for either oil or gas heating. After injecting the metal into the die, there is a short interval to permit the metal to solidify, the interval period being either electrically or manually controlled.

The Author has achieved this very successfully by instructing the operator to cast to a large and marked photographic timing clock. This interval varies with the weight of the casting produced. The injection speed is also varied as heavier castings have a slower solidification and require feeding. When platen A and the removable half of the die is withdrawn, the casting, which is planned so that it remains in the movable die-half, is ejected by means of an ejector plate (not shown). This ejector plate is actuated when it strikes the stationary ejector pin K. This die is illustrated by a typical example later in this Paper.

It is essential that the metal in the die-halves solidifies up to the point of contact with the nozzle, whereas the metal in the nozzle remains molten at all times, permitting it to run back into the gooseneck. This condition is achieved as follows: There is a drilled water-cooling cavity in the fixed die-half, with an adjustable water supply. This takes care of the solidification of the sprue hole and other comparatively heavy metal sections. The nozzle is continuously heated with an independent gas jet.

From this it is evident that die temperature and its attendant water-cooling, the nozzle and its heating jet and the metal temperature in the pot must all be correct before casting operations can commence. Machines built for manually-operated cycles usually have two operating levers, that is, one for die closing and one for metal injection. These are so interlocked that it is not possible to inject the metal before the die halves are closed, and also injection pressure has to be released before the dies can be opened.

The Author has built a manual- and air-operated machine with the necessary interlocks, but with trapped flash between the die-halves it is still possible to operate the injection cylinder. He found this out, to his cost, and the pattern of metal sprayed on his skin and his clothing was interesting, but far from amusing or comfortable!

Limits to Size of Die-castings

Normal pressure on the metal by the piston in the gooseneck is in the region of 1,600 to 2,500 lb. per sq. in. This is for zinc machines; those arranged for aluminium and brass operate at much higher pressures. The pressure tending to separate the die halves must, in the interests of safety, be calculated, especially on large die-castings. If the casting area of a cavity, including runners and overflow wells, is, for example, 20 square inches (that is equivalent to a rectangle of only 5 inches by 4 inches) and there is a metal pressure of 2,000 lb. per sq. in. there then is a theoretical resultant of 20 tons tending to separate the die halves. In practice this is, however, only very momentary, as solidification is rapid.

This will illustrate that there are very definite limits to the size in which die-castings can be made and that for comparatively large castings exceedingly robust machines are required. It is vital that

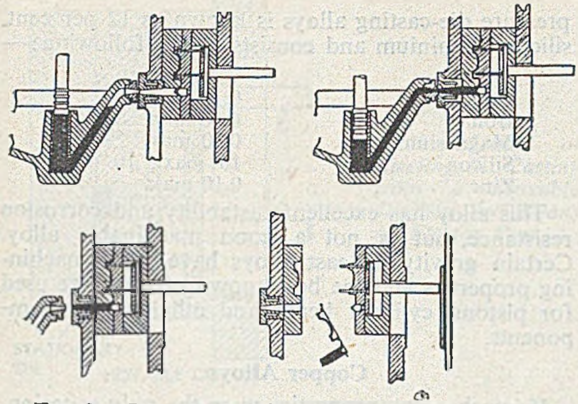

FIG. 2.—*Stages in Production from a Die-casting Machine utilising a Vertical Plunger.*

at no time should the metal pressure in the die exceed the locking pressure of the toggle mechanism.

Die-casting machines are made with platen sizes varying from 12 in. by 12 in. to 36 in. by 36 in., the latter being considered a very large machine. It is interesting to note at this stage that the largest area aluminium die-casting ever made was cast in a 48 in. by 48 in. machine, having a closing pressure of 424 tons. This casting is an experimental aluminium door for the Kaiser-Frazer car, and the die-casting machine during the trial runs produced between 30 and 50 doors per hour.

As far as die operations are concerned, "cold-chamber" machines are generally similar to the "hot-chamber" machines previously described. They are, however, more robust for equivalent die sizes due to the larger metal injection pressures used, which usually range from 6,000 to 20,000 lb. per sq. in.

Referring to Figs. 2 and 3. The cylinder A in Fig. 3 forming the "cold-chamber" metal reservoir is filled before each "shot" through a pouring slot. An extension of the cylinder is formed in the fixed die-half B from which the casting is gated. When the two die-halves have been locked and the cylinder charged with molten metal, the plunger C is hydraulically advanced, forcing the metal into the die and leaving a slug excess metal in the cylindrical recess of the fixed die-half B. When the die is opened the plunger C continues its stroke and forces the slug out of the fixed die along

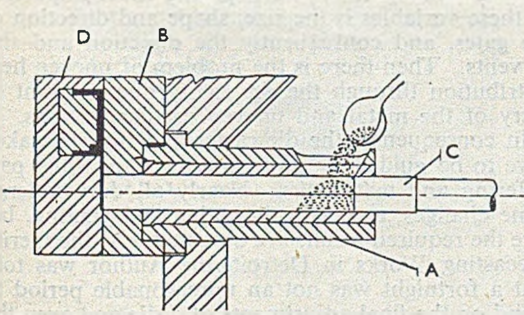

FIG. 3.—*Cold-chamber Die-casting Machine with Horizontal Plunger.*

with the casting and movable die. The plunger is then withdrawn and the casting is ejected in the normal way by the ejector pins in the movable die D.

Fig. 4 illustrates diagramatically four stages in this cycle and shows a die with a side core which is withdrawn before the die is opened. Machines of the "cold-chamber" design are employed chiefly for making castings in aluminium and brass. The lower-melting-point alloys can also be cast in these machines but are more economically cast in the faster-operating "hot-chamber" machines.

The Author learnt that in the U.S.A. nearly all large American plants devoted exclusively to die-casting, design and build their own die-casting machines, although some also purchase and use proprietary makes. It will be found, however, that practically all designs make use of the principles already outlined.

A gooseneck machine which the Author has constructed operates very successfully. The speed of operation can be held at 6 shots per minute but 4 are easier to handle. Metal pressure is 2,000 lb. per sq. in. and furnace capacity is sufficient to maintain the pot full of molten metal at 6 shots per minute. He has three other machines of improved design under construction.

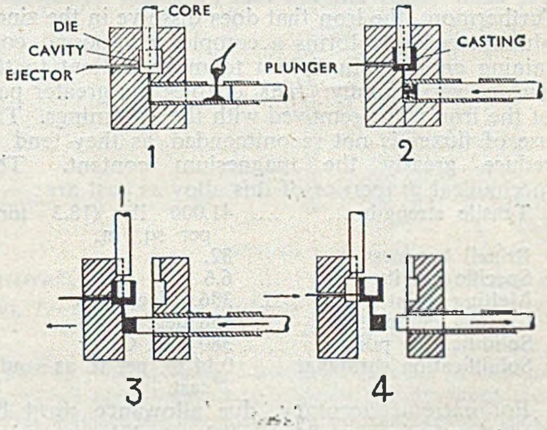

FIG. 4.—*Production Diagram for a Cold-chamber Horizontal-plunger Machine.*

Zinc Alloys

It is on record that early zinc alloys were subject to hidden cracks that could then only be detected by sounding the casting, probably, amongst other causes, due to hot-shortness of the alloy. They were seriously affected with destructive intercrystalline oxidation and so-called "ageing," which greatly reduced the strength characteristics and rapidly altered the shape and size of the product. The cause of these failures was at the time unknown but it is stated that early die-casters, in order to overcome mechanical casting difficulties, added a "sweetener" in the form of lead or tin bar to the melting pot, not realising the harmful effects, which time alone would tell.

Sufficient knowledge has been gained from these experiences to enable the die-caster to avoid combinations which accelerate intercrystalline growth.

The Process of Die-casting

Due to investigations carried out by the Research Division of the New Jersey Zinc Company, a very stable and mechanically sound zinc alloy has been found. This is available on the American market under the trade name of "Zamak." The British equivalent of this alloy is called "Mazak." Whilst in America the Author visited the New Jersey Zinc Company, and they very kindly gave him much information on zinc die-casting and their alloys.

Zamak No. 3, which is the most popular alloy, has the following composition:

	per cent. max.	per cent. min.
Aluminium	4.3	3.9
Copper	0.03	—
Magnesium	0.06	0.03
Iron	0.075	—
Lead	0.003	—
Tin	0.001	—
Cadmium	0.003	Remainder zinc

The remarkable increase in corrosion resistance of this alloy is stated to be due to its magnesium constituent. The presence of 4 per cent. aluminium reduces the tendency to dissolve iron to less than 1 per cent. of the amount that pure zinc will absorb, furthermore, the iron that does dissolve in the zinc/aluminium alloy forms a complex compound containing enough aluminium to make it float to the surface very rapidly. This enables the greater part of the iron to be removed with the skimmings. The use of fluxes is not recommended, as they tend to reduce greatly the magnesium content. The mechanical properties of this alloy as cast are:—

Tensile strength	41,000 lb. (18.3 tons) per sq. in.
Brinell hardness	82.
Specific gravity	6.6
Melting point	386.6 deg. C.
Casting temperature ...	458 deg. C.
Solidification point ...	380 deg. C.
Solidification shrinkage ...	0.14 in. per ft. as sand cast.

For extreme accuracy, due allowance must be made for the increased size of the steel die at casting temperature. The ductility of "Zamak" is adequate at room temperature, a property which is of extreme value in the assembly of zinc-base components.

Aluminium Alloys

There are so many aluminium alloys designed for special applications, for gravity and pressure die-casting, that it is not possible to mention more than those in the silicon group.

Pressure die-casting aluminium alloys are usually non-heat-treatable. Aluminium castings in permanent moulds and pressure machines have made rapid progress during recent years, and it would be difficult to say which is the most popular method; the main difference being that pressure die-castings would show finer detail, greater dimensional accuracy and economy in large quantities due to speed of operation and thinner sections. Gravity die-castings could, in instances of heavier work, be mechanically sounder than pressure castings as a result of less air and oxide inclusions. One of the most popular pressure die-casting alloys is known as 12 per cent. silicon aluminium and consists of the following:—

	per cent.
Copper	0.10 max.
Iron	0.60 max.
Magnesium ...	0.30 max.
Silicon	13 max., 10 min.
Zinc	0.10 max.

This alloy has excellent castability and corrosion resistance, but is not a good machinable alloy. Certain gravity die-cast alloys have good machining properties and the best known of these are used for pistons, cylinder heads and other engine components.

Copper Alloys

If mechanical properties were the only criterion, copper-base die-castings, usually a 60-40 brass, would displace those made of other alloys. It happens, however, that other factors have to be considered, with the result that copper-base alloys probably account for less than five per cent. of the total tonnage of all die-castings produced in the United States. A primary reason for this is the relative high cost in producing brass die-casting dies. Most alloys which are rich in copper have melting points of 850 deg. C. or higher, and thermal fatigue of the die face results from high temperature gradient between the die face and sub-surface parts. It is necessary to use expensive alloy die steels which are not easily machinable and require heat-treatment, which often brings disastrous results. Die life is relatively short and casting speed slow.

The high pressures used, sometimes in excess of 20,000 lb. per sq. in., require expensive hydraulic equipment and particularly massive and robust machines. Consequently the projected area of castings is limited. Brass forgings do not present the same problems and can often be produced in complex hollow shapes at much lower cost.

Die Construction

The construction of die-casting dies must necessarily differ in so far as their cavities and cores are concerned, because these elements are obviously controlled by the design of the part to be cast. There is no established theory covering such construction, as die design involves numerous variables. The combined effect of these makes it virtually impossible to predict with certainty just how the die will operate. Perhaps the most important of these variables is the size, shape and direction of the gates, and consequently the direction and size of vents. Then there is the problem of uneven heat distribution through the die cavity due to point of entry of the metal and uneven casting sections.

In consequence, the die-caster and his die-maker have to be guided by past experience, possibly past suffering and text-books. Nearly all dies undergo some changes, especially in gating and venting, before the required results are obtained. At the Gerity Diecasting Works in Detroit, the Author was told that a fortnight was not an unreasonable period to spend on the final adjustments of a die and even the simplest die very rarely operated satisfactorily on the first trial runs.

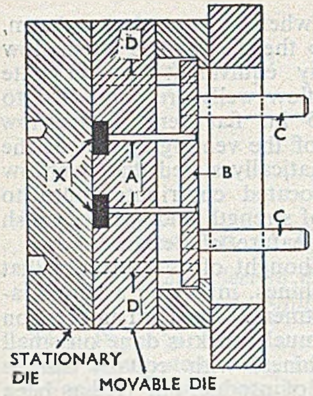

FIG. 5.—*Method of Ejecting a Casting from a Movable Die-half by Means of Ejector Pins.*

However, die mechanisms may follow the same fundamental principles for a large variety of different applications. This is true of the methods employed for casting ejection, core operation, automatic gate-cutters and so on.

Fig. 5 shows a system of ejecting the casting from the movable die-half at the end of each operation. This type of mechanism consists of ejector pins A attached to plate B, which is assembled in such a way as to allow movement relative to the die and independent of the machine. When this die approaches the end of its opening stroke, rods C make contact with bar stops on the machine and hold plate B stationary as the die completes the stroke. This means that the die slides back along the pins A so that they extend into the cavities X and thus eject the castings. When the movable die is closed against the stationary die, preparatory to a casting operation, pins D make contact with the stationary die and return the ejector pins to the casting position.

In Fig. 6 a simple method of operating a sliding core is shown by means of a pin fixed at an angle in the stationary die. The core A is mounted in a slide B, which operates in block C. This block is fastened to the front of the movable die. Extending at an angle from the face of the stationary die, there is a pin D, which is designed to engage an angular hole in slide B when the movable die approaches the stationary die at the beginning of each operation. At this stage, the angular relation of pin D

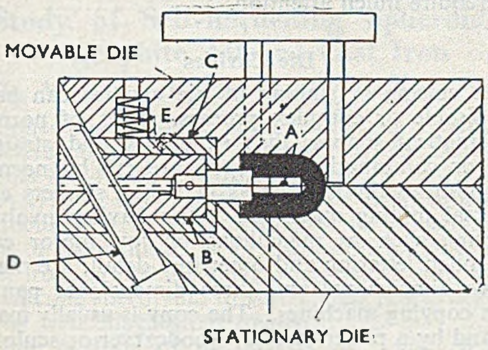

FIG. 6.—*Simple Method of Operating a Sliding Core.*

and the corresponding hole in slide B causes the slide to move laterally for advancing the core into the die-cavity, as shown. When the movable die withdraws from the stationary die at the end of each operation, the core is pulled sideways from the die-cavity as slide B slips off the end of the pin D. The casting can then be ejected in the usual manner. Dimples should be drilled in slide B and a spring detent provided in the movable die (as shown at E) to lock the core slide in its inner and outer positions. The face of the stationary die is recessed to encompass the projecting portion of block C. Movable cores can be operated in practically any direction in relation to the die-face by means of rack-and-pinion mechanisms, which are usually located within the movable die-half. This system lends itself to an infinite number of variations and applications.

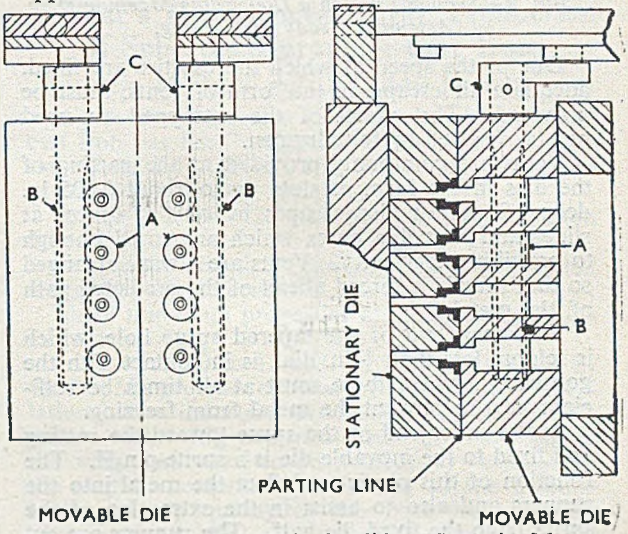

FIG. 7.—*Operation of Multiple Sliding Cores by Means of Holders moved by Rack-and-pinion.*

In Fig. 7 the sliding cores are mounted in holders A, which are arranged to slide in the movable die-half. Rack teeth are provided on the back of these holders for engaging a pinion shaft B, so that the cores are operated to or from the die-cavities. The rollers attached to levers C follow the cam paths of bars mounted on top of the machine.

Small die cores are usually mechanically operated, whereas in larger machines simple hydraulic cylinders operate the cores to a timed cycle.

On simple dies it is sometimes possible to dispense with water cooling, but this is rare. The speed of operation and the quantity of metal used generally places more heat in the dies than they can normally or naturally dissipate and some form of internal and adjustable water circulation is necessary. This is achieved by drilling channels through the die blocks in positions where they will not foul or interfere with the cavities or movable parts.

When the parts of a die are in the correct relative position, locked and ready for the casting (see Fig. 8), metal is injected through sprue F and passes through runners and gates G and thence into the die cavities.

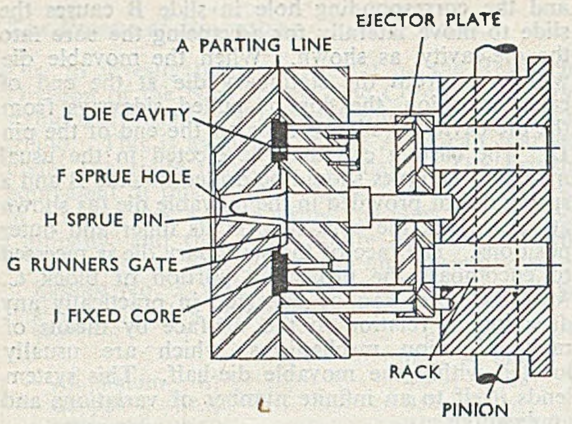

FIG. 8.—*Section through a Die-casting Machine Die Assembly Ready for Casting.*

Due to the speed at which the cavities are filled, adequate air escape, in the form of vents, must be provided. The effects of the entrapped air need not be stressed to foundrymen.

Vents are commonly provided at the parting of the dies in the form of slots up to about 0.005 in. deep. Some air also escapes by way of spaces at slides and movable cores which are small enough to prohibit metal entry. Vents are always arranged so that the air is forced ahead of the predicted path of the metal.

The small end of the tapered sprue hole, which is seldom less than ½ in. dia., is in contact with the gooseneck, where there must at all times be sufficient heat to prevent the metal from freezing.

At the inner end of the sprue toward the casting and fixed to the movable die is a sprue-pin H. The function of this pin is to deflect the metal into the runners and also to assist in the extraction of the sprue from the fixed die half. The runners are cut into the die at the parting face and their dimensions depend on the size of casting and the rate at which the cavities are to be filled. In general, the depth of the runners decreases and the width increases to form gates as they approach the die-cavity. Gates exercise some control over the direction and rate of metal flow into the die-cavities. The problems of venting and gating with either gravity die-casting or core-blowing are familiar to most foundrymen.

Changes in both gating and venting are very likely to be required when the die is placed in service and there are no fixed rules which determine the location and size of gates and vents. Gates and vents influence to some extent both the soundness and surface finish of the casting. A thin gate naturally facilitates the removal of the runner from the casting and leaves a minimum blemish, but these should not be so thin as to prevent proper filling of the die cavity. As heavier gates promote soundness and better physical properties, a compromise is made in arriving at a workable gate thickness. It is also desirable to provide a few overflow wells on the vented side or sides of the casting. These wells catch some of the first and possibly finely dispersed metal which has passed through the die cavity and also provide space into which air escapes or is trapped where it can do no harm. The wells are joined to the die cavities by shallow openings approximately equivalent to the gate openings and the overflow wells are connected to atmosphere with 0.005 in. flat vents. Overflow wells constitute a part of the venting system of the die and it can be emphatically stated that overflow wells when properly located contribute more to soundness, uniformity of strength and surface finish than any other single feature of design.

Die-casting is often thought of as a process that requires automatic machines, involving a comparatively high initial investment. Such an impression is decidedly wrong, as much work is done on small and simple hand-machines, with equally simple dies and at a high rate of production. It has been stated that die-casting is the " shortest distance from raw material to finished product."

There are many overseas firms who run one or two machines producing castings for their own use and have no need to possess their own tool-room. The well-known Dinkie Toy is, it is stated, produced on simple hand-machines. There are firms who concern themselves only with some particular product, such as clasps for ladies' handbags, Zipp fasteners, which are cast directly on to the cloth, bungs for barrels and so on. The process does, however, become involved where firms cater for the die-casting needs of all and sundry. This class of work is not entered into light-heartedly.

Dies designed for producing castings from zinc-, tin- and lead-base metals can, as a general rule, be made from ordinary machine steel or cold-rolled steel, since the melting point of these metals does not exceed 325 deg. C. If a zinc casting of complicated design requiring a number of sliding cores is to be produced, it is preferable to construct the die from heat-treatable alloy die-steel. In this instance ordinary steels are sometimes used and then case hardened.

In dies for brass and aluminium it is essential to use what is termed a " hot-die steel " and this is carefully heat-treated. Aluminium can be very successfully gravity poured in cast-iron dies, which have machined or cast cavities. The life of dies for zinc-base alloys is practically unlimited, but the higher working temperature of brass and aluminium rapidly cause heat checking and movable die members require much attention.

Die Cavities

The cutting or sinking of die cavities can be a very simple or complex process. Dies of normal mathematical shapes, that is, circles and straight lines, or combinations thereof, are cut by normal machining methods, such as in lathes, shapers and universal milling machines. Dies having involved contours, such as medallions or toy motor cars with much lettering and other fine detail, are made on two dimensional and three dimensional pantograph copying machines. The copy is usually made by hand by a patternmaker, woodcarver or sculptor and from two to four times life-size, in wood, plaster or clay. Reverse copy is taken from these models by plaster casts or zinc spraying. This reverse

(*continued on page* 422)

Abstracts from the Brussels Conference Technical Papers

(*Continued from page 361*)

Classification of Foundry Defects

By G. Henon (Société des Hauts Fourneaux de Saulnes)

This Paper presents a classification of foundry defects as adopted by the International Commission on Foundry Defects at the Buxton meeting in 1950.

The proposed classification is based on the aspect, form, position, dimension and generally speaking on criteria which can be directly observed or measured. Each defect is numbered by four figures The first figure gives the general class into which the defect can be included. The other figures give more information on the defect and its specific classification. To each defect the usual name is given, together with the causes and remedies.

Nickel Cast Iron and Spheroidal-graphite Cast Iron for Engineering Applications

By J. V. Bairiot and J. Berthelier (Nickel Information Bureau, Brussels)

The field of application of cast iron and especially of so-called alloyed cast iron is very broad. Cast iron has a range of mechanical properties covering a wide field from the ordinary usual grey iron to the recently-discovered spheroidal-graphite cast iron. in any engineering work cast iron has a rôle to play.

In any problem related to gas-, steam- or diesel-engines, machine-tools, pipes, etc., everywhere the engineers have to find the most suitable iron grade representing the best solution.

Every so often, it is perhaps necessary to examine the existing position and state a case. The Authors have tried to do this, and give some hints as to the principal applications of nickel and ductile cast irons in engineering.

Study of Self-hardening Spheroidal-graphite Alloyed Cast Iron

By M. Ballay, R. Chavy and J. Grilliat (Paris)

Spheroidal-graphite cast irons have different mechanical properties according to the heat-treatments to which they are submitted.

A type of lamellar-graphite cast iron, called self-hardening, is of a great interest to industry. The aim of the Authors is, by using spheroidal-graphite cast iron, to make similar irons with a slow critical quenching speed, and to verify their properties. The irons were magnesium treated.

The position of the arrests AC1 and AC3 has been determined to mark the maximum tempering temperature and the minimum pre-quenching temperature. Tests have shown that one can easily obtain cylindrical castings of more than 100 mm. dia., the hardness of which is more than 450 Brinell. These castings are easily machined after annealing at about 650 deg. C.

This quench allows the hardening of thick sections without any risks of shrinkage cracks and extends the range of application of these irons.

A Year's Experiences in the Production of Spheroidal-graphite Cast Iron

By F. Canti and C. Galletto (Italy)

In the Petri foundry (Saronno-Italy) spheroidal cast iron has been produced on an industrial scale since June-July, 1950. The mechanical properties of the iron produced are:—

As cast : Tensile 35 tons per sq. in.; elongation 0 to 2 per cent.

Treated (annealed): Tensile 26.5 tons per sq. in.; elongation 12 per cent.

These minimum properties are guaranteed to the customers.

Each week 10 to 15 cwt. of iron are treated by the Ni/Mg process followed by ferro-silicon inoculation. For industrial production the major difficulties of the Mg treatment are:—(1) Variation of the weight of metal to be treated; (2) variation of the sulphur content; (3) efficiency of the inoculation; and (4) quality of the base iron, varying according to the raw materials charged in the cupola.

However, these problems can be solved by careful control of all the foundry operations, which rapidly become a routine work. During a shortage of Ni/Mg alloy, the Cu/Mg alloy was experimented but the mechanical properties obtained were not as god as with the Ni/Mg.

During this year of practice, the Authors have found that spheroidal-graphite cast iron could be employed in a very great number of applications. But the most significant results were obtained with castings requiring specially good soundness, fatigue or impact strength.

Annealing and Heat Treatment of Nodular and Other Cast Irons

By J. E. Rehder, (Foundry Engineer, Physical Metallurgy Division, Department of Mines and Technical Surveys, Ottawa, Ontario)

From the data and discussion presented, certain rules to be followed when quenching and tempering malleable irons, grey cast irons, or nodular irons may be drawn up, and are listed as follows:—

(1) From the chemical composition of the iron,

Abstracts from the Brussels Conference Papers

determine the location of the critical temperature range.

(2) Heat the iron to at least 28 deg. C. above the top of the critical temperature range and hold at temperature for at least one-half hour before quenching. If the initial microstructure is predominantly ferritic, heat to higher temperatures and/or hold for longer times to ensure complete re-solution of ferrite.

(3) Quench from not more than 28 to 42 deg. C. above the top of the critical temperature range, to decrease susceptibility to quench cracking.

(4) Quench in oil unless the section be large, in which case water may be necessary. Slower quenches may be necessary for thin sections of relatively high silicon content.

(5) Use iron of normal silicon content, incorporating a carbide stabiliser such as manganese or chromium for control over secondary graphitisation. The latter will be less necessary for blackheart malleable irons because of the lower silicon content.

Important Attributes of Malleable Iron

By James H. Lansing (Technical and Research Director, Malleable Founder's Society, Cleveland, Ohio)

The Author, after having defined malleable iron, has examined its chief properties and industrial applications, which are consequential on these characteristics. An important quality of malleable is the ease with which it can be machined—obtained through the heat-treatment of white iron, castings in malleable iron are remarkably homogeneous throughout the mass, the skin, however, represents a discontinuity, which must be taken into consideration. Other properties of malleable such as fatigue resistance; shock resistance; adaptability to moulding techniques; proportional elastic and corrosion resistance are briefly set out.

Experimental Study on the Efficiency of Insulation in a Brickwork Drying Stove

By G. Ulmer

After having shown the importance of heat loss through the walls in a non-insulated stove, the Author studies the different insulating materials and where to use them: in the stove, walls, roofs or chimney, etc.

To carry out the tests, the Author has used an experimental stove of 9 cub. meters capacity. A comparison is made between the fuel consumption at full load and empty. Through very carefully conducted pyrometric measurements, it shown by thermal balance sheets that good insulation and general soundness are of paramount importance for efficiency.

For thermal reasons, the metallic walls are preferred in the small recirculating core ovens. For the big mould ovens, bricks of suitable composition are better.

By proper insulation, it is possible to cut down fuel consumption by 35 per cent., so proving that insulation always pays.

Bombay Foundry of the Indian Naval Dockyard

By A. E. Hook and J. J. Freitas (Inspection Department, Indian Admiralty)

The Authors refer to the recent descriptions of the large mechanised foundries located near Calcutta which were recently printed in the FOUNDRY TRADE JOURNAL, and point out that in the West, the foundries are smaller and turn out a wider variety of castings. The Authors describe the plant and the methods used in the Bombay Dockyard, particularly referring to the diversity of its products ranging from iron castings weighing 14 tons, and 300-lb. non-ferrous components, down to small art castings. A centrifugal casting machine is in use.

Simplified Method of Moulding Average-weight Castings

By Ir. A. Cappon (Rotterdam)

For the loam moulding of average-size castings it is possible to bring about an important economy in sand, handling and time when in place of the usual method of moulding, what the Author calls "Moulding with joint separation facing upwards" is used. The proposed method has been applied with great success to all easy-stripping patterns and in some other cases.

Cement sand can replace loam in the semi-permanent moulding system described. On the other hand, by the increase of the number of cores or of their dimension within certain limits it is possible to make certain castings economically the mould for which is fully permanent, mostly consisting of core-prints.

Statistical Control of Foundry Operations

By H. A. Schwartz (National Malleable and Steel Castings Company, Cleveland, Ohio)

Statistical control methods for quality make possible the determination of the probability of seeing a certain property reduced below the limit at which the product is no longer acceptable. This method is obviously preferable to guesswork, which causes some unpleasant surprises to the foundryman. The Author has set out a statement by which he proves that statistical control methods for quality lower the number of tests to be made and overall control. They are very much surer for revealing defects in manufacture than 100 per cent. control. He then develops some important mathematical steps to be taken, showing how far one can deviate from the standard Ox—the coefficient of the ratio $r x y$ of two properties x and y, the standard error Ox giving the coefficient of regression. The Author gives a series of cases where statistical calculation is possible and can be made to be of real service to the foundry.

Considerations in the Mechanisation of Foundries

By William A. Morley (Foundry Superintendent, Link Belt Company, Philadelphia)

The demand for the continued improvement in the quality of castings and the rapid increase in foundry cost place a great burden on foundry management in maintaining their competitive position with other methods of fabrication. A good tool to assist in meeting this competition is the introduction of mechanical equipment. Mechanisation can assist to a major degree the attainment of these objectives:—

1. Lower unit costs. 2. Increased productivity per man-hour. 3. Conservation of manpower and building space. 4. Improved working conditions. 5. Improved quality. 6. Greater earnings for labour and capital.

In considering the problem of mechanisation in any type of foundry, however, there are certain common factors. These factors will be of varying importance in the individual shops. Careful consideration of them, and an appraisal of their relative value to the individual foundry planning mechanisation, can assure correct decisions.

Probably of greatest importance in appraising these factors is the need to consider them in the light of the following general principles. Mechanisation must:—1. Reduce the cost of the product to the customer and maintain or improve its quality. 2. Benefit the worker in improved earnings, better continuity of employment and improved working conditions. 3. Make available to the owner or stockholders a return on their investment, from profit.

It is not enough to fulfil any one or two of these requirements—*all* must be met at least to some degree. This must be the object of those responsible for the mechanisation and they must demonstrate it to the others involved.

The human factor is of the utmost importance and, as many are reluctant to accept changes in a routine, a plan for selling the advantages of proposed changes must be established. It must be realised that machinery should be complementary to the efforts of the individual and that each concerned must be aware that the changes planned will directly benefit him.

Cursory examination of the volume of information required before mechanisation is attempted is likely to discourage its consideration. However, the examination of the benefits to be gained will demonstrate that it is well worth the time and effort required to appraise the situation properly. It is suggested that if each factor is examined individually and answers are secured, the complete picture will develop quickly and without too much difficulty. Current and immediate future economic conditions have a direct bearing on any business planning, and these conditions should be examined in order that the proper timing of changes be selected.

French Position *vis à vis* with Mechanical Tests for Cast Iron

By E. Doat

The *"Commission technique de la métallurgie des fontes"* of the *"Centre technique des industries de la fonderie"* has established a specification for cast iron.

Tensile strength has been selected as basic property and five classes have been proposed.

The test-bars have been standardised corresponding to the four thickness ranges from ½ in to 2 in. The Frémont test has been maintained as a complementary test.

Comparison between Sand- and Machine-cast Pig-Iron

By Prof. A. Scortecci, W. de Micheli, M. Drufuca and A. Palazzi (Italy)

The Authors have carried out systematic tests to determine whether there was a sensible difference between sand- and machine-cast pig-iron when remelted in the cupola. From the same blast-furnace iron diverted in two parts, they have remelted in the same cupola the machine- and the sand-cast pigs maintaining constant all the other conditions. The tests have proved that there was no practical difference in the cupola iron, the differences which appeared in the structure of the pig disappearing during the cupola operations. These tests have been statistically conducted to minimise as far as possible the unpredictable errors inherent in the processes.

Recent Developments in Foundry Equipment

By Blankenhorn (Badische Machinenfabrik Durlach, Germany)

The foundry industry has notably improved its technique. The introduction of mechanisation has fully changed the traditional aspect of the foundry. The Author, in a general way, presents all the latest improvements introduced into the foundry equipment field. From the sand-preparation plant to the melting department, the moulding bay and the cleaning room, numerous machines are now at the disposal of foundrymen. All of these machines respond to a specific need. They all have a well-defined range of application in a modern foundry.

Some Recent Experiments with the C-Process in Denmark

By Prof. O. Hoff (Technical High School, Copenhagen)

The Author describes in great detail the C-process as applied to manufacture of small engine cylinders for bicycles at the works of Valentin Aage Moller & Company. No fewer than 6,000 units have been delivered.

Abstracts from the Brussels Conference Papers

Risering Castings—A Progress Report

By *J. B. Caine* (*American Exchange Paper*)

Recent work on scientific risering has been summarised and partially interpreted. This work, especially that on feeding distances for steel has filled an important gap in the knowledge of risering. Difficulties with the use of closely-spaced risers required to meet feeding distances for steel are discussed. Methods are advanced to overcome these difficulties and to enable the steel foundry to produce castings free from centreline shrinkage with the minimum number of reasonably sized risers and acceptable yield.

There is still much to be learned. The following points are, in the writer's estimation, the most important:—

(1) Determination of the effect of riser contact on feeding distance.

(2) Determination of constants in equations quoted for metals other than steel.

(3) Feeding distances in junctions of sections.

(4) Determination of the restriction of heat flow into the sand at junctions of sections and its correlation to effective surface area.

(5) Determination of the correlation of temperature gradients set up by external chills and feeding distances.

Application of "Ultra-Sonic" Waves to Casting Inspection

By *P. Bastien* (*Professor at the Paris Foundry High School*)

The application of the "ultra-sonic" waves to the control of castings, for the discovery of such defects as: shrinkage cavities, blow-holes, gas-holes, etc., is more complex than for the control of forging ingots.

The Author had studied the causes of error which can influence the technique. The principal types of these causes of error are:—(*a*) Due to the physical and geometrical conditions of the emission; (*b*) due to the liaison between the apparatus and the casting; (*c*) resulting from definite relations between the wave-length used and different physico-chemical characteristics of the media and (*d*) due to the physical conditions of the material and to the nature of the defects.

To conclude, the Author presents the general problem of the visibility of the defects. The "ultra-sonic" waves techniques are delicate, especially with castings but still they can provide very valuable information to foundrymen for the control of their products, if a suitable trained staff is available.

FOUNDRIES in the Midlands are co-operating with the Birmingham and District Industrial Safety Group in its decision to launch a junior section with the express purpose of developing safety training and accident prevention among young employees.

The Process of Die-Casting

(*Continued from page* 418)

copy is now of the same shape as the finished die cavity is intended to be, but two to four times larger. It is said that a good die-maker has to have the strength of a horse and the fingers of a surgeon. Moving heavy die blocks does require strength, and sharpening and manipulating cutters sometimes less than $\frac{1}{32}$ in. dia. does need skill.

It is one of the principal advantages of die-castings, and in particular zinc alloy castings, that the article produced requires little or no machining. The complexity of form, the accuracy of detail and the smoothness of surface obtainable commonly make it unnecessary to perform expensive cutting operations in order to prepare the castings for use. However, every casting has its adhering runner, overflow wells and sundry pieces of flash. It is not practically feasible or even desirable to produce a casting free from flash. The runner has to be cut off and the usual foundry hacksaw and vice is not a suitable method.

A die-casting is by virtue of its economies, a quantity and quality product and it is accepted practice to provide blanking or shaving dies, which, when operated in hand or power presses, simultaneously remove all traces of runners, flash and overflow wells. Light machining operations are sometimes required for certain critical surfaces, which may require trueing to compensate for die-clearance tapers. Such holes that are not readily cored, may have to be drilled. Such undercuts or threads which are not economical to cast have to be subsequently cut. Broaching, reaming and bending is standard practice.

Economics of Die-casting

Die-casting materials are non-ferrous and naturally more expensive than iron or steel. It is therefore evident that if a die-casting is to compete it must have considerable advantages, such as better appearance, thinner sections, little or no finishing operation required, unusual and complex shapes impossible to produce by other methods, rapid rate of production, with unskilled or operative help, and ease with consistent certainty of assembly.

Zinc die-casting can and does compare favourably with metal pressings. Whereas a metal pressing may require, apart from blanking, quite a number of forming and assembly operations, die-casting can usually be completed in two operations. Furthermore, with die-casting, there is no loss of metal in the form of trimming, all of which can be returned to the melting pot. The same yield cannot be obtained by using expensive sheet metal and its attendant scrap.

The minimum number of castings which will warrant the construction of a pressure die is said to be in the region of five to ten thousand castings, depending on the complexity of design.

BRITISH INSULATED CALLENDER'S CABLES LIMITED announce that their Middlesbrough office has an additional telephone number. The telephone numbers of the office are now:—Middlesbrough 2838 and 43569.

System of Studying Casting Defects*

By G. W. Nicholls and D. T. Kershaw, B.Sc.

(Continued from page 390)

GATING

The effect of gating on the resultant casting cannot be too strongly emphasised. Even to-day, in many foundries, the runner is regarded simply as a channel to permit the molten metal to enter the mould cavity. It is made as quickly and as cheaply as possible, since it is not realised that the gating system is subjected to a more severe cutting action than any other part of the mould and should, therefore, receive the most attention from the moulder.

The principal function of an efficient gating system is to allow clean metal to enter the mould with the minimum of turbulence and agitation. To be efficient, therefore, some form of dirt-trap must be included to hold back any dross or slag which may be present in the metal. It is a mistaken view, however, to think that the inclusion of a dirt-trap at some one point is sufficient to ensure a clean casting. The whole of the gating system from the pouring basin to the ingates must be fashioned to minimise the possibility of dross entering the casting. This entails the correct proportioning of the various components of the gating arrangements in order to obtain the required degree of choke on the metal flowing through the system, in addition to incorporating such dirt-traps as may be deemed necessary.

The separation of slag from metal in a gating system is usually accomplished by making use of their differing physical properties, density and viscosity. Slag, which is largely composed of ferrous and calcium silicates has a much lower specific gravity than cast iron, and consequently floats on the surface of the molten iron. Unfortunately, the rate at which entrained slag appears on the surface of the iron under this normal effect of gravity is not so rapid as could be desired. By causing a molten mixture of slag and metal to rotate, the centrifugal force produced acts in addition to the normal gravitational effect, and so ensures a more rapid separation of the two constituents. This principle is employed successfully in the whirlgate types of runner used in the gating of small castings. With larger castings, however, the use of the whirlgate is not always practicable and so other methods may have to be used. One such method employs a slag dam, usually in the cross runner, whereby any slag floating on the surface of the flowing metal is held back, permitting the clean metal to pass underneath the dam and into the ingates.

The degree of separation obtained in this way is dependent upon the velocity of the metal flowing through the system. This in turn depends on the cross-sectional area. It is evident, therefore, that the most effective position for a slag dam or siphon runner is at the end of a runner of large cross-sectional area where the metal is flowing slowly compared with the small-section portions of the system.

The same principle is employed in the so-called "dirt riser" sometimes incorporated into the gating system. This takes the form of a riser located at a position along the cross runner, whereby any dross on the surface of the metal stream enters this riser and is removed from the gating system.

One very effective method of gating large castings which have to be machined on both top and bottom faces, is to employ a double runner basin with a plug in the outlet from the second basin. The quantity of dross remaining in the second basin after the casting has been poured gives some indication as to the efficiency of this method. If, in addition, siphon runners are included in front of the ingates, there is little likelihood of any dross from the metal entering the mould cavity. The location, size and number of gates to be used for a casting depends on a number of factors, each of which must receive due consideration before the form of the gating system is decided upon.

Location of Gates

Gates should be placed with a view to producing simultaneous cooling of light and heavy sections, thereby reducing or eliminating the internal stresses present in the casting. This may be achieved by gating so that the hottest metal goes in to the lighter sections and cooler metal into heavier sections. Also, since any dross or dirt which enters the mould cavity through the ingates tends to lodge in front of them, it is better to gate the casting at points remote from machined surfaces. Heavy castings, however, which are usually bottom-poured to ensure quiet delivery of metal, are moulded with the heavy machined, sliding surfaces downwards in the mould to obtain clean slideways. It is usually impossible, therefore, strictly to observe the above principles in the moulding of this class of work.

A sketch of a horizontal boring-machine bed is shown in Fig. 13. With the ingates in position (A) occasional defects in the undercut portion of the slideways (C) appeared during the machining operation. It was noticed, however, that these defects (dirt

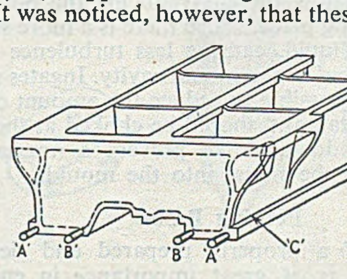

FIG. 13.—*Sketch of a Horizontal Boring Machine Bed Casting.*

* Paper presented at the Newcastle-upon-Tyne Conference of the Institute of British Foundrymen, with Mr. E. Longden in the chair. The Authors are respectively manager and metallurgist, and chief chemist at Modern Foundries, Limited, Halifax.

System of Studying Casting Defects

or gas holes or both) usually occurred at the ends of the beds and that if the bed was gated at one end only, the defects only occurred at that end.

The gating system was therefore modified by incorporating slag dams at the junction of the cross runner with the downgate, and moving the ingates to position (B) by attaching prints to the pattern and making a special core for the down- and in-runners. In addition, all cross-sectional areas were checked to ensure that a progressive choke occurred from the pouring basin to the ingates, and the whole system was thoroughly dried. This procedure was found to be successful for the elimination of the defects.

Gates should also be situated so that the metal on entering the mould cavity does not impinge against a core or a fragile part of the mould, nor should it flow on to a surface which is drained immediately the metal strikes it.

Rate of Pouring

The rate at which a mould is poured has a pronounced effect upon the resultant casting. Slow pouring aggravates those troubles associated with the expansion of the sand, such as buckles, rat-tails and pulldowns, due to the increased time during which these defects may occur. In addition, there is more likelihood of dirt adhering against the sides of the slowly rising metal in the mould, and of dross forming on the surface of this metal. Slow pouring may also result in cold laps or seams if the loss of temperature taking place during the filling of the mould causes the metal to set before the cavity has been completely filled.

Fast pouring, whilst reducing or eliminating the defects outlined above, has its own attendant disadvantages. Intricate jobs containing many cores require time to elapse before the free functioning of the vents from these cores can commence. If the mould cavity has been filled with metal before this occurs, core gases may be forced into the metal and trapped in the casting. Higher pouring speed also involves greater turbulence in the flowing metal with a consequent increase in the erosive action.

Shape of Ingate

Where possible, round ingates are preferred to square or rectangular ones. A circular ingate, possessing no corners, is much easier to dry thoroughly than other shapes, and has less surface area for a given cross-section, thereby reducing the possibility of erosion taking place. Also there is a more streamlined flow of liquid, causing less turbulence as the metal is delivered to the mould cavity. Ingates should be as short as possible to reduce the amount of heat lost by the metal, and should be choked at the junction with the downgate to prevent a nozzle-effect from squirting the metal into the mould.

Pouring Basins

The use of a properly prepared and designed pouring basin is of great importance in ensuring clean castings. The main objects in basin design are (1) to permit quiet entry of iron through the sprue opening, and (2) to allow time for the separation of slag before the metal enters the sprue.

The major portion of slag which passes from the pouring basin, does so in the time which elapses before the basin is completely filled with metal. The use of a skim plate or plug, therefore, to ensure that the basin is full before any metal passes through the sprue, is a wise precaution. Plugs are the best preventive in this respect, but great care must be taken in their preparation and use. Badly-fitting plugs permit small quantities of metal to pass into the sprue and freeze before the plug is removed. The removal of the plug must be accomplished in one smooth movement to avoid disturbing the sand around the sprue orifice. Any sand which is loosened in this way is carried into the gating system proper by the velocity of the metal leaving the pouring basin.

Dry-sands moulds should never be prepared with green-sand pouring basins. Heat from the warm dry mould rises through the gates, producing a friable skin-dried crust on the green-sand which is easily washed away. Furthermore, the steam produced in drying this crust condenses on the cooler parts of the pouring basin and causes a boiling action when the mould is poured. Accordingly, pouring basins for large dry-sand work at the Authors' foundry are now prepared on the day the mould is finished, and are either dried *in situ* by means of portable hot-air dryers, or are transported to a mould or core oven and thoroughly dried.

It must be remembered, however, that an efficiently-designed gating system is not adequate in itself to ensure a clean casting, since it will not compensate for any slipshod methods used in the making of the system. The majority of large castings are bottom-poured to ensure quiet delivery of metal with the minimum of agitation, so that impurities picked up by the metal after passing from the cross runner to the downgate must be carried into the casting. If this part of the gating system is made by the normal method of ramming sand around gate sticks, the use of a finishing tool or the application of a coating of refractory material to the sand is impossible.

The vital part of the gating system is, therefore, the most difficult part to produce satisfactorily. In order to overcome this difficulty, all downgates and ingates are now made in the form of cores, so designed that the core maker can finish and coat the portion against which the metal will flow.

Feeding

Successful feeding of a casting consists of supplying liquid metal to the casting to compensate for the reduction in volume which occurs as the metal changes from the liquid to the solid state. The amount of shrinkage contraction which takes place however, is related to the composition of the iron, so that before designing a feeder for a particular casting, consideration must be given to the type of iron to be used. Carbon, silicon, and phosphorus are the main elements affecting this solidification shrinkage. High carbon and silicon cause less shrinkage due to the increased amount of graphite thrown out of solution during solidification. The effect of phosphorus on cast iron is to increase the solidification range, causing the heavy sections to supply feed metal to the thinner, faster-setting portions and an increased opportunity for the segregation of the lower-melting-point constituents in the later-setting portions of the casting.

In order to satisfy the basic fundamentals of feeding, the casting should freeze progressively from the bottom of the mould to the top, thus ensuring that the last part of the casting to set is immediately below the heads which supply feed metal to the casting. This entails gating so that the hottest metal enters the feeder heads. With small work, it is often possible to gate through the feeder head in order to establish this condition, but with bottom-poured, heavy castings, heat is lost to the mould and cores during the filling of the mould, causing the coolest metal to enter the feeder heads. Topping-up of feeders, as soon as the rising metal enters the neck, assists in rectifying the position.

In recent years, the use of exothermic sleeves for feeders has been developed, whereby the temperature of the metal in the head is increased by the heat generated from the chemical reaction taking place in the sleeve. By taking advantage of these materials, therefore, hotter metal than that in the mould can be guaranteed, leading to greater efficiency of the feeder.

Liquid metal is supplied to the casting, by the combined effect of gravity and atmospheric pressure, only for the length of time that the surface of the metal in the feeder remains liquid. Once a skin of solid metal has formed over the surface, the atmospheric pressure (amounting to approximately 14 lb. per sq. in. and equivalent to nearly 5 ft. of metal head) ceases to function.

One means of retarding the freezing of the surface layer of an open feeder is to cover the surface of the metal with a heat-insulating material—the so-called feeding flux. Another method of utilising atmospheric pressure for feeding purposes is to allow a small piece of oil-sand core to penetrate into the centre of the feeder head. The oil-sand core is quickly heated to the temperature of the liquid metal in the riser without absorbing sufficient heat to cause a skin of metal to solidify round it. Atmospheric pressure is then transmitted through the sand to the liquid metal in the centre of the feeder even though the upper surface may have solidified.

Head Pressure

From the foregoing section, it is seen that the effect of metal pressure head is small compared with atmospheric pressure in forcing fluid metal into the shrinking casting. When the atmospheric pressure ceases to act, however, through the formation of a skin on the surface of the iron in both feeder and the casting, the metal head provides the only pressure for promoting feeding. Contraction taking place within a solid skin of metal capable of withstanding atmospheric pressure does so with the formation of a vacuum. Freezing-over of the surface of the feeder, therefore, provided that the body and neck are still liquid, does not prevent metal head pressure from playing its part in feeding the casting, since all movement of metal takes place *in vacuo* and no additional energy is needed to increase the space between the fluid surface of the metal in the feeder and the solid top. The gravitational effect of a high metal head can thus play an important rôle in securing sound castings.

In actual practice, of course, the above conditions are very rarely established, since the atmospheric pressure is usually sufficient to puncture the soft surface skin of a feeder once a vacuum is formed underneath, causing the well-known tearing effect on the surface. The general principle operates, however, and its validity can be judged from the increased feeder efficiency gained by increasing the metal head pressure. This is very noticeable in small castings where the metal solidifies in a very short time. In many cases, the metal in the gates remains liquid long enough to allow metal pressure caused by a high pouring head to be sufficient to feed the casting without the use of additional feeders.

High head pressure, however, causes an increased strain on the sand walls of the mould, and additional care must be taken whilst moulding to ensure that no deformation occurs when the mould is poured. Yielding of the sand walls has been known to produce defects which at first were wrongly attributed to shrinkage troubles caused by incorrect metal composition or inefficient feeding technique. If the mould cavity has been filled before the deformation occurs, a depression, having the appearance of a typical shrinkage defect, is formed in the upper surface of the casting at the place where the metal has drained to fill the increased mould dimensions.

In the application of the principles of feeding to the production of sound castings, it has been found necessary to study the design of each casting produced and to indicate on the pattern the location of the necessary feeders. Standard feeder patterns, suitable for the metal section they are required to feed, are then issued to the foundry along with the casting pattern. Wherever possible, side feeders are used in preference to top or flange feeders, since they appear to function more efficiently and possess the additional advantage that any dirt which may fall down them does not enter the mould.

Side-feeder patterns are made in two sections, the neck (Fig. 14 (*a*)) which is moulded into the sand at the parting line, and the feeder which is rammed up with the cope. The two sections of the pattern

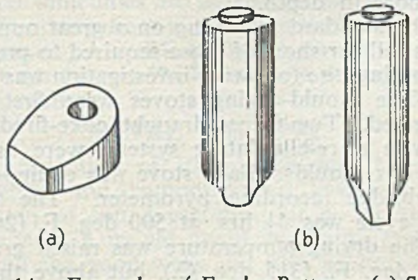

FIG. 14.—*Examples of Feeder Patterns;* (*a*) *Side Section, and* (*b*) *Top Sections.*

System of Studying Casting Defects

are dowelled to ensure correct positioning, so avoiding the defect commonly associated with side feeders, namely, too long a neck, causing premature freezing, and thereby preventing the flow of metal from the feeder to the casting. The other end of the feeder portion is shaped so that it may be used as a top or flange feeder (Fig. 14 (*b*)).

Heavy feeders, however, are not always essential in the production of large castings. Many such castings can be produced without feeders if due regard has previously been given to the location of gates, and to the incorporation of chills or denseners to promote a uniform cooling rate. In such cases, small-section risers, as distinct from feeders, prove invaluable in ensuring clean, sound castings. By permitting flow-off metal from such risers to run into pig moulds in the foundry floor, more equable cooling conditions are established in the casting, in addition to the flushing of any gas through the riser openings.

DRYING

The drying practice of the foundry under consideration had previously been in charge of a foreman moulder. However, the high proportion of castings which were defective due to blowholes and scabs, etc., made it imperative that the whole drying practice should be reviewed. Accordingly, a careful study of the matter was undertaken. Every mould was inspected immediately prior to coring and the depth to which the dried sand extended was noted. Each casting was inspected immediately after shot-blasting, any surface blemishes were recorded and correlation was made between the condition of the mould and the condition of the casting.

The conclusions were:—

(*a*) On a mould which was cast within 12 hrs. of drying, a dried skin averaging $1\frac{1}{2}$ in. deep was necessary to prevent scabbing;

(*b*) A convex mould surface required to be dried to a depth of $2\frac{1}{2}$ in.;

(*c*) On a concave mould, surface drying to a depth of $\frac{1}{2}$ in. was sufficient to produce a clean surface;

(*d*) On a mould which was required to stand from 24 to 40 hrs., one inch extra skin depth was required to allow for "striking back";

(*e*) A "burnt" mould would produce an excellent casting provided the surface was not damaged in coring and the dried skin was $1\frac{1}{2}$ in. or more in depth.

As the standard of drying on a great number of moulds fell far short of those required to produce a good casting, the following investigation was carried out:—The mould-drying stoves were first of all investigated. Two forced-draught, coke-fired stoves, each with a re-circulating system, were used for drying box moulds. Each stove was equipped with a Cambridge recording pyrometer. The average drying cycle was $4\frac{1}{2}$ hrs. at 500 deg. F. (260 deg. C.). The drying temperature was raised gradually to 600 deg. F., (315 deg. C.), but above this temperature the moulds near to the air inlet were burnt, despite the fact that the largest boxes were placed in the hottest part of the stove. The increase in temperature seemed to have little effect on the moulds furthest away from the air inlet.

The drying time at 600 deg. F. was then gradually increased until at 9 hrs. every mould was dry, whilst none was burnt. Variations in the size of the batch were usually allowed for by lengthening or shortening the cycle. However, it was soon found that however small the batch, any reduction in the drying time tended to produce under-dried moulds; the drying cycle was therefore standardised at 9 hrs. at 600 deg. F. (315 deg. C.).

Convex surfaces required drying to a greater depth than flat surfaces and concave surfaces to a lesser depth. Fortunately in stove drying any area where the skin is thin is usually on a concave surface while the convex surfaces are dried to a greater depth than average. Every mould is checked for dryness before coring commences. When occasionally a mould is insufficiently dry, the matter is rectified by re-drying with a portable hot-air drier. The reason for the mould being under-dried is sought and invariably found before the next drying cycle commences. Among the common causes of under-dried, or burnt moulds, have been found the following:—

(1) Instructions not fully carried out by operator; (2) faulty temperature recording; (3) stoppages in re-circulation flues; (4) exceptionally-poor-quality coke and, on a number of occasions (5) the reversal of the fans consequent upon faulty re-wiring after an electrical breakdown. The results of these alterations was to bring about a worth-while improvement in the finish of the castings.

Unfortunately, the moulds for nearly half the tonnage of castings were, of necessity, dried by portable dryers. For many years, the drying of moulds by this method had been a matter of guesswork. The drying, even in different parts of the same mould was found to be very uneven and it was sometimes found that one half of a mould was crumbling due to its burnt condition, while the other half was hardly dried at all. The lack of control over the behaviour of the drying pans was a serious stumbling-block to any re-timing of the drying periods.

Before any attempt could be made to improve the standard of drying, some attempt had to be made to control the temperature of the gases entering the mould. A portable drying stove was therefore set up and the temperature recorded for various posi-

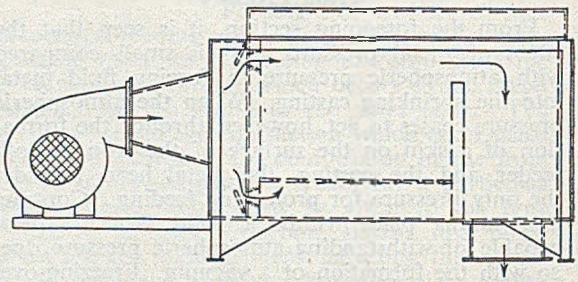

FIG. 15.—*Side Elevation of a Portable Drying Pan for Mould Drying.*

tions of the dampers. It was found that the temperature of the gases produced could be varied between 100 and 1,000 deg. C. by various settings of the dampers. It was known from experience on the drying stoves, that the optimum temperature of the mould face was in the region of 300 deg. C. Experiments were carried out to find out under what conditions the pans had to be run to produce this desired temperature.

Portable Drying Pan Experiments

The drying pans were of simple design (Fig. 15), consisting of a firebox with one damper controlling the air supply to the fire and another controlling the supply of secondary air. The following results were recorded:—

Temperature with bottom air only, 1,060 deg. C.

Temperature with all dampers open, 800 deg. C.

A series of temperatures was taken at 5 min. intervals during the combustion of a full firebox of coke with the bottom air shut off and using top air only. The results are shown in Table II:—

TABLE II.—*Tests on Portable Drying Stoves.*

Time (min.).	Temperature, deg. C.	Remarks.
0	480	—
5	420	—
10	390	Half of fire burnt away.
15	380	—
20	370	—
25	350	—
30	340	—
35	330	—
40	320	—
45	300	—
50	300	Three-quarters of fire burnt away.

Any opening of the bottom damper was found to produce temperature in excess of 450 deg. C. It was, therefore, decided in all subsequent experiments to run with the bottom damper closed.

An experimental sand bed was then made on the floor and dried in a similar manner to the usual practice, with the following results:—Directly under the nozzle the surface was burnt to a depth of $\frac{3}{4}$ in. over an area of approximately 2 sq. ft. The bed was dried to a depth of 7 in. immediately under the burnt area, tapering to a depth of $1\frac{1}{2}$ in., 2 ft. 6 in. from the centre of the nozzle (Fig. 16). A rather significant feature was a definite crack approximately one inch below the surface.

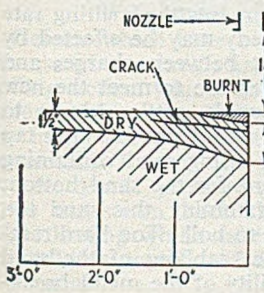

FIG. 16.—*Depth of Drying Experiment I, showing Section through a Sand Bed with Burnt and Cracked Portion.*

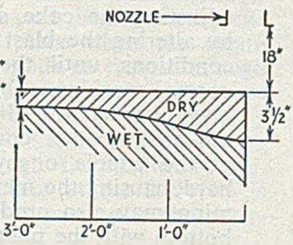

FIG. 17.—*Depth of Drying Experiment II, showing Adequate Drying of the Sand Bed at 300 deg. C.*

The experiment was repeated, the hot gases being kept at a temperature of 300 deg. C. It was noted that to maintain this temperature, the bottom damper had to be closed and the firebox slightly less than half full. The fuel consumption was 20 lb. of coke per 40 min. charge. The bed was again examined after three hours. This time there was no burnt area, no cracking and the depth of sand dried varied from $3\frac{1}{2}$ in. at the centre to one inch at 2 ft. 6 in. from the centre of the nozzle. (Fig. 17.) From this test it was concluded that a drying pan would not efficiently dry any part of the mould which was more than 2 ft. 6 in. away from the centre of the nozzle

The next step was to standardise the practice throughout the foundry. First, a standard drying peg was made to ram up in the top part, leaving a hole of 20 sq. in. All drying holes were put in 5 ft. or less apart. Several moulds were dried successfully and careful records kept. Each casting was examined and followed through the machine shops. When details of sufficient moulds had been collected, the exact relationship between the surface area to be dried and the time required to dry it was ascertained. It was found that one pan-hour was required for every 7.5 sq. ft. of mould surface. Using this formula, the drying times for many moulds were worked out with excellent results.

It was soon found that deeper moulds could be dried satisfactorily at a faster drying rate than shallow ones. The rate of charging was therefore increased from 20 lb. every 40 min. to 20 lb. every 30 min. and the drying time was shortened proportionately, *i.e.*, one pan-hour was required for every 10 sq. ft. of mould.

In addition to the surface area, however, special attention needs to be paid to convex mould surfaces. These can often be taken care of by careful positioning of drying holes in the cope. Failing this, considerable periods of extra drying are necessary to prevent scabbing from such areas. It is also desirable to increase the skin-dried depth in front of the ingates.

Great difficulty was experienced in drying the runner systems, because there was considerable condensation on the cold runner during the drying of the mould cavity. The only method of overcoming this difficulty was found to be by drying the runner after the completion of the mould drying, as though it were a separate mould.

A record is now kept of every mould dried. Any particular difficulties are noted and all drying times are filed under pattern numbers, as well as in chronological order. A vast improvement in the surface of the castings has resulted since the drying practice was reviewed.

METAL MELTING

The production of iron possessing the desired temperature and composition is essential in the production of sound castings, for no matter how well-prepared a mould might be, faulty metal can nullify all the good work put into its preparation. In order to obtain this type of iron consistently, it is necessary to practice strict cupola control, and to

No. D14 28 CUPOLA CONTROL.

Date 8th June, 1950.

Signature E. B.

Blast.			Melting.				Remarks.		
Time.	Press in. Water	Vol. (Pitot) in. Water	Tap No.	Time. Start.	Time. Finish.	Temp. deg. C.	Approx. weight, cwts.	Castings made.	Time Tuyeres cleaned.
			Blast on	3.15					
			First metal	3.23					
3.25	25.5	0.38							
3.40	27	0.42	1	3.42	3.43½	1,300 C., 1,360 C.	30	Saddles	
4.00	28	0.45	2	3.55	3.57	1,320 C., 1,360 C.	30	Grates	4.0 p.m.
4.10	29	0.45	3	4.06	4.07½	1.340 C., 1,370 C.	25	Pillars	
4.20	28	0.44	4	4.15	4.16½	1,330 C., 1,370 C.	25		
Slag Hole Opened			5	4.24	4.25	1,340 C., 1,380 C.	25		4.30 p.m.
4.30	30	0.50	6	4.36	4.38	1,350 C., 1,370 C.	35	Planer table	
4.45	29.5	0.52	7	4.47	4.49	1,350 C., 1,380 C.	35		4.50 p.m.
5.05	29	0.50	8	4.59	5.01	1,360 C., 1,390 C.	35		
5.20	30	0.55	9	5.12	5.14	1,360 C., 1,380 C.	35		
5.35	28.5	0.45	10	5.25	5.27	1,350 C., 1,380 C.	35		5.30 p.m.
5.50	29	0.48	11	5.40	5.42	1,370 C., 1,390 C.	35		
6.00	30	0.52	12	5.51	5.53	1,380 C., 1,400 C.	30	Bases, arms, etc.	
6.10	27	0.47	13	6.02	6.03½	1,370 C., 1,390 C.	30		6.10 p.m.
6.20	22	0.40	14	6.12	6.13½	1,360 C., 1,380 C.	30		
6.30	15	0.35	15	6.25	6.26½	1,350 C., 1,380 C.	30		6.30 p.m.
			16	6.40	6.41	1,350 C., 1,360 C.	25		

No. D14 28 CUPOLA CONTROL.

Date 8th June, 1950.

Signature E. B.

Cupola No. D. Melt No. 3143

Time of lighting	11.30 a.m.
BED Time of making	2.30 p.m.
Distance from Charging Door ...	16 ft. 0 in.
Height above Tuyeres	42 in.
Time furnace completely charged ...	3.10 p.m.
Time blast on	3.15 p.m.
Time of last charge	5.55 p.m.

1 Mixture.	2 Mixture.	3 Mixture.	4 Mixture.	5 Mixture.
3 Charges.	3 Charges.	5 Charges.	14 Charges.	10 Charges.
Saddles 1,250 deg. C.	Grates	Pillars 1,270 deg. C. 1,240 deg. C.	Planing M/c Table A. 1,260 deg. C. B. 1,240 deg. C.	Arms 6 ft. 0 in. 1,270 deg. C. 4 ft 6 in. 1,260 deg. C. Bases 6 ft. 0 in. 1,260 deg. C. 4 ft. 6 in. 1,260 deg. C.

FIG. 18.—*Cupola Control Form. The Form is Issued and Completed by the Laboratory Staff; one Portion is Detachable at the Perforations shown.*

establish standard methods of cupola operation so that the many variables may be reduced to a minimum. In addition to the weighing of all ingredients of the charge, including air, this involves an efficient method for the segregation of the different classes of scrap. Under the prevailing conditions of supply, no foundry can afford to reject any scrap allocated to them, with the consequent result that many grades of scrap have now to be used for the compounding of charges. This scrap, which is frequently high in phosphorus content and high in silicon, can create havoc if used for making castings where closeness of grain is essential, as, for instance, for high-pressure work, unless it is blended with the correct grades of pig-iron. It is essential, therefore, to check the analysis of each consignment of scrap immediately it is received by the foundry.

The efficiency of melting technique can be judged from the appearance and temperature of the metal as tapped, and from simple control tests,[4] which may be carried out at the cupola spout. Any deviation from the production of satisfactory, hot metal can usually be traced to some variation of the standardised procedure and rectified immediately. Thus:—

(1) Oxidised metal (indicated by excessive sparking at the spout) may be caused by too much blast or by rusty or too-small pieces of scrap in the charge.

(2) Metal which is tapped at the correct temperature, but loses its "life" and becomes pasty very quickly, is characteristic of an oxidised iron with a reduced carbon content and can be rectified by reducing the blast.

(3) Dull iron may be caused by too low or too high a bed height. A high coke bed slows down the melting rate, whilst a low coke bed maintains or slightly increases the melting rate for a period. The remedy may be effected by adjusting the coke split between charges and by altering the blast pressure to meet the new conditions, until the cupola settles down to normal working. Dull iron from the first tap may also be caused by using sand containing too high a water content for the sand bottom of the cupola or by ramming this sand too hard, causing the metal to boil. Too-hard ramming may also produce scabbing of the sand bottom with the possibility of the metal breaking through to the drop-bottom doors.

The method adopted by the Authors to standardise the melting conditions is to use a cupola control form (Fig. 18), on which all relevant data of the daily operation are recorded.

LADLES

Melting control does not end with the production of hot iron of suitable composition at the cupola spout. The metal melting section is responsible for the metal until it is ready for pouring into the waiting moulds. Many defects have been found to be produced through the use of inefficiently-prepared ladles to collect the molten iron. Ladles should always be clean, dry and pre-heated before use. Any damage which occurs to the ladle lips should at once be repaired and the patch thoroughly dried. Amongst the defects which have been traced to imperfections in ladle practice, the following may be enumerated:—

Dirty Ladles

Clean metal cannot be poured from dirty, slag-encrusted ladles, because slag or dross is melted by the hot metal in the ladle and is continually rising through the liquid metal. During the pouring operation, therefore, no matter how well-skimmed the ladle may be, entrained slag passes from the ladle into the pouring basin and thence into the mould. If, in addition to slag, solidified iron has been left in the ladle from the previous melt, new metal tapped into the ladle quickly loses heat to the cold, solid iron. This results in cool metal being poured into the mould and may be responsible for the following defects:—

(*a*) *Gas-holes*, caused by gas being trapped in the rapidly-solidifying iron, usually just under the skin at the top surface of the mould.

(*b*) *Mis-runs*, if the metal is not sufficiently fluid to fill the mould completely.

(*c*) *Shot iron*, if heat available in the molten iron is not sufficient to re-melt the iron shot formed by the first metal passing through the gating system into the mould.

(*d*) *Shrinkage cavities* formed when risers freeze soon after the metal has entered and so prevent feeding from taking place. In less extreme cases, open-grain structure occurs through lack of feeding.

(*e*) *Hot-tears and cracks.*—The core-bonding materials may not be sufficiently destroyed by cool iron to permit free contraction of the casting to occur.

(*f*) *Hard spots* are caused by the chilling action of cores and mould.

(*g*) *Incomplete fusion of chaplets.*

Wet Ladles—Lips and Lining

Defects which have been found to occur through the use of wet ladles are caused principally by the boiling action which takes place when the steam generated from the moisture finds an escape through the liquid metal. Moisture in ladle lips is more detrimental than in the lower lining since there is less ferrostatic pressure at the top of the ladle to force the steam back through the ladle casing. Also, boiling which takes place at the ladle lip is immediately transferred during casting to the pouring basin.

Steam reacts chemically with molten iron, forming an oxide of iron together with hydrogen. The result of this reaction, therefore, is to produce dross within the metal itself and hydrogen, which is partly dissolved in the iron and liberated on cooling, with the formation of gas holes or porous metal. Other defects which have been attributed to the boiling action resulting from damp ladles are: (*a*) Seams, caused by oxide films on the extremities of impinging streams of metal not permitting perfect metal-to-metal fusion, and (*b*) dross, slag and dirt inclusions formed by the reaction between steam and iron.

Cold Ladles

A cold ladle is invariably a damp one, caused by condensation of moisture on the cold surface. Defects associated with cold ladles, therefore, are those listed under wet ladles and dull iron. Efficiently-maintained equipment, however, is not in itself a sufficient safeguard against producing defective castings. Effective control over the pouring operation is also required, as careless pouring may result in defects such as dirt-inclusions, shot-iron and cold-laps, through improperly-skimmed metal, faulty positioning of the ladle, interrupted pouring or by not having a sufficient basin-depth-to-sprue-area ratio.

Pouring Temperature

No hard and fast rules can be laid down as to the optimum pouring temperature for a particular casting, but, generally speaking, moulds should be cast with metal as hot as is practicable in order to avoid the defects associated with cool iron. This does not mean that the hotter the metal, the better it is for the casting, since design of casting or refractoriness of the sand may prohibit the use of very hot iron to achieve desirable results. Defects associated with too high a pouring temperature are as follow:—

(1) Shrinkage cavities, if inadequate provisions for feeding have been allowed.

(2) Open-grain structures resulting from the reduced cooling rate promoting coarse graphite.

(3) Erosion scabs, usually immediately in front of ingates.

(4) Expansion scabs (blind or dummy scabs, rat-tails, etc.).

(5) Metal penetration and sand fusion.

(6) Premature fusion of chaplets permitting cores to lift.

Conclusions

The Authors do not claim that the above recording system is the panacea for the curing of all defects, but by its use they have, in many cases, been able to determine the exact cause of defects in castings and take the necessary action for their elimination. Many defects originate from factors not readily discernible, in which case investigations have frequently to be carried out before a complete understanding of the problem is reached. Other defects are relatively simple, and the mere act of writing down the conditions under which the casting is being made is often sufficient to draw attention to some point which, because of its very simplicity, would otherwise have been overlooked.

The success of such a system, therefore, depends largely upon the efficiency of the laboratory as a production unit in controlling the various operations daily performed in the foundry. Too many

System of Studying Casting Defects

foundry laboratories are simply show-pieces carrying out routine analyses to the whims and fancies of the management, without direct contact with the problems constantly arising in the production of sound castings.

The industry as a whole cannot fail to benefit from a more comprehensive study of the origins of the defects appearing on castings. The adoption of a similar recording system to that outlined, modified to suit the conditions peculiar to each individual foundry is recommended as one method of achieving this object.

The Authors wish to express their thanks to the directors of Modern Foundries, Limited, for permission to publish this Paper, and to Mr. B. Priestley for his assistance in preparing the illustrations.

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Increased Prices for Enamelled and Galvanised Hollow-ware

Manufacturers of enamelled and galvanised hollow-ware are to be allowed higher maximum prices by new Board of Trade Orders which came into operation on October 8. In the case of enamelled hollow-ware, the new maximum prices are 8 per cent. over those legally chargeable during the prescribed "basic period" of February, 1949, instead of 3 per cent. as previously. This increase is entirely due to the advance recently sanctioned in the price of steel and blackplate. For galvanised hollow-ware the new maximum prices will be 25½ per cent. over those legally chargeable during the "basic period" of June/July, 1951, as against 15½ per cent. under the previous Order. This increase is due to further rises in the cost of zinc and steel over the levels of which account was taken when the last increase in the prices of these goods was sanctioned.

The Orders giving effect to these increases, which have been made by the Board in consultation with the Central Price Regulation Committee, are the Enamelled Hollow-ware (Maximum Prices) (Amendment) Order, 1951, and the General Hollow-ware (Maximum Prices) Order, 1951 (Amendment) Order, 1951. Distributors' margins are not affected by these Orders. However, a review is now being made of all distributive margins for hardware and ironmongery, including both goods already price controlled and those over which the reimposition of control is under consideration. Copies of the Orders may be obtained from His Majesty's Stationery Office, York House, Kingsway, W.C.1, or through any bookseller.

AT THE ANNUAL GENERAL MEETING of the British Valve Manufacturers' Association in London recently, MR. N. P. NEWMAN, managing director of Newman, Hender & Company, Limited, Woodchester (Glos), was elected chairman of the association in succession to MR. E. BRUCE BALL, managing director of Glenfield and Kennedy, Limited, Kilmarnock (Ayrshire), who has held the chairmanship for the past three years.

New Catalogues

Dust Collection. There is something a little droll in the use by Keith Blackman, Limited, Mill Mead Road, London, N.17, in using dust containers as a background for the contents list of a 10-page catalogue they have just issued. This brochure is devoted to wet-type units, several models of which are portable, whilst others service a line of machines. The catalogue is available to our readers on writing to Mill Mead Road.

Safety Clothing. From J. & A. Hillman, Limited, Dudley, Worcestershire, we have received a well-got-up catalogue describing in the main a line of industrial gloves but also including moulders' spats and leather aprons. There are sufficient varieties of industrial gloves to match a display in the departmental stores—long gloves, short gloves, mittens, composite and asbestos. Five models of moulders' spats and gaiters are included. Of the latter the reviewer prefers the quick-release type rather than those incorporating the use of straps. It is desirable that all foundry purchasing officers should procure a copy of this catalogue for reference. It is available on application to Dudley.

Foundry Plant. The Constructional Engineering Company, Limited, of Titan Works, Birmingham, 12, have issued an abridged catalogue covering both Titan and balanced blast cupolas, sand mills and dryers, ladles, and, though not exactly plant, a pattern store. Then there are four pages devoted to a line of core-blowers which include some useful auxiliaries. A good range of various types of shot-blast machines is then described and well illustrated. Following this there is a section devoted to the moulding machines made by the Adaptable Moulding Machine Company, and finally a page covering the steel moulding boxes made by E. Tallis & Sons, Limited, a second associated company. The nicest section is the one covering the Sand Wizard, and the reviewer would have liked to see this layout used throughout the catalogue. The machinery covered is so important that it well warrants inclusion in every foundry executive's library of trade literature, and so it is recommended that a letter should be addressed to Titan Works for a copy.

Moulding and Core-making Machines. J. W. Jackman & Company, Limited, of Vulcan Works, Blackfriars Road, Manchester, 3, have wisely converted Sections 3 and 4 of their general catalogue into a separate publication covering moulding and core-making plant. The book opens with an illustrated description of simple swing-head press moulding machines, followed by hand-turnover table and down-draw machines. Then follow the pneumatic jolt-lift, Mumford jolters, and finally a range of Osborn machines. The core-making machinery section opens with the Osborn roll-over hand-jolt model, followed by a line of "sausage" machines, Mumford, and then Osborn jolters, the latter being a rollover machine. No fewer than 17 pages are devoted to Osborn core-blowers. The catalogue finishes with a core-sand mixing machine and a range of drawer-type ovens. Commendably, each machine in every range carries its own code word. The catalogue is essentially businesslike, and is no worse for that. This is certainly preferable to flights into modernistic publicity which may or may not suit all tastes. It is available to our readers on writing to Vulcan Works and ranks amongst the most important of British foundry equipment catalogues.

Change-over Pieces for Master Coreboxes

By " Checker "

For the production of metal coreboxes a wooden master corebox must first be made. From this, castings are produced which are machined and finished to size by the metal pattern-maker. Often their shape is such that a corebox which must finally be in two halves dowelled together, has first to be made in wood in one piece. Sometimes, however, it is possible to make only one half of the wooden master corebox, and after a casting has been produced from this, alterations are made to its shape, by using change-over pieces, before the opposite half corebox casting is obtained. The use of change-over pieces can often eliminate the necessity for making two half master coreboxes, thus reducing considerably the amount of patternmaking time.

Fig. 1 shows a core where all shapes except the large, centre portion were regular cylinders. Only one half master corebox was made for this first to produce the full half-cylinders. Then a change-over piece was fitted in the large, centre diameter to conform to the flat required in the corebox bottom, as shown in Fig. 2. This was then used for producing the second half corebox casting. Another example where only a half master corebox was required is shown in Fig. 3. This required a change-over piece in one end of the core-print diameter to form a set, as shown. If preferred, this could of course be made as a separate piece and fixed in the metal corebox afterwards.

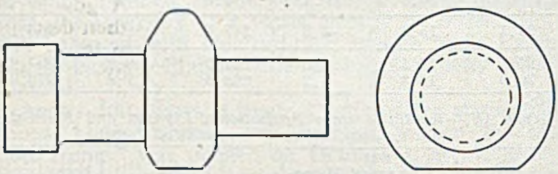


FIG 1

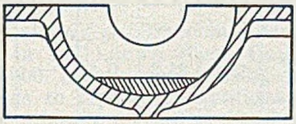


FIG 2

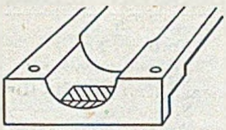


FIG 3

FIGS. 1 TO 3.—*Examples of Corebox Pattern Construction. Fig. 1, Symetrical Casting except for a " Flat " on the Lower Side; Fig. 2, Section through Half Corebox showing Loose Piece for the " Flat " and Fig. 3, Change-over Piece on a Corebox Print to form a " Set."*

When making multiple metal coreboxes, the saving in patternmaking time and timber is even greater, if only one half wooden master corebox with change-over pieces can be arranged. Fig. 4 illustrates a triple metal corebox where the change-over pieces are made for a core set in one half-print and a channel running along the centre chamber. The master corebox first is made to incorporate these, and then change-over pieces are fitted in to give the desired shape for the opposite half. Fig. 5 illustrates this, showing two sections of the half m aster corebox, with change-over pieces in position for forming a complete radius as required on the other half metal corebox. Whenever possible it is best to fix these pieces in position with small screws to permit rapid removal when desired.

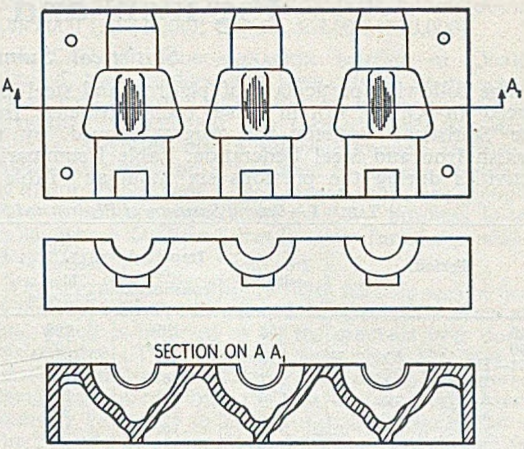


FIG 4

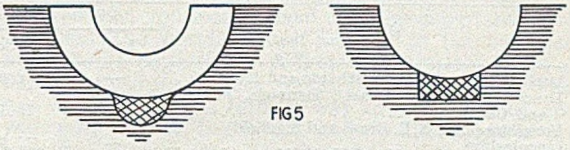


FIG 5

FIG. 4.—*Multiple Pattern for a Metal Corebox requiring Change-over Pieces both for a Central Channel and for a " Set."*

FIG. 5.—*Sections through the Central Channel and Core-print " Set " respectively.*

Sulphur Exploitation

The recent formation of a sulphur exploration syndicate, composed of the principal consumers of sulphur in the United Kingdom, has been followed by the registration of the British Sulphur Corporation, Limited. The purpose of the registration of this company is to provide a vehicle for the exploitation, if required, of properties considered of interest by the syndicate. The eventual form of the company, its final directorate, and finance are all matters which will be decided in the light of future requirements.

The members of the syndicate will not necessarily participate financially in the activities of the company, and the amount of finance required and its source are matters on which no decision has yet been taken.

DESIGNED to take full advantage of Canada's vast resources of pyrites and other sulphur-bearing ores, the construction of new plant, part of a $2,500,000 expansion project, has been commenced at the Valley Field, Quebec, by the Nichols Chemical Company. The project will double the capacity of acid facilities there and operations are expected to start next spring.

It is expected that taxation experts from the Federation of British Industries, the Association of British Chambers of Commerce, and the National Union of Manufacturers will be examined by the Royal Commission on Taxation of Profits and Income, sitting in public, early in November. The commission, which was appointed at the end of last year, has so far considered written evidence.

The organisations mentioned above have already submitted much evidence both to the commission and earlier to the Millard Tucker Committee on Taxation of Trading Profits.

Pig-iron and Steel Production

Statistical Summary of July Returns

The following particulars of pig-iron and steel produced in Great Britain have been extracted from the Statistical Bulletin for August, issued by the British Iron and Steel Federation. Table I summarises activities during the previous six months; Table II gives the production of steel ingots and castings in July, Table III gives deliveries of finished steel, and Table IV the production of pig-iron and ferro-alloys in July. (References applicable are given at the foot of column 2.)

TABLE I.—*General Summary of Pig-iron and Steel Production. (Weekly Average in Thousands of Tons.)*

Period.	Iron Ore output.	Imported ore consumed.	Coke receipts at blast furnaces.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy).			
						Imports.[2]	Output of ingots and castings.	Deliveries of finished steel.	Stocks.[3]
1949	258	169	199	183	188	17	299	233	1,071
1950	249	174	197	185	197	9	313	239	997
1951—February	262	164	202	186	193	7	326	252	875
March	267	167	204	184	187	6	318	253	848
April	279	149	201	179	195	6	323	261	800
May[1]	287	159	204	182	180	7	305	242	762
June	315	159	204	183	182	7	308	262	737
July	299	162	202	182	153	9	256	226	705

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in July,* 1951. *(Thousands of Tons.)*

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derby, Leics., Notts., Northants and Essex ..	—	2.6	0.7(basic)	1.4	0.2	13.2	0.7	13.9
Lancs. (excl. N.W. Coast), Denbigh, Flints., and Cheshire .. Yorkshire (excl. N.E. Coast and Sheffield) ..	1.5	16.1	—	1.7	0.5	18.9	0.9	19.8
Lincolnshire	—	17.7	—	—	0.1	17.7	0.1	17.8
North-East Coast	1.7	52.0	—	1.0	0.5	53.5	1.7	55.2
Scotland	2.0	19.6	—	0.7	0.5	21.7	1.1	22.8
Staffs., Shrops., Worcs. and Warwick	—	13.5	—	0.8	0.7	13.6	1.4	15.0
S. Wales and Monmouthshire	7.8	52.8	5.7(basic)	0.9	0.1	66.8	0.5	67.3
Sheffield (incl. small quantities in Manchester) ..	8.6	18.6	—	8.5	0.6	34.3	2.0	36.3
North-West Coast	0.1	2.8	4.7 (acid)	0.3	0.1	7.8	0.2	8.0
Total	21.7	195.7	20.1	15.3	3.3	247.5	8.6	256.1
June, 1951	23.0	243.6	21.1	16.5	3.6	297.9	9.9	307.8
July, 1950	23.6	215.3	20.9	13.3	3.2	268.5	7.8	276.3

TABLE III.—*Weekly Average Deliveries of Non-alloy and Alloy Finished Steel. (Thousands of Tons.)*

Product.	1949.	1950.	1950.	1951.	
			July.	June.	July.
Non-alloy steel:					
Ingots, blooms, billets and slabs[4]	4.5	3.6	2.7	3.9	3.2
Heavy rails, sleepers, etc.	9.8	11.3	10.4	13.1	10.7
Plates ⅛ in. thick and over ..	39.2	40.0	32.9	45.5	31.2
Other heavy prod.	37.5	40.2	36.7	44.1	35.2
Light rolled prod...	46.4	47.6	43.2	47.7	42.4
Hot rolled strip ..	17.1	19.4	17.5	21.1	20.1
Wire rods	15.4	16.3	13.1	16.7	12.6
Cold rolled strip ..	4.9	5.5	5.7	6.6	6.3
Bright steel bars ..	5.6	6.2	6.7	7.2	6.7
Sheets, coated and uncoated ..	27.6	30.5	30.1	34.8	35.1
Tin, terne and blackplate ..	13.7	14.3	14.4	15.7	13.3
Tubes, pipes and fittings	18.5	20.0	19.9	23.6	22.8
Mild wire	12.0	12.6	11.8	12.3	10.9
Hard wire	3.2	3.5	3.2	4.0	3.2
Tyres, wheels and axles	4.1	3.5	3.3	4.5	4.3
Steel forgings (excl. drop forgings) ..	2.4	2.2	1.8	2.4	2.2
Steel castings ..	3.6	3.5	3.3	4.7	3.9
Total	265.5	280.2	256.7	307.9	264.1
Alloy steel	10.4	10.6	10.3	13.7	12.0
Total deliveries from U.K. prod.[5] ..	275.9	290.8	267.0	321.6	276.1
Add imported finished steel	9.5	3.8	5.7	4.3	4.2
	285.4	294.6	252.7	325.9	280.3
Deduct intra-industry conversion[6] ..	52.8	55.6	47.0	63.6	54.7
Total deliveries ..	232.6	239.0	225.7	262.3	225.6

TABLE IV.—*Weekly Average Production of Pig-iron and Ferro-alloys during July,* 1951. *(Thousands of Tons.)*

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants and Essex	24	—	15.3	25.2	0.9	—	41.4
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire .. Yorkshire (incl. Sheffield, excl. N.E. Coast) ..	6	—	6.9	—	—	0.7	7.6
Lincolnshire ..	14	—	23.9	0.6	—	—	24.5
North-East Coast	23	7.0	34.6	0.2	—	1.4	43.2
Scotland	9	0.7	9.7	2.6	—	—	13.0
Staffs., Shrops., Worcs. and Warwick ..	9	—	9.2	1.5	—	—	10.7
S. Wales and Monmouthshire	7	3.4	23·1	—	—	—	26.5
North-West Coast	7	14.3	—	—	—	1.2	15.5
Total ..	99	25.4	122.7	30.1	0.9	3.3	[7]182.4
June, 1951 ..	99	25.1	125.1	28.0	1.2	3.2	182.6
July, 1950 ..	96	29.0	114.9	27.5	0.7	2.8	175.0

[1] Five weeks.

[2] Weekly average of calendar month.

[3] Stocks at the end of the years and months shown.

[4] Other than for conversion into any form of finished steel listed above.

[5] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.

[6] Material for conversion into other products also listed in this table.

[7] Including 100 tons direct castings.

News in Brief

THE FOUNDRY TRADE SOCIETY (Derby Branch) held a smoking concert at the Osmaston Park Hotel, Derby, on October 5.

GENOSIDE FOUNDRY COMPANY SPORTS CLUB held their first dinner and prize distribution on October 5, at the Midland Hotel, Chapeltown.

FIVE EMPLOYEES of Plowright Bros., Limited, have completed over 50 years' service. The firm have introduced progressive 10-year awards.

THE VIETNAM PRIME MINISTER, Tran Van Huu, inspected part of the Corby (Northants) steelworks of Stewarts and Lloyds, Limited, recently.

SUNVIC CONTROLS, LIMITED, manufacturers of temperature control equipment, has acquired a new factory on the industrial estate at Harlow New Town, and has already commenced production.

FORTH CHEMICALS, LIMITED, which is at present constructing a plant at Grangemouth for the production of monomeric styrene, has decided to proceed immediately with an expansion of its capacity.

PIG-IRON IMPORTS in July into the Republic of Ireland totalled 10 tons, valued at £299, compared with 680 tons (£9,070) in July, 1950. Exports of scrap during the same period were 430 tons (£2,565), against 449 tons (£2,725) in July, 1950.

ARRIVALS OF IRON ORE in the Tees in August were over 70,000 tons in excess of import figures for August, 1950, while imports of scrap decreased by 26,000 tons. There was a marked decline in the exports of iron and steel products and of coal in the same period.

AN ORDER has been received by William Pickersgill & Sons, Limited, Sunderland, for a 4,460-ton cargo ship, the sistership of a vessel already on order. Both will be fitted with Doxford-type engines made by the North Eastern Marine Engineering Company (1938), Limited.

ABOUT 500 VISITORS made a tour of the engineering shops, blast furnaces, and foundries, when the first "At Home" was opened on October 3, at the Sheepbridge Works. It was instituted by Mr. Tom Brown, deputy managing director, of the Sheepbridge group of companies.

A REPORT published in a Midlands newspaper claims that a well-known Black Country foundry has saved £20,000 in a year by using alternative core-bonding agents to replace conventional materials. The saving was in labour as well as direct purchases and yet output was increased by 40 to 50 tons of cores per week.

A £1,000.000 CONTRACT has been secured by the English Electric Export & Trading Company, Limited, and Metropolitan-Vickers Electrical Export Company, Limited, for the hydraulic, mechanical, and electrical equipment for a new power station to be built on the River Zezere, about 120 miles north-east of Lisbon (Portugal).

AT BURTON TECHNICAL COLLEGE, a new departure is a course in foundry practice. Mr. N. Croft, chief metallurgist at Lloyd's foundry (Burton), will be the lecturer. He was previously metallurgist at Hadfields, of Sheffield, and has given lectures to the Institute of British Foundrymen, in various parts of the country. The course is intended for foundry apprentices.

STEEL PRODUCTION in Spain during the first five months of the year totalled 330.000 tons, compared with 343,000 tons in the corresponding period of 1950, the decline being partly due to the general shortage of locally produced and imported coal.

Other production figures (in tons) for the first five months of the year, with figures for January-May, 1950, in parentheses, are as follow:—Pig-iron, 252,654 (272,908); anthracite, 633,000 (631,000); bituminous coal, 3,885,000 (3,933,000); lignite, 562,000 (570,000).

A £300,000 REORGANISATION SCHEME at Qualcast, Limited, ironfounders, and lawn-mower manufacturers, of Victory Road, Derby, should be completed early next year. Space that was formerly used for storage will be converted into a fully-mechanised ferrous die-casting foundry, and it is hoped to increase production by about 50 per cent. Also, negotiations are going forward to acquire an existing foundry business in Australia, where facilities already exist for the production of lawn-mowers.

ON SEPTEMBER 26, No. 10 blast furnace was blown-in at the Appleby-Frodingham Steel Company after a re-line, which is believed to be the quickest ever done in this country. The blowing-in took place 32½ days after blast was taken off. During this time a complete re-lining was carried out, the hearth being increased in diameter from 22½ to 25 ft. Auxiliary equipment was overhauled and extensive modifications were made to an adjacent railroad. The re-lining of the furnace in world record time is the outcome of 100 per cent. co-operation between men and management and one department and another. The world's fastest relining, so far, has been at the South African Iron & Steel Corporation's plant at Pretoria, where a furnace was re-lined in 28 days. This was in 1948, but the furnace was an old-fashioned one with only a 17-ft. hearth dia. and no alterations in design were carried out. The fastest re-lining in America was of a furnace at the Bethlehem Steel Corporation's plant at Johnstown, when, in 1942, a 21-ft. hearth dia. furnace was re-lined in 31 days. Though this furnace, like the one at Scunthorpe, had its hearth diameter enlarged to 25 ft., it was not blown-in for some eight days after the completion of the re-line. In Australia, so far as records show, the fastest re-lining was round about 75 days for an 18-ft. furnace. The previous record for Great Britain was attained last year at Corby (Northants), where a 20-ft. furnace was re-lined in 39 days.

Increases of Capital

The following companies are among those which have recently announced details of capital increases:—

FOSTER INSTRUMENT COMPANY, LIMITED, Letchworth (Herts), increased by £30,000, in 10s. ordinary shares, beyond the registered capital of £30,000.

WHARTON CRANE & HOIST COMPANY, LIMITED, Reddish (Lancs), increased by £300,000, in 5s. ordinary shares, beyond the registered capital of £100.000.

STERLING FOUNDRY SPECIALITIES, LIMITED, London, S.W.1, increased by £50,000, in £1 ordinary shares, beyond the registered capital of £100,000.

EVERED & COMPANY, LIMITED, brassfounders, etc., of Smethwick, Birmingham, increased by £250,000, in £1 ordinary shares, beyond the registered capital of £300.000.

PARKER, WINDER & ACHURCH., LIMITED, pump manufacturers, etc., of Birmingham, increased by £130,000, in 5s. ordinary shares, beyond the registered capital of £120.000.

DANIEL ADAMSON & COMPANY, LIMITED, boiler-makers, etc., of Dukinfield (Ches), increased by £150.000 in £1 ordinary shares, beyond the registered capital of £295,000.

SIMON-CARVES, LIMITED, coke oven manufacturers, etc., of Cheadle Heath, Stockport (Ches), increased by £200.000, in £1 ordinary shares, beyond the registered capital of £400.000.

GLENFIELD & KENNEDY, LIMITED, hydraulic engineers and founders, of Kilmarnock (Ayrshire), increased by £1,000,000, in £1 ordinary shares, beyond the registered capital of £1.000.000.

JOSEPH COOK, SONS & COMPANY (1930), LIMITED, steel and ironfounders, etc., of Washington (Co. Durham), increased by £40,000, in £1 ordinary shares, beyond the registered capital of £60.000.

G. PERRY & SONS, LIMITED, engineers' pattern makers, etc., of Leicester, increased by £46.000, in 28,000 5 per cent. cumulative redeemable preference shares and 18,000 ordinary shares of £1, beyond the registered capital of £54,000.

Personal

Mr. T. L. Garner, M.Sc., of Precision Rubbers, Limited, has been elected president of the Purchasing Officers' Association.

Mr. J. L. Vaughan has been appointed director of the Process Engineering Department at National Research Corporation, Cambridge, Massachusetts.

Mr. E. H. Salinger is shortly leaving for a protracted stay in America. His address will be:—12 East 86th Street Hotel "The Croydon," New York 28, N.Y.

Mr. W. R. Clayton has been elected to the board of directors of C. T. Skelton & Company, Limited, Sheafbank Works, Sheffield, tool manufacturers.

After 51 years' service as foreman brass finisher at the St. Peter's engine works of R. & W. Hawthorn, Leslie & Company, Limited, Newcastle-upon-Tyne, Mr. J. S. Short has retired.

Mr. John Kelly, of Ayr, who, at 84 years of age, has just retired after close on 70 years as an iron moulder, was presented with a wallet of notes by Mr. John M. Hunter, a partner of the firm of A. & J. Hunter, Limited.

Mr. Arthur G. Gilbertson, a director of Brown, Lenox & Company, Limited, engineers and steel founders, etc., has been appointed joint manager with Mr. R. J. Richardson of the company's works at Pontypridd (Glam).

In recognition of his 50 years' service with the company, a presentation has been made to Mr. Robert Blaylock, for the last 15 years works manager of the Darlington Railway Plant & Foundry Company, Limited.

Lt.-Col. R. S. Goodhind, assistant to the district goods superintendent, British Railways, Sheffield, has been appointed transport and traffic superintendent of Newton Chambers & Company, Limited, ironfounders, etc., of Thorncliffe, near Sheffield. Mr. F. Norman has been appointed road transport manager of the company.

Mr. F. F. McFadzean has retired, as at September 30, from his position as secretary of the National Light Castings Ironfounders' Federation, a position which he had held since December, 1938. Mr. McFadzean has been succeeded by Mr. I. A. Sutherland, who has been assistant to the chairman, Mr. W. Shelton, over the past three years.

Mr. Moffat McCormack retired last week after 50 years' continuous service with Glenfield & Kennedy, Limited, Kilmarnock, as a machinist in "M" department. Mr. Henry Gardner, managing director, presented him with a gold medal suitably inscribed, together with £20, under the company's long service award scheme, and a certificate of service. Mr. McCormack retires under the retiring allowance scheme with a pension.

Ironfoundry Quiz

The correct answers to the 20 questions posed on page 412 are:—(1) All correct; (2) 82,000 tons; (3) the year 1365; (4) 70 parts; (5) 1,200 tons; (6) 26 tons per sq. in.; (7) 50 to 60; (8) 3,800 tons; (9) 2½ million tons; (10) John Wilkinson; (11) 62 specifications; (12) the year 1921; (13) 75 per cent.; (14) the year 1779; (15) Yorkshire; (16) 0.6 ton; (17) 2,250 foundries; (18) 3½ million tons; (19) 152,000 personnel, and (20) 130,000 tons.

A reader with 75 per cent. correct answers may congratulate himself on having a good general knowledge of the industry.

Obituary

Chairman and joint managing director of Lehmann, Archer & Lane, Limited, manufacturers of engineers' tools, etc., of Fairlop (Essex), Mr. Samuel Paul Lehmann died on September 27.

Mr. Cyril Ward, a director and secretary of B. Huntsman, Limited, steel manufacturers, of Sheffield, which was founded by Benjamin Huntsman, inventor of the crucible method of melting steel, and dates back to 1740, died recently at the age of 61. Mr. Ward was also a director and secretary of John Cooper & Son, Limited, tool manufacturers, of Sheffield, and vice-president of the Crucible Steel Makers' Association.

The death has occurred at Birmingham of Mr. James Edward MacLaren, who was managing director of B.S.A. Tools, Limited. He held a similar position with the Cardiff Foundry & Engineering Company (1947), Limited, B.G. Machinery, Limited, the Index Automatic Machine Company, Limited, Burton, Griffiths & Company, Limited, and Leo C. Steinle, Limited. Mr. MacLaren, who was 53, was a member of the council of the Machine Tool Trades Association.

The death occurred last week of Mr. W. H. Bean, of Bradford, at the age of 66 Mr. Bean was a partner in the firm of Newton, Bean & Mitchell, steam-engine manufacturers, of Dudley Hill, Bradford, prior to its purchase by Crofts (Engineers), Limited, Bradford, some four years ago. The firm was founded in 1896, and Mr. Bean's father, Mr. Henry Bean, was one of the original partners. The steam engines installed in many West Riding woollen mills have been made by this firm. Most of the time since the business changed hands, Mr. W. H. Bean had suffered from ill-health. He was an ex-president of the Bradford Ironfounders' Association.

Sir Robert Norman Thompson died last week. Chairman of Joseph L. Thompson & Sons, Limited, the Sunderland shipbuilders, and a great-grandson of the founder of the firm, Sir Norman was also a director of T. W. Greenwell & Company, Limited, Sir James Laing & Sons, Limited, John Crown & Sons, Limited, the Sunderland Forge & Engineering Company, Limited, and the Wolsingham Steel Company, Limited. He was 73. Sir Norman, who became chairman of Joseph L. Thompson & Sons on the death of Sir James Marr in 1932, was knighted for his services to shipbuilding in 1946, in which year the firm celebrated its centenary.

Europe's Expanding Steel Production

European crude steel production in the first half of 1951 was about 10 per cent. greater than in the corresponding period of last year. While production in the United Kingdom remained level all the other major producers increased their outputs, the upward trend being particularly noticeable in Belgium, Luxemburg, Italy, and the Saar. Statistics published by the Economic Commission for Europe in Geneva show that the United Kingdom's production in the first six months of the year was at an annual rate of 16,555,000 metric tons, compared with an annual rate of 16,568,000 metric tons in the first half of 1950.

The E.C.E. states that it is doubtful whether in the second half of 1951 Europe will be able to maintain the same rate of production mainly because of the incidence of the holiday season.

There has been a substantial increase in the iron-ore imports of Belgium-Luxemburg and the iron-ore exports of France, whence these countries largely meet their requirements. Imports of scrap into Italy have also increased. On the other hand, Germany's scrap exports and the United Kingdom's scrap imports, have severely declined, a factor which accounts largely for the levelling off of production in the latter country.

Raw Material Markets

Iron and Steel

With no improvement in the supply of pig-iron and scrap, production of castings at foundries continues to be hampered. Many foundries could absorb much larger quantities of pig-iron than are allocated to them, but they would be satisfied if they could at least procure their allocations. Some of the light foundries have, in fact, purchased Continental pig-iron at a much higher price, while some of the engineering foundries would like to buy imported low- and medium-phosphorus irons and hematite if these could be obtained. Deliveries of iron ore to home furnaces have recently improved and outputs of pig-iron, particularly hematite, could be greatly increased if more coke were available.

The engineering, speciality, and textile foundries are urgently in need of additional supplies of iron, as they have plenty of work on hand. Every ton of iron they can procure is readily accepted, including refined and Scotch foundry pig-iron. The light and jobbing foundries are seeking full supplies of high-phosphorus pig-iron, which remains very stringent. These foundries are well occupied and increased supplies of raw materials would enable them to step up production.

Suitable cupola scrap is in urgent request, and all parcels which become available in both cast iron and steel are readily accepted. Foundry coke is coming forward in sufficient quantities to meet immediate needs, but stocks are low. Ganister, limestone, and firebricks are available to requirements. Some grades of ferro-alloys are restricted, but users are generally able to obtain adequate supplies.

The re-rollers are unable to expand production, as there has been no improvement in deliveries of steel semis. Most of them are still working on a reduced number of shifts, their position depending on day-to-day deliveries of material from home steelworks, as they have no stock and deliveries from abroad are insufficient to ease the position. Orders, which are plentiful for all sizes of sections, bars, and strip, are badly in arrears. The re-rollers of sheets also have heavy order-books, but outputs are restricted owing to the shortage of sheet bars. Any materials which can be utilised are readily accepted, including defectives and crops, but these are as difficult to obtain as prime material.

Non-ferrous Metals

There was an unexpected but nevertheless welcome drop of £5 in the lead price last week to £175, the change being made possible, it was stated, by adjustments in the contract with producers. At the same time the quotation in the United States advanced by 2 cents per lb., equal to £16 per ton, becoming 19 cents per lb. This constitutes a ceiling price, fixed by the Office of Price Administration, and since the Mexican interests are not prepared to sell at that level, it looks as though U.S. consumers will go without the much needed Mexican metal. The price of Mexican lead today is understood to be 21½ cents per lb., delivered Mexican refinery.

The U.S. zinc price was also raised by 2 cents to 19½ cents, but even so it is considerably below the level ruling in the U.K. No change is anticipated in British prices as a result of these increases in the States. Both lead and zinc are in short supply in America, but of the two lead is probably the worst case. In lead the American consumers' loss will be a gain for users in other parts of the world, who are now reasonably well supplied. In the U.K., for example, the position is decidedly easier and looks like continuing so.

An Order, made by the Minister of Supply, came into force on Monday reducing the price of re-melted lead and lead scrap by £5 per ton. The new prices are: re-melted lead, £160 per ton; scrap cable sheathing, £160 per ton; lead scrap other than cable sheathing, £156 per ton.

After steady trading tin dropped sharply at the end of last week following overnight weakness in the Eastern price. Behind this there may have been disappointment over the news of lack of progress in the negotiations between the United States and Bolivia on a long-term contract. It is reported that the Bolivian producers wished to secure a price of $1.50 per lb., but the R.F.C. is certainly not prepared to sign a contract on this basis. It will be remembered that the 30 days pilot contract was fixed at $1.12 and probably the Americans will not be prepared to pay much over this figure for the larger quantity.

Allocations of copper and zinc to the United Kingdom under the international scheme have been announced, the copper total being 91,690 tons and zinc 60,250 tons. These figures are very much in line with our present rate of supplies which are, of course, below what we really require.

London Metal Exchange official tin quotations were as follow:—

Cash—Thursday, £987 10s. to £990; Friday, £955 to £960; Monday, £1005 to £1,010; Tuesday, £1,012 10s. to £1,020; Wednesday, £1,005 to £1,010.

Three Months—Thursday, £927 10s. to £930; Friday, £905 to £910; Monday, £945 to £947 10s.; Tuesday, £945 to £947 10s.; Wednesday, £942 10s. to £947 10s.

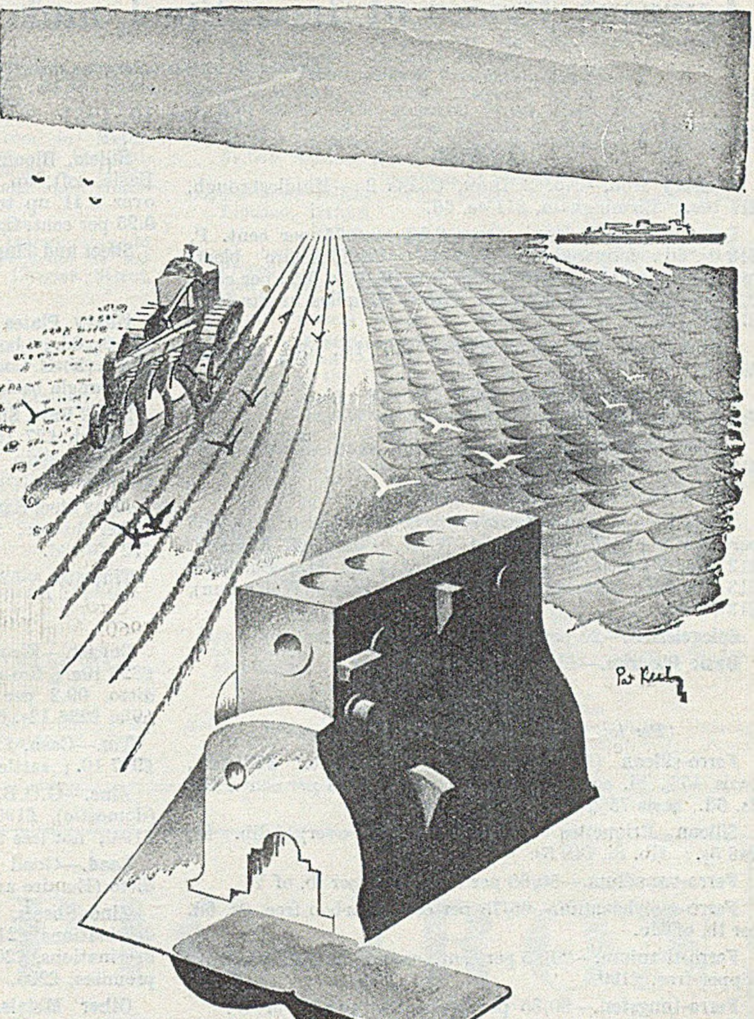
O.E.E.C. Copper Agreement

Joint action to alleviate the world shortage of copper, including common restrictions on the use of copper and copper alloys vital for defence purposes, has been agreed upon by the 18 member countries of the Organisation for European Economic Co-operation. From October 1 the use of copper and copper alloys of 40 per cent. or more by weight will be prohibited in the manufacture of more than 200 different commodities ranging from window frames to cocktail shakers, and including building material, furniture, hardware and electrical appliances, transportation and refrigeration equipment, jewellery, gifts, and novelties.

The 18 European countries have also agreed not to export to each other commodities on the list containing copper in prohibited quantities, in order not to interfere with steps already taken to liberalise trade. In certain cases—for example, where articles containing copper are required for repairs or essential technical work—or where hardship is involved, member countries may grant exemption from the new rules for their home markets. Exports to non-member countries may continue in cases where the value of the commodities exported is high in relation to the value of their copper content. General exemption for a period of three months may be granted to enable manufacturers and traders to dispose of their stocks of finished or semi-finished products on the home or foreign markets.

All member countries are required to report to the O.E.E.C. by November 30 on the measures which they have taken to implement this decision.

THE DEATH occurred on October 6 of Mr. Stanley Croft, who was 61. He was chairman and managing director of Stancroft, Limited, Birmingham, and was trained as an engineer at Crofts, Limited, Thornbury, Bradford, a firm founded by his father.



Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered, unless otherwise stated)

October 10, 1951

PIG-IRON

Foundry Iron.—No. 3 Iron, Class 2:—Middlesbrough, £11 10s.; Birmingham, £11 4s. 6d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £13 0s. 6d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £13 12s. 3d.

Scotch Iron.—No. 3 foundry, £13 1s., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £15 7s.; South Zone, £15 9s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £15 17s.; South Zone, £15 19s. 6d.

Cold Blast.—South Staffs, £17 5s. 6d.

Hematite.—Si up to 2½ per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. Coast and N.-W. Coast of England, £12 17s.; Scotland (Scotch iron), £13 3s. 6d.; Sheffield, £13 13s. 6d.; Birmingham, £14 0s. 6d.; Wales (Welsh iron), £13 3s. 6d.

Spiegeleisen.—20 per cent. Mn, £18 15s. 9d.

Basic Pig-iron.—£11 15s. 6d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered.)

Ferro-silicon (6-ton lots).—40/55 per cent., £40 15s., basis 45% Si, scale 15s. 6d. per unit; 70/84 per cent., £56 2s. 6d., basis 75% Si, scale 16s. per unit.

Silicon Briquettes (5-ton lots and over).—2lb. Si, £48 5s.; 1lb. Si, £49 5s.

Ferro-vanadium.—50/60 per cent., 15s. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 9s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £175; ditto, copper-free, £190.

Ferro-tungsten.—80/85 per cent., 33s. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 35s. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent C, £74, basis 60% Cr, scale 24s. 6d. per unit; 6/8 per cent. C, £70, basis 60% Cr, scale 23s. 3d. per unit; max. 2 per cent. C, 1s. 8¼d. per lb. Cr; max. 1 per cent. C, 1s. 8¾d. per lb. Cr; max. 0.15 per cent. C, 1s. 9½d. per lb. Cr.; max. 0.10 per cent. C, 1s. 9¾d. per lb. Cr.

Chromium Briquettes (5-ton lots and over).—1 lb. Cr, £78 9s.

Cobalt.—98/99 per cent., 17s. 6d. per lb.

Metallic Chromium.—98/99 per cent., 5s. 11d. per lb.

Ferro-manganese (blast-furnace). — 78 per cent., £40 8s. 9d.

Manganese Briquettes (5-ton lots and over).—2lb. Mn, £49 10s.

Metallic Manganese.—96/98 per cent., carbon-free, £215 per ton.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—Basic: Soft, u.t., £21 11s. 6d.; tested, 0 08 to 0.25 per cent. C (100-ton lots), £22 1s. 6d.; hard (0.42 to 0.60 per cent. C), £23 19s.; silico-manganese, £29 15s.; free-cutting, £24 15s. 6d. Siemens Martin Acid: Up to 0.25 per cent. C, £27 16s.; case-hardening, £28 4s.; silico-manganese, £30 16s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £25 15s.; basic, hard, over 0.41 up to 0.60 per cent. C, £26 15s.; acid, up to 0.25 per cent. C, £28 4s.

Sheet and Tinplate Bars.—£21 16s.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £25 6s. 6d.; boiler plates (N.-E. Coast), £26 14s.; chequer plates (N.-E. Coast), £26 15s. 6d.; heavy joists, sections, and bars (angle basis), N.-E. Coast, £23 15s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £27 11s.; flats, 5 in. wide and under, £27 11s.; hoop and strip, £28 6s.; black sheets, 17/20 g., £35 15s. 6d.; galvanised corrugated sheets, 17/20 g., £49 18s. 6d.

Alloy Steel Bars.—1-in. dia. and up: Nickel, £44 17s. 3d.; nickel-chrome, £65 2s. 9d.; nickel-chrome-molybdenum, £72 10s. 3d.

Tinplates.—52s. 1½d. per basis box.

NON-FERROUS METALS

Copper.—Electrolytic, £227; high-grade fire-refined, £226 10s.; fire-refined of not less than 99.7 per cent., £226; ditto, 99.2 per cent., £225 10s.; black hot-rolled wire rods, £236 12s. 6d.

Tin.—Cash, £1,005 to £1010; three months, £942 10s. to £947 10.; settlement, £1,007 10s.

Zinc.—G.O.B. (foreign) (duty paid), £190; ditto (domestic), £190; "Prime Western," £190; electrolytic, £194; not less than 99.99 per cent., £196.

Lead.—Good soft pig-lead (foreign) (duty paid), £175; ditto (Empire and domestic), £175; "English," £176 10s.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £210 10s.; rolled zinc (boiler plates), all English destinations, £208 10s.; zinc oxide (Red Seal), d/d buyers' premises, £205.

Other Metals.—Aluminium, ingots, £124; antimony, English, 99 per cent., £390; quicksilver, ex warehouse, £73 5s. to £73 15s.; nickel, £454.

Brass.—Solid-drawn tubes, 25d. per lb.; rods, drawn, 32⅞d.; sheets to 10 w.g., 29⅝d.; wire, 31¼d. rolled metal, 28⅜d.

Copper Tubes, etc.—Solid-drawn tubes, 26d. per lb.; wire, 254s. 9d. per cwt. basis; 20 s.w.g., 281s. 9d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £265 to £280; BS. 1400—LG3—1 (86/7/5/2), £275 to £300: BS. 1400—G1—1 (88/10/2), £330 to £360; Admiralty GM (88/10/2), virgin quality, £330 to £360 per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £340 to £370; L.P.Bl, £295 to £315 per ton.

Phosphor Bronze.—Strip, 38¼d. per lb.; sheets to 10 w.g., 40⅜d.; wire, 42¾d.; rods, 38d.; tubes, 36¼d.; chill cast bars: solids 3s. 11d., cored, 4s. (C. Clifford & Son, Limited.)

Nickel Silver, etc.—Ingots for raising, 2s. 7d. per lb. (7%) to 3s. 6¾d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 3s. 1d. (7%) to 4s. 0¾d. (30%); to 12 in. wide × .056, 3s. 1¼d. to 4s. 1d.; to 25 in. wide × .056, 3s. 3¼d. to 4s. 3d. Spoon and fork metal, unsheared, 2s. 10d. to 3s. 9¾d. Wire, 10g., in coils, 3s. 6¼d. (10%) to 4s. 6½d. (30%). Special quality turning rod, 10%, 3s. 5¾d.; 15%, 3s. 10½d.; 18%, 4s. 2¾d. All prices are net.

Forthcoming Events

OCTOBER 15

Incorporated Plant Engineers

Dundee branch:—"Fuels and Firing Appliances," by Dr. E. G. Ritchie, 7.30 p.m., at Mathers Hotel, Dundee.

Institute of Metals

Sheffield local section:—"Radio-active Tracers in Metallurgy," by Dr. H. M. Finniston, 7.30 p.m., at the University Building, St. George's Square, Sheffield, 1. (Joint Meeting with the Sheffield Society of Engineers and Metallurgists.)

Institution of Mechanical Engineers

Midland branch graduates' section:—"An Introduction to Furnace Design," by J. W. Bassett, 6.30 p.m., at the James Watt Memorial Institute, Great Charles Street, Birmingham.

OCTOBER 16

Incorporated Plant Engineers

Glasgow branch:—"Fuels and Firing Appliances," by Dr. E. G. Ritchie, 7 p.m., at the Engineering Centre, 351, Sauchiehall Street, Glasgow.

London branch:—Works visit to Broom & Wade, Limited, High Wycombe.

Institute of British Foundrymen

East Anglian section:—Presidential address: "The Rôle of Metallurgist in the Foundry," by B. W. Child, 7 p.m., in the Central Hall, Public Library, Ipswich.

Sheffield Metallurgical Association

"Problems of Scrap Sampling," by H. C. Harrison, 7 p.m., in the Grand Hotel, Sheffield.

Institute of Welding

North London branch:—Works visit to the Research Laboratories, The General Electric Company, Limited, Wembley, Middx.

OCTOBER 17

Institute of Metals

General discussion on Metal Economics, beginning at 10 a.m., at the Park Lane Hotel, Piccadilly, London, W.1.

Institute of Fuel

North-western section:—"Collection of Dust from Flue Gases," by J. C. Cleeves, 2 p.m., at Engineers' Club, Manchester. (Luncheon, 1 p.m.)

Incorporated Plant Engineers

Edinburgh branch:—"Fuels and Firing Appliances," by Dr. E. G. Ritchie, 7 p.m., at the Edinburgh Chamber of Commerce, 25, Charlotte Square.

Institution of Production Engineers

Coventry branch:—"Factory Layout," by R. Gore, 7 p.m., at the Geisha Café, Hertford Street, Coventry.

Edinburgh branch:—"Some Aspects of a Factory Inspector's Work," by Miss G. M. Mitchell, 7.30 p.m., at the North British Station Hotel, Edinburgh.

Institute of Metals

Oxford local section:—Visit to the works of Morris Motors, Limited, Oxford.

Purchasing Officers' Association

Slough branch:—Discussion on "Purchasing and Progress Procedure," 7.15 p.m., at the Reindeer Hotel, Slough.

Sheffield branch:—Films loaned by Stewarts and Lloyds, Limited, 6.30 p.m., at the Firth-Brown Research Department, Princess Street, Sheffield.

Institute of Vitreous Enamellers

Northern section:—"Shot-blasting Methods," by Eric Plant, 7 p.m., at the Queens Hotel, Manchester.

OCTOBER 18

Institution of Mechanical Engineers

Annual dinner at 7 for 7.30 p.m., at the Dorchester Hotel, Park Lane, London, W.1 (men only).

North-western branch:—"Further Mechanical Aids for the Foundry," by A. S. Beech, 6.45 p.m., in the Engineers' Club, Albert Square, Manchester.

Incorporated Plant Engineers

Liverpool and North Wales:—"Factory Building, Layout and Design," by J. W. Gray, 7.15 p.m., at Radiant House, Bold Street, Liverpool.

OCTOBER 19

Manchester Association of Engineers

"Electrical Power Distribution in Factories," by E. Jacks, 6.45 p.m., at the Engineers' Club, Albert Square, Manchester.

OCTOBER 20

Institute of British Foundrymen

Bristol and West of England branch:—"Some Casting Defects," by H. Balme, 3 p.m., at the Grand Hotel, Broad Street, Bristol.

CLASSIFIED ADVERTISEMENTS

PREPAID RATES : Twenty words for 5s. (minimum charge) and 2d. per word thereafter. Box Numbers, 2s. extra (including postage of replies).

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, 49, Wellington Street, London, W.C.2. If received by first post Tuesday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

PATTERNSHOP MANAGER (44), M.I.B.F. Cast Iron, Aluminium and Non-ferrous, seeks position with large mechanised foundry. Present foundry and patternshop manager. House essential.—Box 1288, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER (35) desiring change, seeks position in Lancashire or West Riding of Yorkshire. Fully conversant with all aspects of Foundry administration. Accustomed to full control. Castings up to 10 tons.—Box 1302, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

CHARGE HAND required for small semi-mechanised moulding unit incorporating Cupolette. Knowledge of power moulding machines and equipment essential and Midland experience an asset. South East London area.—Box 1283, FOUNDRY TRADE JOURNAL.

ASSISTANT FOUNDRY MANAGER required for Engineering and Light Castings Foundry in South Yorkshire. To the successful applicant this will be a progressive post and only those with initiative and drive need apply. Age 30-35 years. Write with full details of experience, qualifications and salary required.—Box 1278, FOUNDRY TRADE JOURNAL.

THE INTERNATIONAL MEEHANITE METAL CO., LTD., 66, Victoria Street, London, S.W.1, have vacancies for two METALLURGISTS with iron foundry experience to become Foundry Engineers. Ability to speak a foreign language desirable but not essential and to be willing to travel in Europe. Applications must state clearly all educational and workshop experience, with dates, salary, married or single, and be as complete as possible in the first writing.

APPLICATIONS are invited from men having experience of Non-ferrous Scrap Metals and Residues Buying. Progressive positions for representatives with the ability to extend and enlarge existing connections. Pensions fund. Applications, which will be treated confidentially, should be addressed to the SECRETARY, Wolverhampton Metal Co., Ltd., Wednesfield, Staffs.

MANAGING DIRECTOR of small Midlands foundry requires young man with common-sense and initiative as assistant. Duties would include progressing of orders, assisting in price fixing, metal control if possible, etc. Experienced Foundry Manager or Assistant Foundry Manager would be considered. Very good prospects for the right man.—Box 1291, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

FOUNDRY MANAGER required for Jobbing Foundry situated near North Lincs. seaside resort. Output 50/55 tons monthly.—Box 1296, FOUNDRY TRADE JOURNAL.

STEEL FOUNDRY in Lancashire requires the services of METALLURGIST, age 21-28, for metal control work on their steel plant. Write stating age, training, experience and salary required to Box 1295, FOUNDRY TRADE JOURNAL.

SKILLED MOULDERS, PLATERS, TURNERS, BORERS, etc., required by Distington Engineering Co., Ltd., Workington, Cumberland.—For further details apply to the LABOUR MANAGER.

EXPERIENCED PATTERNMAKERS required. Top London rates for good men.—MACHINE PATTERN Co., Liverpool Road, Trading Estate, Slough, Bucks.

PATTERNMAKER required for Engineering Department, mining property Peru, fully experienced. Salary about US.$300 monthly, depending upon age, capabilities. Single or single status one year. Knowledge Spanish advantage. Three-year contract, free passage out, home.—Box 1300, FOUNDRY TRADE JOURNAL.

MOULDERS.—Jobbing Moulders required for Iron Foundry; rate 3s. 6d. per hour, plus £2 week bonus, plus merit bonus. Also, all classes of Foundry Labour.—P.M.A., 136, Bramley Road, W.10. LAD. 3692.

FOUNDRY FOREMAN required for mining property Peru, to organise and install modern foundry practices, also train local personnel in modern Foundry Metallurgy. Salary about US.$400 monthly, depending upon age, capabilities. Single or single status one year. Knowledge Spanish advantage. Three-year contract, free passage out, home.—Box 1299, FOUNDRY TRADE JOURNAL.

OPPORTUNITY for fully qualified Foundry Manager to take complete control of small jobbing Iron Foundry in the Midlands. This is a genuine opening for a conscientious man to acquire a share in profits and a Directorship in firm—upon proved results. Fullest particulars of experience, etc., in the strictest confidence.—Box 1289, FOUNDRY TRADE JOURNAL.

HOOVER (ELECTRIC MOTORS), LIMITED, Cambuslang, Lanarkshire, have a vacancy for a Metallurgist. Applicants must have Higher National Certificate or University Degree. Experience in light alloys and toolroom heat treatment of steel preferable. Knowledge of Chemistry an advantage. Good salary and prospects. Apply in writing to the PERSONNEL OFFICER.

SITUATIONS VACANT—*Contd.*

KEEN young FOUNDRY METALLURGIST required with sound knowledge of Cupola Operation and Sand Control for Mechanised and Non-mechanised Grey Iron Foundries East Lancs. region. Write, stating age, qualifications, experience to Box 1298, FOUNDRY TRADE JOURNAL.

PATTERNMAKER.—Really first class man, able to make own Master Patterns, and supervise the completion of all types of metal patterns. Good flat available. Details of age, etc., to G. PERRY & SONS, LIMITED, Pattern Makers, Leicester.

YOUNG METALLURGIST required by large engineering company situated in the Eastern Counties, for metallography of ferrous and non-ferrous materials, special analysis, etc. Progressive position for successful applicant showing initiative and willingness to work with minimum supervision. Please state age, experience and qualification.—Box 1301, FOUNDRY TRADE JOURNAL.

WEST YORKSHIRE FOUNDRIES, LTD., require young man as METALLURGICAL ASSISTANT for the Iron Foundry Technical Control.—Apply Sayner Lane, Leeds, 10.

BIRLEC, LTD., Tyburn Road, Erdington, Birmingham, 24, require a trainee SERVICE ENGINEER for starting up, servicing, and field research on large arc and induction melting furnaces, ferrous and non-ferrous. Qualifications are H.N.C. or equivalent in electrical or mechanical engineering and practical experience in foundry work. The position offers excellent prospects, with opportunities for travelling abroad. Applicants should give full details of their education and experience, and state the salary required.—Apply to PERSONNEL OFFICER.

FOUNDRY SUPERINTENDENT required for Foundry near Birmingham producing 50 tons of High Duty Castings weekly. Must have experience in all types of jobbing castings varying from a few ounces to two tons in weight. Please give complete details of experience and salary required in first instance. This is a progressive and permanent job for a man who is able to produce results.—Box 1304, FOUNDRY TRADE JOURNAL.

FACTORY PREMISES WANTED

DISUSED FOUNDRY or Premises suitable for smelting required within 25 miles London, either Surrey or Sussex. Approx. 5-8,000 sq. ft.—Full details and price to Box 1106, FOUNDRY TRADE JOURNAL.

GREY IRON FOUNDRY premises required in Midlands. Approximately 10,000 sq. ft. Full details and price to Box 1290. FOUNDRY TRADE JOURNAL.

PLANT WANTED

FOUNDRY PLANT required. Cupola Blower (motorised), Redford or similar. Core Blowers, B.M.M., B.I.C., Moulding Machines, Pendulum, Gravity Roller, etc., Conveyors, Cupola, Table Shot Blast Machine, etc., surplus foundry plant, must be modern, in good condition and reasonable prices.—Box 1279, FOUNDRY TRADE JOURNAL.

FINANCIAL

ENGINEERING OR ALLIED INDUSTRY.—Advertiser, with substantial financial resources, desires to acquire an interest in (or would purchase outright) an Established Concern with good profit-earning record. Continuity of management and personnel essential.—Address Box 1268, FOUNDRY TRADE JOURNAL.

MACHINERY WANTED

10-CWT. POLFORD OR SIMILAR MIXER MILLER, WITH OR WITHOUT SKIP FEED. — NEWCASTLE FOUNDRIES, Silverdale, Staffs.

OFFER YOUR SURPLUS PLANT TO

FRANK SALT & CO., LTD.,
Station Road, Blackheath, Birmingham,
BLA. 1635

WANTED.—Steel Moulding Boxes. Nearest 18 in. by 13 in. by 4 in. to 6 in. deep each part. Also a 1-ton Electric Hand Travel Hoist Block; one 10-cwt. Ladle, geared or ungeared.—Full particulars to BERRY'S FOUNDRY (1949), LTD., New Bank, Halifax.

MACHINERY FOR SALE

SAND MIXERS and DISINTEGRATORS for Foundry and Quarry; capacities from 10 cwts. to 10 tons per hr.—W. & A. H. BEALEY (MACHINERY), LTD., Station Works, Ecclesfield, Sheffield.

FOR SALE.

3-TON and 6-ton ELECTRIC OVERHEAD TRAVELLING CRANES, 30 ft. span, single girder type, Electric Hoist and Hand Long Travel and Cross Traverse. 400/3/50 supply.

FRANK SALT & CO., LTD.,
Station Road, Blackheath, Birmingham.
BLA. 1635.

KEITH BLACKMAN. Twin stage large cubic capacity Blower, powered by 5 h.p., 400/440 volt, 50 cycle, 3-phase Brook Motor. Price, ex works, £35, or near offer.

COWLEY METAL,
3, Blackfriars Road, Salford, 3.
'Phone: Manchester Blackfriars 7577.

FOR SALE.

TILTING FURNACE, by Smidt. Oil fired. Capacity 600 lbs. Brass. Complete ready bricked. £200, ex works.

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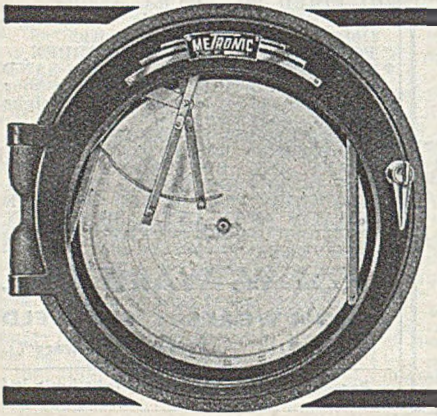

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