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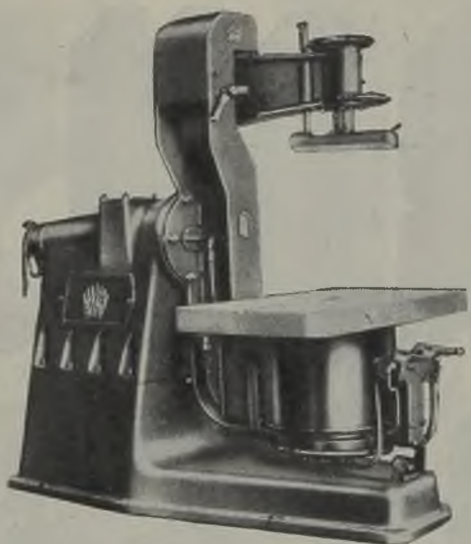

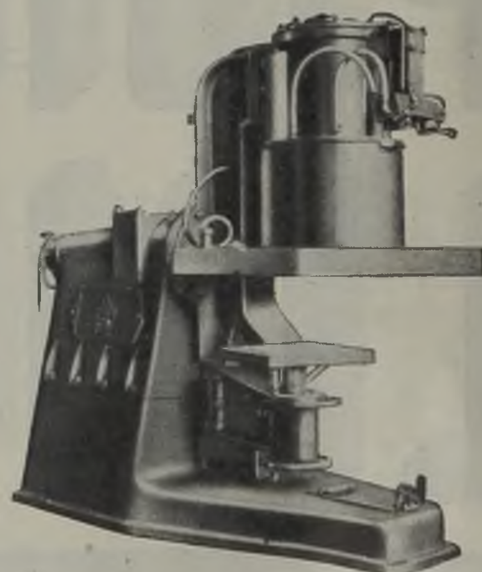

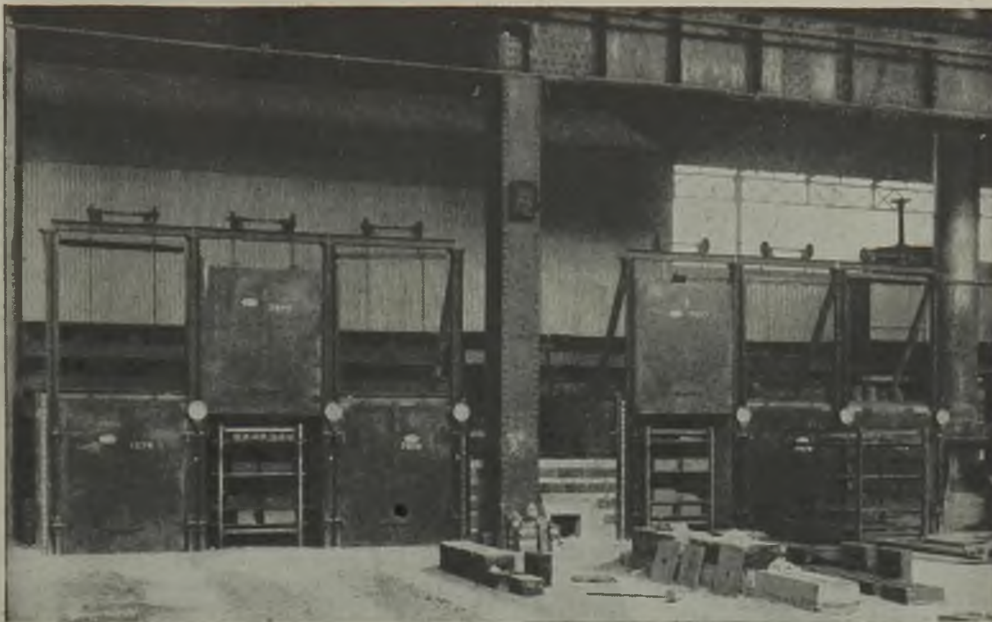

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Foundry Dust Hazards

The publication as Technical Report No. 1, by the Industrial Welfare Division of the [Australian] Department of Labour and National Service, of a booklet "Dust Hazards in Australian Foundries," marks the beginning of a new era in the conduct of shops devoted to the manufacture of castings. The Authors, Mr. A. A. Ross and Mr. N. H. Shaw, have presented the pneumoconiosis problem in a new light. They assume from the literature of the subject that pulmonary diseases can be associated with foundry practice; more with mechanical production the hazard is increased, because the major dust-producing operations follow one another in a more rapid sequence. Using the Owen's Jet Dust Counter from samples collected with the Greenburg-Smith Impinger, the Authors have made a logical survey of most foundry processes, and have established where the major hazards are to be found. With such a statement available, the industry is now well placed for a proper attack on the problem with every chance of a successful outcome.

The technique used by the Authors has been to establish the study on the number of particle-hours per c.c. In seven foundries using machine moulding, the figures were not high at from 163 to 250 particle hours per c.c., but the figures could be much lower if only the industry can reduce the dust produced by the application of parting powder, facing powder, the brushing of patterns, and cleaning them with air blast. It is these three operations which are the principal factors in noxious dust production, especially parting powder, which in many cases carries a very high proportion of silica flour. The solutions appear to be the use of powders free from silica and an adaptation of the vacuum cleaner. The facing powders, usually compounded of plumbago and talc, do not produce silicosis, but the inhaling of large quantities is not too healthy. The dust at the knock-out shows a somewhat higher dust concentration, and an exhaust ventilation offers the best means of control. Much dust can be generated during sand reconditioning, and this can be reduced by pre-wetting and the strategic positioning of exhausts.

The Authors included an examination of the interior of sand and shot-blast helmets, and as a result, though they found a low concentration, they draw attention to the need for the supply air to be taken from a clean source or that the air be filtered. The conditions around sand-blast rooms and cabinets, where dust concentration is dangerously high, demand amelioration by a rigid insistence on good housekeeping. Rumblers, unless properly modernised, are soundly condemned by the Authors. This problem is resolved in the United Kingdom by existing legislation. The use of scratch brushes produces, in many cases, a high dust concentration, containing much free silica, and there is a recommendation that this process should be conducted in an exhausted booth. The concentrations recorded by the Authors vary from 188 to 1,515, and they ascribe the minimum figure as being due to the removal of the fines from the moulding in the particular case yielding this result. The Authors are satisfied that foundry grinding operations are now innocuous, with the possible exception of some portable and swing grinders where the guard only covers 180 deg., instead of the 300 deg. or so usual with stationary grinding wheels, but even then the swing grinders propel the dust away from the operator. Pneumatic chisels used for fettling castings which are too large for shot-blasting create rather heavy dust concentrations, which contain high percentages of free silica and wetting before and during cleaning is advocated.

The final process to be studied by the Authors is the filling and emptying of malleable annealing pans. Here, whilst the dust production is high, the silica content is low (9 per cent.) and is relatively harmless. The Report very tentatively suggests

(*Continued overleaf, col. 2.*)

Contents

IRONFOUNDRY FUEL NEWS—II

The first phase in any works fuel economy campaign is, of course, to save as much fuel as possible with existing plant. It may be found, however, that very substantial economies could be effected by the installation of some new equipment, and to cover such cases a common standard for licensing the installation has been agreed upon by the Government departments concerned. Briefly, it requires that if the new plant does not affect the type of fuel to be used the scheme will be authorised if the fuel saved in 2½ years (from the date of authorisation) exceeds in value the capital cost of the equipment. The period of 2½ years may be increased if the new plant enables the existing fuel to be replaced by one which is in better supply.

Applications for licences for new fuel-saving plant should be made to the secretary of your Regional Fuel Efficiency Committee (Ministry of Fuel and Power), who will consult the Regional Panel of the Ironfounding Industry Fuel Committee in the cases of applications received from ironfounders.

The Ironfounding Industry Fuel Committee consider that the following types of plant are those which may with most advantage be considered:—(*a*) Forced draught equipment for the conversion of existing natural draught drying stoves; (*b*) portable mould driers to replace fire-baskets for drying large moulds; (*c*) weighing machines for cupola charges; (*d*) proper stoves to replace fire-baskets for shop heating purposes; (*e*) complete new drying stoves to replace existing stoves of obsolete type; (*f*) continuous core-drying stoves to replace small batch-type stoves; (*g*) complete new cupolas or cupolettes to replace melting plant, the capacity of which is far in excess of requirements.

Would any new plant such as the above enable you to save a large amount of fuel? Your Regional Panel will help you to decide whether the fuel which would be saved would justify the installation.

CATALOGUES RECEIVED

Surface Hardening Compound. Monard, Limited, of Green Lane, Braughing, Herts, have just issued a four-page leaflet which outlines the advantages of Monard surface hardening compound; gives instructions for its use, and carries a price list.

Wire Straightening and Shearing Machine. A machine, which consists of a brilliantly conceived meshed, horizontally-disposed plate arrangement, so as to form a square cavity on closing, is described and illustrated in a four-page leaflet received from the Coleman Foundry Equipment Company, Limited, Windsor Works, Stotfold, Beds. Wires and rods up to ⅝ in. dia. inserted between the two sets of manganese steel plates or dies are on closing made quite straight. By a simple adaptation, involving changing the dies, the machine can be used for the formation of gaggers. Again an attachment is provided for converting it into a shearing machine. The air consumption is 4 cub. ft. per min. in the standard machine carrying a 12-in. length of dies. The pamphlet is available to our readers on request.

FOUNDRY DUST HAZARDS

(*Continued from previous page.*)

safe working specifications, a final decision of which must be taken by the foundries themselves in order that the industry be made as attractive as its competitors. The standards suggested by the Authors are, as determined by the Owen's Jet Dust Counter: (*a*) When the dust contains less than 50 per cent. of free silica, the average exposure over a complete cycle of operations should not exceed 500 particle hours per cubic centimetre, and (*b*) where the percentage is higher than 50 per cent., then 200 is suggested.

Some of the generalisations enunciated by the Authors are of distinct interest. They reassert that the hazard is higher in steel foundries than others in other types; they dislike saw-tooth roofs for foundries, and prefer the Monitor or Inverted Monitor types; they recommend the use of vacuum cleaners for removing accumulations of dust from rafters and the like. What impresses us about the Report is that the problem is laconically stated, and when this is done the solution is well within reach. This booklet is issued free of charge to Australian citizens, but no doubt for important foundry organisations and individual firms in this country, a few copies will be available. The address of the Department is 129, Swanston Street, Melbourne. Australia.

Melting Plant. A leaflet received from the Monometer Manufacturing Company, Limited, Green Lane, Braughing, Herts, illustrates on one side an open-hearth rocking and tilting furnace designed to operate on either gas or oil. A wide range from 600 to 1,750 deg. of operating temperature is claimed, thus making the plant applicable for use as a receiver and superheater for cupola metal, or as a continuous melting furnace for aluminium and other non-ferrous alloys. The reverse side pictures a hot metal receiver of the forehearth tilting ladle type. The capacity range is from 1 to 3 tons.

Research on the heat-treatment of grey cast iron described by M. BADER in the "Archiv für angew. Wissen. u. Technik," indicates that if the carbon content of cast iron is varied between 3 and 3.3 per cent. and the Si between 1.5 and 2.5 per cent., about 0.7 to 0.9 per cent. C will be present as Fe carbide, the remainder being precipitated as graphite in the matrix. This matrix will be pearlitic to sorbitic in structure and possess the characteristics of steel, enabling it to be heat-treated in a manner similar to steel. Internal stresses in the cast iron may be relieved by annealing at a maximum temperature of 500 deg. C., but if the annealing period is made longer, the temperature may be reduced to 250 to 300 deg. Various types of heat-treatment, which are outlined in the Paper, may be employed.

SHRINKAGE AND POROSITY IN LIGHT IRON CASTINGS*

Bearing of variable factors of casting of metals on the occurrence of shrinkage and porosity

By C. A. PAYNE

It is generally appreciated that the casting of any metal whatsoever is attended by a whole host of variable factors, the majority of which cannot be eliminated. The object of metallurgical control is to hold each of the variables within such a narrow range that the effects of each are minimised, with a resulting closer approach to uniformity and consistency of production. Needless to say, the ultimate objective can be achieved only by the closest attention to detail of each stage of the process.

Some of the principal factors affecting the production of castings, and their inter-relationships, are set out in the "family tree" of the foundry process (Fig. 1). A few minutes' study of the diagram will make its meaning self-evident. It is the object of this Paper to draw attention to some of the items indicated in Fig. 1, particularly in their bearing on the occurrence of shrinkage and porosity.

The definition of shrinkage, for the purpose of this Paper, is the decrease in volume of cast iron whilst cooling down in the liquid state and whilst undergoing solidification. Porosity is more difficult to define concisely. It is to be considered as the occurrence of voids or discontinuities within the structure of the metal (ranging from those large enough to be visible on fracture to microscopic defects), which by their presence lead to failure under pressure tests. Both these defects have their origin in that period of time which elapses between the filling of the mould with molten metal and the subsequent complete solidification of that metal.

The most convenient aspect from which to view the variables that come under the heading of "metal" is that of the equilibrium diagram. As the Paper deals with a very complex alloy, namely cast iron, the simplified picture presented by the iron-carbon or a section of the ternary iron-carbon-silicon diagram (Fig. 2) can be only a starting point and not the complete story.

Without considering this diagram in detail, the following points are stressed. First, the liquid zone in which the volume occupied by a given weight of the alloy will decrease with decreasing temperature, *i.e.*, on cooling down within this range, we get the purely liquid shrinkage. Next come the areas bounded by the "liquidus" line on the upper side, and by the "solidus" lines on the lower sides. In these areas, except at the point 3.7 per cent. carbon, solidification takes place over a range of temperature, and the wider the range the greater the tendency for segregation to occur. In this zone occurs the solidification shrinkage, and the final formation of such defects as internal porosity, external shrinkage, cavities, blowholes arise. The third zone is the shaded area in which graphitisation occurs. It is to be noted that above eutectic composition this zone extends into the liquid zone (separation of kish graphite), but at the lower range of carbon it does not start much above the "solidus." In view of the present limited knowledge of the actual detailed mode of solidification of cast iron, this zone must be considered as a convenience of presentation rather than a quantitative statement of fact. Lastly, and of importance, in assessing the effects of graphitisation, is the point which shows the maximum percentage of carbon soluble in γ iron at the completion of solidification. Further reference will be made to these points later in the Paper.

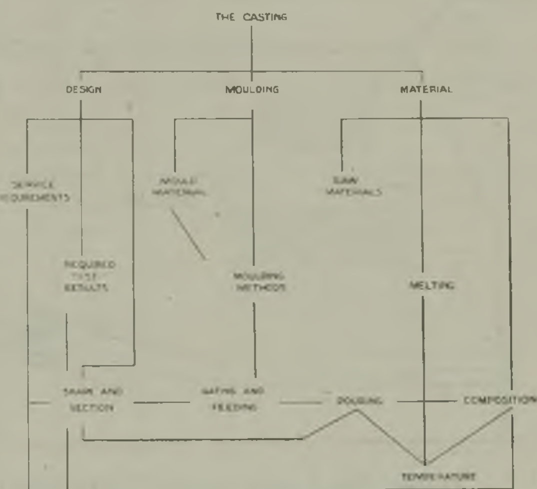

FIG. 1.—FACTORS AFFECTING THE PRODUCTION OF A CASTING.

Contraction of Cast Iron

From the next illustration (Fig. 3) an idea is given of the amount of contraction during the solidification process. The iron-carbon diagram, as applicable to white irons, is matched against the percentage contraction, and it is interesting to note the similarity in shape of the two curves, particularly the minimum at the eutectic percentage of carbon. This means in fact

* A Paper read before the Lincoln Section of the East Midlands Branch of the Institute of British Foundrymen, Mr. J. H. Bingley presiding.

Shrinkage and Porosity

that for the least possible shrinkage a eutectic composition is indicated. In the bottom portion of the diagram there is on a similar scale the shrinkage, changing into an expansion, as influenced by the separation of graphite. This curve is a very much idealised representation, but clearly indicates the influence of increasing graphite. The triple row of figures attaching to this part of the diagram brings out the relationship of carbon and graphite in the presence of 2 per cent. silicon, under the stipulated conditions that the cooling rate results in equilibrium, and that all the carbon in excess of that soluble in the austenite (1.5 per cent. C from Fig. 2) is as graphite. The percentage of graphite given is that existing at this particular temperature, and will be further increased by separation of carbon from the saturated austenite as cooling proceeds below the solidus. Dependent upon the cooling rate below this point, the ultimate graphite content will be some 0.6 to 1 per cent. higher. This is taken by weight. Taking the proportion by volume, it is quickly realised why this deposition of graphite causes such a marked change in the properties of cast iron. The expression "C + 0.3 Si" gives the effective carbon content for given analyses, where C is the actual total carbon and Si is the silicon content. If this correction be made to the carbon per cent. figures given it will be found that they are scaled off to match the carbon content in the upper part of the diagram. When thinking in terms of the iron-carbon diagram alone, it is always necessary to make such a correction for the silicon content of the particular cast iron under discussion.

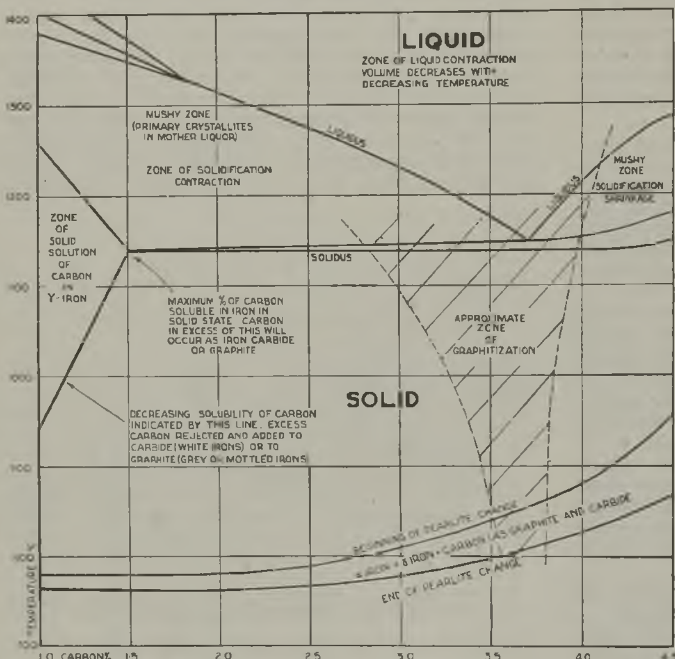

Fig. 2.—Iron Carbon Silicon (2 Per Cent.) Diagram (Greiner, Marsh and Stoughton, Modified).

Considering these two diagrams from the practical aspect, the conclusion is reached that, as regards solidification shrinkage and minimum opportunity for segregation, the most suitable compositon to work to would be that of the eutectic. In practice it is an uncertain business to rely on the expansion due to graphite in compositions above the eutectic, for this graphite may commence to precipitate (as kish) whilst the iron is molten, and its effects on the actual solidification zone are thus considerably reduced. Furthermore, the solidification of such iron in varying sections results in very variable graphite structures, and is to be considered too unreliable from a point of soundness.

Where the desired test results are the main factors, that is, when castings are required in a high-duty iron, the extent to which the composition can fall below the eutectic is controlled by circumstances affecting cooling rates for graphitisation and machinability, the need for feeding or use of denseners to overcome the differential solidification due to the wider range between liquidus and solidus. In the main, the bulk of light iron castings range from 2.0 to 2.5 per cent. silicon and 3.2 to 3.5 per cent. carbon, the stronger grades of iron being on the lower limits for both carbon and silicon.

Another thing to be taken into account with irons in the lower effective carbon ranges is the increase in temperatures at which solidification commences. One hears often that these irons are difficult to pour because of their "shorter freezing range." A single glance at the diagram in Fig. 2 will show the reverse to be the case. A "shorter pouring range" is the better term, indicating the range between tapping temperature and the minimum temperature giving freedom from mis-running. It is this range that is decreasing, not the solidification range.

The question of pouring temperatures is one of very great interest, and the bibliography of the subject issued by the B.C.I.R.A. gives much food for thought in this direction. Unfortunately much confusion is caused by the loose employment of the term *hot* and *cold* as applied to pouring temperatures. It is not sufficient even to give actual temperature values, for these must be amplified by reference to such factors as section thickness, weight of casting, gating relative to sectional changes, the provision, if any, made for feeding and the chemical composition and type of irons being used. Taking into account the casting design and the method of moulding, with a given composition of iron, the hotter the pouring temperature, the greater provision should be made for feeding. First, there is a decrease in volume in the liquid state, this being increasingly important with increasing size of casting. It must not be overlooked, however, that with many of the smaller-sized automobile castings, particularly in multiple pattern moulds, the volume of metal in the mould is sufficient to reflect this volume change. Then, due to increased temperature of the mould, solidification in the heavier sections tends to take place more slowly, giving time for segregation and for "self feeding" of the earlier freezing sections. With high-duty irons—the inoculated types particularly—higher pouring temperatures are usual to get the best results in physical properties, as well as ensuring in many cases, machineability and freedom from mis-running in the lighter sections.

Less Shrinkage

With the higher silicon, higher carbon irons, there is less shrinkage to cope with and a somewhat lower

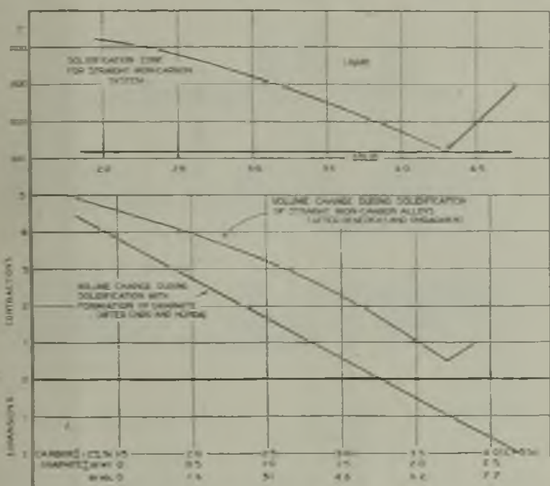

Fig. 3.—Effect of Carbon and of Graphite on Solidification Shrinkage.

liquidus temperature. With such irons the principle of flash gates into thin sections with the heavier sections if possible in the drag, and generally very little provision for feeding, is commonly employed. With runner systems of this kind it is important that their sensitivity to variations of pouring temperature and metal compositions should not be overlooked, nor should slow running, *per se*, be considered as synonymous with progressive solidification. In this system the location of the gates is the primary consideration, the size of gates being determined by the section of the casting metal composition, and desirable pouring temperature.

Two other points to be mentioned before leaving the subject of metal, are the effects of the type of graphite formation, and of that recently much-publicised element, phosphorus. With regard to the graphite formation, the classical investigations of Norbury and Morgan into the occurrence and methods of production of super-cooled graphite structures have established their peculiar property of almost complete freedom from porosity in considerably wider ranges of composition than is permissible with an iron giving a normal flake graphite structure. This would seem to be due in great measure to the difference in the time of precipitation of graphite. In the case of normal flake graphite structures, it is highly probable that the formation of graphite is spread over a considerable portion of the solidification period, so that the expansion due to graphite at any given point of time may not be very effective in counterbalancing the shrinkage

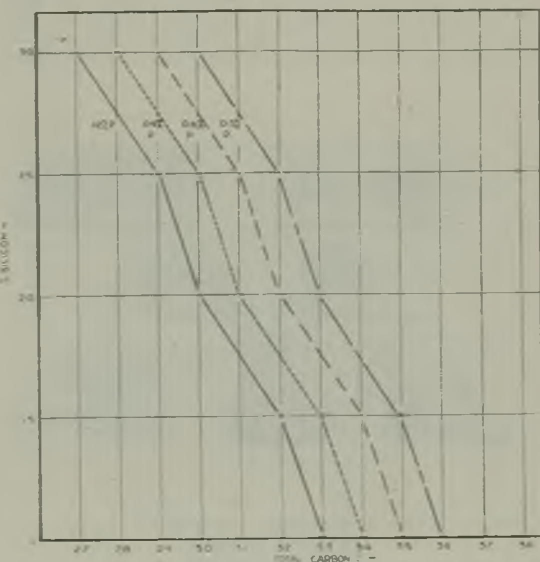

Fig. 4.—T.C. and Si Required to Obtain Soundness with Varying P Contents (B.C.I.R.A.).

of the iron, particularly in the case of variable section thicknesses, where solidification takes place at different times in different parts of the casting. With the fine graphite structure, however, this separation occurs at a lower temperature than normal, solidification of the undercooled iron being extremely rapid and graphitisation virtually instantaneous. As a result of this sudden graphitisation, an intense pressure is set up in the interior of the metal due to the increasing volume required to accommodate the graphite.

This undercooling can be achieved in more ways than one; the B.C.I.R.A. titanium and CO_2 treatment being applied after tapping in the ladle; or by the use of moulds of high thermal conductivity for casting

Shrinkage and Porosity

irons of suitable composition. This latter method has the merit of being applicable to cupola melted cast iron, a point upon which there is some doubt with regard to the Ti and CO_2 treatment. This difference in graphite formation produces a pronounced difference in fracture, that of the super-cooled iron being lustreless, dark grey to black in appearance, as against the brighter "crystalline" fracture of the normal graphite iron.

Influence of Phosphorus

Phosphorus is an element which has a marked effect upon the solidification of iron-carbon alloys. In brief it lowers the initial freezing point some 30 to 40 deg. C. for 1 per cent. of phosphorus, and the final solidification temperature of any free phosphide constituent that forms is in the region of 960 deg. C. As does silicon, phosphorus lowers the carbon content

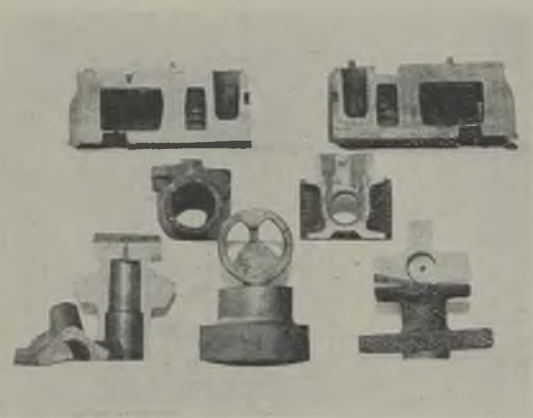

Fig. 5.—Typical Examples of Design Liable to Produce Defects.

of the eutectic by approximately 0.1 per cent. for each 0.3 per cent. phosphorus. (Note: taking 4.3 per cent. carbon as eutectic point for iron-carbon alloys, with 2 per cent. silicon this is reduced to 3.7 per cent., and with 2 per cent. silicon and 1 per cent. phosphorus there is a further reduction to 3.4 per cent.). The influence of phosphorus on the solidification temperature is the basis for the improved fluidity of phosphoric irons. But, owing to the wider interval between the beginning and the end of solidification, there is the increased opportunity for the segregation of the lower melting point constituents to the last areas to solidify, and for the "self-feeding" in which the thinner, more quickly frozen, sections of the casting withdraw liquid metal from the heavier, more slowly cooled, sections. Among the various publications upon the effect of phosphorus, the B.C.I.R.A. give their opinion on the modifications to be made to carbon and silicon with varying phosphorus contents in order to achieve soundness and to maintain satisfactory physical properties. This information is given in graphic form in Fig. 4. The conclusion to be drawn from this graph is that to achieve the same results when modifying the phosphorus content, compensation must be made in the amount of either or both carbon and silicon.

It is to be understood and appreciated that very many good castings from all sorts and sizes of patterns, have been produced in a very wide range of phosphorus content. There is, however, a class of work which is more difficult to make perfectly sound in the higher phosphorus irons. The chief characteristics of this class are sudden changes of section thickness, usually (with light castings) in the form of comparatively large bosses adjoining thin walls, frequently

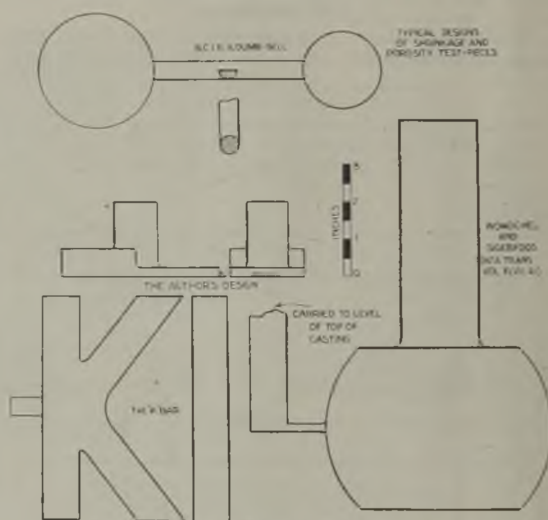

Fig. 6.—Four Types of Test-pieces.

inaccessible for the application of feeders. Often, too, the design of the casting results in hot spots, where projecting tongues of sand are heated up by the metal to such an extent that they, in turn, delay the cooling of the casting in the neighbourhood of the sand projections. A further factor is the demand that many castings with these features of design shall withstand high, fluid, or air pressure after machining. Some typical sections are shown in Fig. 5.

Influence of Design

The design of a casting is a matter of the greatest importance to the foundryman as well as to the user. Without doubt, the most satisfactory design is that achieved by the intelligent co-operation of these two parties. To this end the foundry should know clearly the intention of, and the limitations imposed by other circumstances of manufacture upon, the designer. In turn the designer should be aware of the scope and the limitation of the foundry science and art, but foundrymen can hardly hope for this unless they are fully aware of the latest knowledge and developments in their own field. As a result of foundrymen's endeavours, many test-pieces have been evolved for the further investigation of shrinkage and porosity. Four representative test-pieces are illustrated in Fig. 6. Of these, the two larger approach the subject more from the angle of volume changes in unfed bulk of metal, with fairly symmetrical cooling; and the other, smaller, test-pieces are more directly related to the effects of abrupt, sectional changes, with correspondingly different solidification rates in the differing sections. The author's ideas on the matter were based on the ruling problem as it appeared to him; a comparatively heavy boss, usually unfed, but requiring to be sound, adjoining a change of thickness. The thinner section of this test-piece is a useful guide to any chilling tendency. Further, as this casting is of small size, it is a comparatively simple job to section it and to polish the cut surface.

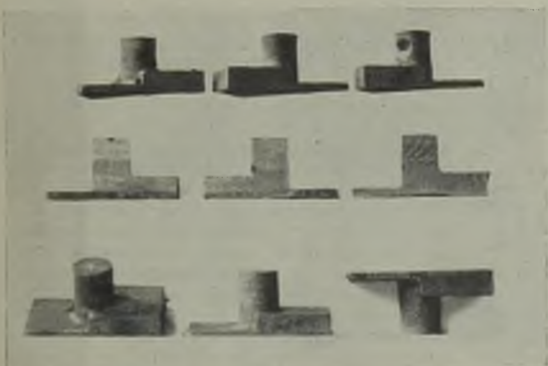

Fig. 7.—Surface Defects Related to Running Conditions.

Moulding

In quantity production of light castings, generally, the type of iron to be used is determined by the design, service requirements, and the supplying in a competitive market, and usually the choice is restricted to a small number of standardised mixes. Metal, or similar, permanent layouts of pattern plant are demanded; and the problems are to decide upon the most satisfactory method of running, and of feeding, if and where necessary, to give soundness; to maintain close dimensional tolerances; to ensure freedom from mis-running in the thinnest sections (particularly with the lower carbon, lower silicon type of high-duty iron); location and supporting of cores; to give but a very short list. Moulding material is generally green sand, and variations in this material have a profound effect upon the results, adding to the foundryman's problems.

It is at this stage that the information to be gained from such test-pieces as indicated is of inestimable value. The method of obtaining the information can be varied, but, broadly speaking, two approaches are available. From daily samples over a long period, by a correlation of the records of all the observed conditions holding for each sample, a critical analysis of the data will indicate the influence of the major variables. Alternatively, by a series of tests in which, as closely as possible, all factors are held constant, but the one whose effect is to be determined, a more detailed knowledge of the influence of these major variables can be obtained. The two methods are really complementary, for the one method can be employed to verify, or modify, the opinions derived from the study of the results obtained with the other method. In any case, the final arbiter is always the soundness or otherwise of the general casting production.

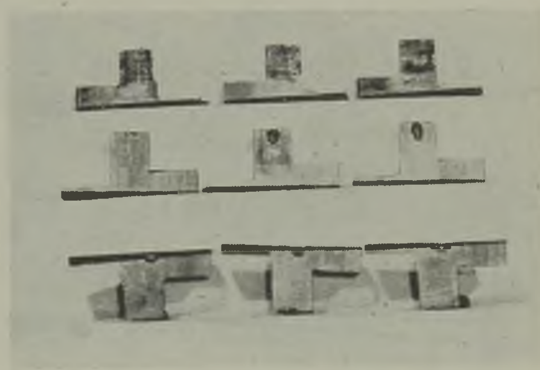

Fig. 8.—Showing Influence of Phosphorus on Severity of Defects.

Isothermal Studies

In order to understand the results obtained with the author's test-piece more clearly, it was necessary to get some idea of the variations in solidification rates in the differing sections. This was done by sketching isothermals for both casting and the mould surface, at various stages of the cooling. Confirmatory evidence was sought by knocking out test-pieces at short intervals after casting, and then breaking them up. Any residual liquid metal gave obvious indications during the breakage, and from examination of the fractures when cold, the final picture was constructed. Taking the case when the boss was uppermost, the casting being flash-gated at the thin end, solidification commences with a thin crust where the metal contacts the sand surface on the bottom, on the sides of the steps and over the top of the thicker step, the crust thickening appreciably as the boss fills up. The same applies in the boss, the crust forming within a very

Shrinkage and Porosity

short period of the filling of this portion of the mould. Soon after pouring is completed, the thin step is entirely solid, and the only remaining liquid or pasty areas are at the centre of the boss, at the centre of the heavy step, and in the zone joining these two areas. Due to the influence of the metal on the sand surfaces between the lower part of the boss and the top of the $\frac{3}{4}$-in. step, the mould in turn delays the final solidification in the zone mentioned above. At the top of the boss, particularly if a whistler be taken off, a thin layer of solid metal tends to form right

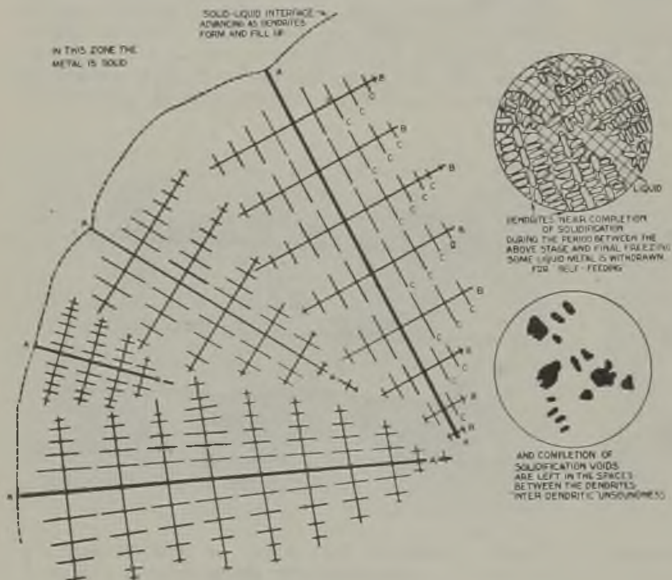

FIG. 9.—DENDRITIC FORMATION DURING COOLING.

across any shrinkage cavity or piping forming just below this layer.

Bearing these details in mind, there is an explanation of some of the surface defects shown in Fig. 7, which gives typical samples from a series in which, as far as possible, the metal composition and pouring temperature (checked by immersion pyrometer) were kept constant, the variables being the position of the boss in the mould, and the moisture content of the sand. As a result of the variations in moisture, there was a difference in the bond and permeability of the sand. The actual figures being:—

Sand A: Moisture, 7.9 per cent.; bond, 9.3 lbs. per sq. in.; permeability (A.F.A.), 21.

Sand B: Moisture, 5.8 per cent.; bond; 7.3 lbs. per sq. in.; permeability (A.F.A.), 27.

The pouring temperature was 1,270 deg. C. in each case, and the metal composition was:—

Iron A: T.C. 3.38; Si, 1.95; Mn, 0.79; S, 0.103, and P, 0.14 per cent.

Iron B: T.C, 3.39; Si, 1.92; Mn, 0.79; S, 0.110, and P, 0.11 per cent.

No venting other than that due to the permeability of the sand was utilised.

The bottom row of castings shown in Fig. 7 serve to indicate the different positions of the boss in the mould, the one on the extreme left being horizontal, not inclined as shown; the joint line is just visible across the thick step. In the top row, the first two specimens show a defect at the root of the boss, and the third shows a very large depression in the side of the boss. The second row is of sectioned test-pieces, the first of which has a slight sink at the top of the boss, the second having a sink between the boss and the $\frac{3}{4}$-in. step, whilst the last one shows a depression on the bottom (the top of the casting as made).

In describing the defects, the term "shrinkage" has been used, but the tests showed that the size of defects was greatly influenced by the steam pressure set up within the mould. This was indicated, too, by the very smooth, rounded contours of the depressions in the first and second castings of the first row and the middle casting of the centre row. Some idea of the volume of steam generated can be obtained from the fact that, under ideal conditions of steam raising, 1 lb. of water will give 118 cub. ft. of dry steam at 1,200 deg. C. Without giving a quantitative value for the result obtained in a green sand mould, it is obvious that the steam evolved will result in a very considerable pressure in the mould cavity.

As the moisture increases and/or the permeability decreases, so will this mould pressure increase. If, by the formation of a hot spot, or as the result of section changes, a wide variation in the solidification rate ensues, then the action of the steam pressure against the thin surface crust will tend to push this crust inwards against the unsolidified zone beneath it. At the same time, there is the natural tendency for this zone to decrease in volume on changing from liquid to solid. Thus, at the point concerned, the net result ranges from a shallow depression or sinks to a deep, very much rounded cavity. If the generation of steam is sufficiently rapid and vigorous, and is assisted by the expansion due to graphitisation, small beads or globules of metal may be squeezed through the thin crust into the cavity.

The first casting in the upper row in Fig. 8 shows a hot spot defect, the cavity at the common junction of the three different sections being actually in the drag of the mould. The other two samples of the upper row and the middle casting of the centre row show this marked effect of steam (and other mould gas) pressure. The end castings of the centre row show the effect obtained with the lower moisture, being shallow depressions on the uppermost surface of the casting in the mould, due to the feeding of the comparatively heavy mass of the casting directly beneath it, compensating for the liquid and solidification contraction.

Effects of Phosphorus

Fig. 8 shows the results of a variation in phosphorus content keeping, for each row, the base mix constant. The samples have been selected from three experiments on two different mixes, one a general engineering iron to BSS. 786, Grade 1, and the other an inoculated iron containing a fair percentage of steel in the mix. The experimental procedure adopted was to cast four moulds with three castings in each mould, the first being cast from the base metal, succeeding boxes being cast, from the same tap of metal, with ferro-phosphorus additions to the hand ladle. Each addition gave approximately 0.25 per cent. phosphorus more than the previous one. There was a slight decrease in temperature in the pouring of the last boxes, but it did not fall outside the range that occurs in normal practice.

The top row shows the results obtained with the first-mentioned iron, the second and third castings showing porosity, more pronounced in the third than in the second. In the two lower rows, no porosity was evident, but marked contraction cavities were present, the size of the cavity increasing with phosphorus content. This demonstrates very clearly the results of widening the period over which solidification takes place, and the immediate influence of increasing the phosphorus content without adjustments in other elements. The shrinkage cavities were all very smoothly rounded, this being attributed to the effect of mould gas pressure upon the progress of solidification contraction. The difference between these two rows was the position of the boss in the mould, being as indicated in the illustration.

Whilst these specific cases were the results of modifications in phosphorus content, similar results are to be expected from comparable alterations in either carbon or silicon. Reduction in carbon will give a wider solidification period as well as increasing the inherent contraction. Increase of silicon or carbon tends to give porosity rather than external shrinkage defects, to some extent a function of the deposition of graphite. With analyses above the eutectic, separation of graphite as kish direct from the melt will give rise to open patches on machining. These may be visible to the unaided eye, but even if they are not, they generally lead to leakage of air or liquid under pressure. If the analysis is just below the eutectic, as a result of the delayed solidification at the last zone, and of the ever present tendency of segregation, a very much coarser structure tends to occur.

Apart from the effect of this coarse graphite formation, another very important cause of porosity is the solidification contraction, and it is this manifestation with which the previously mentioned "self-feeding" is connected. As a result of differential cooling, due to incorrect gating or to marked changes in pouring temperature or in metal composition, one section of the casting may freeze before adjoining areas. If the location of these latter parts facilitates the movement of metal towards the former, then the liquid metal present will be drawn upon to compensate for shrinkage in the more quickly frozen section. Unless this withdrawal is in turn compensated for from a source outside the casting itself, then voids will result in these more slowly solidifying areas. These shrinkage voids in large castings are frequently sufficiently obvious for their cause to be identified with comparative ease.

In the range of section thicknesses met with in light castings, however, the size and distribution do not lead so readily to the correct inferences. This is largely attributable to the mode of formation of solid crystals from liquid iron. This so-called "dendritic" freezing and the resultant "inter-dendritic" unsoundness are shown diagrammatically in Fig. 9. A.A. represents the first solid crystallite extending out into the liquid metal; from this grow the side branches B.B.B., in all directions in the plane at right angles to A.A. If the period of cooling be sufficiently long, and if the composition be far enough from the eutectic, then branches C.C.C. will grow at right angles to these again. This continues until eutectic temperature is attained, when the liquid remaining achieves the eutectic composition and then solidifies spontaneously from a number of independent centres. If, however, this liquid metal be withdrawn from between the crystallites as under the conditions given above, then we get the "inter-dendritic" unsoundness which sometimes, but not always, is recognisable by the comparatively regular arrangement of the voids. The fern-like dendrites can often be seen in hot-tears, particularly of steel, and in some shrinkage cavities in the heavy castings.

Detrimental Influence of Hydrogen

Nothing has been said about the effect of occluded or dissolved gases, or of variations in metal condition due to excessive oxidation (or reduction?) of the melt. The precise effect of the chief suspects (hydrogen and oxygen or gaseous oxides) has not been yet fully established, although the work of Boyles upon the fundamentals of this exceedingly complex and fascinating problem points to a very pronounced and detrimental influence of hydrogen.

It remains to be said that investigations along the lines indicated above can reveal the influence of factors previously unconsidered. The cynic who has it that each time a defective casting is submitted for examination, the laboratory finds a new reason for the defect, may be nearer the truth than was his intention. Careful control and accurate records are the only certain means of establishing those improvements in operation which can be learned most thoroughly and effectively only from continuous and intensive study of defective castings.

In conclusion, the Author wishes to make due acknowledgement to Qualcast, Limited, for their permission to publish the results of, and the illustrations of the work carried out in their foundries; and to thank his friends and colleagues for their interest, encouragement, and active assistance.

LONDON BRANCH ANNUAL MEETING

NEW OFFICERS ELECTED

The London Branch of the Institute of British Foundrymen held its annual general meeting at the National Liberal Club, Whitehall Place, London, S.W.1, on April 27 last, the Branch-President (Mr. H. W. Lockwood) in the chair.

An apology for absence was received from Mr. Wesley Lambert, C.B.E. (Past-President of the Institute and of the Branch).

The minutes of the previous annual general meeting, held on April 29, 1943, were taken as read, and were confirmed and signed.

Mr. V. Delport (Branch Past-President and an hon. auditor) presented the financial report for the past year. He gave details of income and expenditure, showing a satisfactory state of affairs, and emphasised the fact that subscriptions from Branch members paid direct had reached the record total of £700 17s. 6d. in 1943. He referred to a graph showing the trends of subscription revenue and membership over the period 1928 to 1943, and said that for the period 1941 to 1943 there had been an increase of subscription revenue from approximately £525 to £700, the rate of increase having been regularly maintained. That fact, he said, reflected greatly to the credit of the Branch and its officers. The financial report was unanimously adopted, without discussion.

Annual Report

Mr. V. C. Faulkner (hon. secretary and treasurer, Past-President of the Institute and the London Branch) presented the annual report for the past year.

Obituary.—In the first place, he said that during the year the Branch had sustained the loss by death of one member, Mr. T. T. Owen, who had joined as an associate member in 1933. He was a student at Sheffield University, and was working as a melter in Pittsburgh when the 1914 war had broken out. Immediately he had returned to England to join the Army, attaining the rank of Captain before he was invalided out, having been twice wounded. For many years he was the London representative for the Revo Foundry Company, Limited.

Technical.—Since the last annual general meeting, eleven meetings had been held by the Branch. There had been a marked improvement in attendance, whilst the level of discussion had been so high that on several occasions lengthy extracts had been published in the American technical Press. Non-ferrous interests had received special attention, and excellent Papers had been presented by Mr. S. A. E. Wells, Mr. W. A. Baker, Mr. Ian Ross and Mr. Logan. Mr. Baker's Paper has resulted in a unanimous request for the standardisation of test-bars for bronzes. The Paper by Mr. Ross was being presented before the Metropolitan Chapter of the American Foundrymen's Association, reciprocating the courtesy which the London Branch of the I.B.F. had received from the Metropolitan Chapter earlier in the session in the form of an excellent review of foundry control by Mr. Wm. Reichert. Mr. Logan had presented the Atlas of Non-Ferrous Defects on behalf of the Non-Ferrous Castings Sub-Committee of the Institute's Technical Committee. Mr. Well's Paper had proved so popular that there was a request for its presentation a second time at Slough.

A Paper by Dr. Hurst (Past-President of the Institute) on "Acid-Resisting Cast Iron," was also well received, and had given much information on that not too well known but interesting product. Mr. E. W. Harding's Paper on "Quality Control of High-Duty Irons" merited a much better reception than it had received, due to the fact that the Branch Vice-President (Mr. J. F. Kayser) happened to possess very decided views on statistical control.

To close the session, there had been a particularly successful visit to the works of Kent Alloys, Limited, where Mr. F. H. Hoult had given a particularly delightful talk and demonstration on core shop practice. It was regrettable that present-day conditions had limited the party to fifty, but it might be possible to arrange a further visit later this year.

East Anglian Section.—Under the chairmanship of Mr. Tibbenham, the East Anglian Section had made steady progress. The new hon. secretary, Mr. A. N. Sumner, to whom the thanks of the Branch were due for his very efficient conduct of his office, was enthusiastic not only as to the immediate work of the section, but also in the field of local technical education and fuel economy. Mr. C. H. Kain, a Past-President of the London Branch, was to succeed Mr. Tibbenham as chairman of the section.

Slough.—As a result of a series of highly successful lectures, a request from members resident in the area that a Section be formed in Slough had been received. After careful consideration by the Council, permission had been granted for its immediate creation. Its progress would be followed with interest.

Membership.—During the year the membership had increased from 403 to 471. The report gave details of membership, and for purposes of comparison it quoted in brackets the figures for the previous year. The membership at the end of 1943 was made up as follows:—3 hon. members (3); 17 subscribing firms (15); 270 members (237); 176 associate members (146); and 3 associates (2). Thus, there had been a net gain of 68 members, as against 41 in the previous year.

Ten of the branch members were on active service, and another 21 were resident overseas. Of the six who unfortunately were in enemy occupied territory a year ago, Mr. P. Chourin had been transferred to the overseas list, since Kharkov had been recaptured;

whilst Mr. C. Monseur, of Belgium, had escaped to this country.

Distinctions.—Two members of the branch—Mr. W. Gladwell and Mr. H. G. Warrington—had been awarded the Institute's Diploma. Dr. Griffiths had been elected President of the Institute of Metals, and Mr. Bailey a Vice-President, whilst Mr. Murphy (a Vice-President of the Branch) presided over the London section.

Fuel Conservation.—The London Panel for the iron-foundry institution had met regularly under the chairmanship of Mr. R. B. Templeton (Past-President of the Branch), and good progress had been made.

Conclusions.—In a tribute to all who had contributed to the results achieved, Mr. Faulkner said that progress such as had been reported could not have been achieved but for the members' wholehearted co-operation, and especially that accorded him by the Branch President, Mr. Lockwood, to whom all were specially indebted for the great effort he had made in travelling so regularly from Birmingham to London to preside over the Branch meetings with such consummate efficiency. To Mr. Sumner and Mr. J. Pike the Branch owed much for their efficient work in Ipswich and Slough. Thanks were also accorded Kent Alloys, Limited, who, through Mr. F. H. Hoult, were the hosts on the occasion of a works visit; and High Duty Alloys, Limited, and Mr. W. C. Devereux for having placed their magnificent lecture theatre at the disposal of the Branch.

On the motion of Mr. G. C. Pierce and Mr. V. Delport (Branch Past-Presidents), the report was unanimously adopted, and the hearty thanks of the Branch were accorded Mr. Faulkner for his sustained and untiring efforts on behalf of the Branch and the Institute.

Election of Officers

The meeting elected officers and Council for the year 1944-45, as follows:—

Branch-President.—Mr. Lockwood proposed that Mr. J. F. Kayser (Junior Vice-President) be elected President of the Branch for the ensuing year. Mr. Kayser, he said, was an Associate of Sheffield University; he had joined the Institute in 1921, had served on the Council of the Sheffield Branch, and had been awarded the Institute's Diploma; he was a Freeman of the City of London. He was serving the industry well as chief metallurgist to Gillette Industries, Limited, and as consultant to several of Britain's largest works. As Mr. Kayser may visit America during his term of office, he would be in a position personally to present on behalf of the Branch an exchange Paper to the Metropolitan Chapter of the A.F.A. That, he was sure, would be much appreciated by the American foundrymen.

Mr. Kayser was unanimously elected.

Senior Vice-President.—In view of the fact that Mr. Murphy was holding a number of important offices, Mr. Lockwood proposed, and the meeting unanimously resolved, that Mr. Murphy be re-elected Senior Vice-President.

Junior Vice-President.—Mr. Murphy proposed that his former colleague, Mr. G. R. Webster, be elected Junior Vice-President. He recalled that Mr. Webster had joined the Branch in 1928. His interests had been both ferrous and non-ferrous, and he had widened his experience by going abroad, having devoted a considerable time in Switzerland to the study of the technique of malleable iron practice. He was the manager of the Britannia Iron and Steel Works, Bedford. It would be an honour to have his services as a Vice-President of the Branch.

Dr. A. B. Everest (Branch Past-President) took pleasure in seconding, and assured the Branch that Mr. Webster would serve its interests very well indeed.

Mr. Webster was unanimously elected.

Hon. Secretary and Treasurer.—Mr. R. B. Templeton (Branch-Past-President) was honoured to propose the re-election of Mr. Faulkner as hon. secretary and treasurer, and said that, as a Past-President of the Branch, he was able fully to appreciate the value of Mr. Faulkner's work. It would be impertinent to repeat what had been said so many times concerning his great qualities and the splendid work he had done for the Institute over many years. Actually it was just 21 years ago since he held office as President of the Branch, and by serving as hon. secretary he did the Branch great honour.

The proposal was seconded by Mr. Arnold Wilson and supported by the Branch-President.

Mr. Faulkner was unanimously re-elected.

Members of Council.—Three members of the Branch Council retired by rotation, only one of whom (Mr. A. C. Turner) offered himself for re-election. There was a fourth vacancy, due to Mr. Webster's election as Junior Vice-President. Nominations were invited. The following were nominated and duly elected:—Mr. F. H. Hoult, Mr. L. W. Sanders, Mr. R. Elliott, and Mr. A. C. Turner.

The first three members will serve for three years. Mr. Turner will serve for one year, replacing Mr. Webster, who had served two years as a member of council before his election to Junior Vice-President).

A question was raised by Mr. Murphy concerning the position of co-opted members of council, and whether it was necessary to co-opt them each year, if their services were still required. It was agreed that it was a matter for the council to co-opt each year gentlemen whose services were desired. Tribute was paid to the services rendered by the three co-opted members—Mr. E. M. Currie, Mr. Frank Hudson and Mr. A. Logan—and a suggestion was made that when next an opportunity occurred it would be a courtesy to appoint them permanent members of council.

Hon. Auditors.—The meeting unanimously re-elected Mr. V. Delport and Mr. Cleaver as hon. auditors; and appreciation was expressed of their work in that capacity in the past.

Delegates to General Council.—Nominations were invited for election as Branch delegates to the General Council of the Institute. Owing to the growth of the Branch membership, the number of delegates from the Branch was increased from four to five.

London Branch Annual Meeting

There were six nominations, and thus a ballot was necessary, which resulted in the election of the following:—Mr. C. C. Booth; Mr. C. H. Kain, Mr. H. W. Lockwood, Mr. A. Logan, and Mr. G. R. Webster.

Mr. C. Monseur, who reached this country from Belgium recently, was invited to comment on conditions in that country. The conditions there, he said, were very sad. Although there were some black sheep, they were not numerous, particularly in the foundry industry. At the same time, some of the works had been compelled to resume, for there was always the danger of deportation of the workmen. But the work that was in progress was being done very slowly. He added that many people in Belgium would like to be with him in this country; he was very happy to be present at the meeting with his fellow foundrymen.

Mr. Monseur was congratulated on his escape. The Branch-President recalled the hospitality which he and his colleagues in Liège had extended to British foundrymen before the war, and assured him that he was welcome. In response to a request, Mr. Monseur promised to recount his experiences at a future date.

The Institute's Technical Committee

Mr. C. H. Kain (a member of the Institute's Technical Committee) made a brief reference to the forthcoming re-constitution of that body. Its work, he said, was reported each year in the annual report of the Institute, and from time to time in the publications of the Committee.

Originally the Committee had consisted of a Technical Council, consisting of two members elected from each Branch. The Technical Council formed Sub-Committees to deal with various aspects of founding, such as cast iron, non-ferrous castings, steel castings, sands, and so on, to which were appointed conveners or chairmen. If those serving on the Sub-Committees were not already members of the Technical Council, they were co-opted. The Sub-Committees had power to co-opt, and the elected members from the Branches and the co-opted members formed the Technical Committee.

It had been found that that constitution was rather unwieldy in practice, and it was proposed by the Technical Council that a re-organisation should take place. It was proposed that the standing Sub-Committees should be abolished, and that *ad hoc* Committees should be formed from time to time as necessary to deal with specific inquiries or investigations and present their reports, after which they would be dissolved and other Committees formed. It was further proposed that after the next general meeting the Technical Council should consist of one elected member from each Branch, together with eight co-opted members. It was felt that that would maintain the wide geographical representation of the Institute, whilst at the same time enabling the elected members to co-opt men of outstanding technical or other qualifications.

Originally it was intended that the members elected by the various Branches should report to their Branches from time to time on the technical activities of the Institute; but that had proved to be rather spasmodic. Therefore it was proposed that a report of the activities of the Technical Council and Sub-Committees —the technical activities of the Institute generally— should be prepared approximately quarterly by the secretary of the Institute and submitted to each Branch Council. It would be the duty of each Branch Council to decide whether or not to pass the information on to Branch meetings.

Thus, the London Branch had to elect one member to the Technical Council of the Institute. For several years Mr. Murphy and himself had represented the Branch. Inasmuch as the non-ferrous interests of the of the London Branch had grown very greatly and the non-ferrous industry generally had undergone considerable expansion, but was not properly represented in the technical activities of the Institute, he suggested that Mr. Murphy be asked to represent the London Branch on the Technical Council.

Mr. Murphy, whilst appreciating the compliment, and whilst he would be glad to represent the Branch, said that the meetings of the Technical Council were necessarily held in various parts of the country at times which were awkward so far as he was concerned, and he did not feel justified in accepting the work without reasonable prospect of being able to put in a good proportion of attendances. He personally would be glad if Mr. Kain could accept.

Mr. Kain said it had been laid down explicitly, at discussions of the Technical Council and the General Council, that if a Branch representative should be unable to attend he should have power to ask someone else to attend in his stead. Perhaps that would meet Mr. Murphy's difficulty. If, however, Mr. Murphy was still unable to accept nomination, and in view of the importance of the non-ferrous interests of the Branch, perhaps Mr. A. Logan would undertake the work. He proposed that Mr. Logan be elected to represent the Branch on the Technical Council.

Representation of All Interests

Mr. Murphy commented that he would be the last to suggest that the representation should swing over from being predominantly ferrous to non-ferrous; all interests should be represented. If Mr. Logan could accept the work, he would be an excellent representative. Mr. Murphy seconded the proposal, therefore.

Mr. Logan was elected to represent the Branch on the Technical Council.

Mr. Murphy expressed appreciation of Mr. Kain's broadminded gesture.

Mr. Kain said that London was generally very well represented in respect of technical matters. But he was sure the Technical Council would be very anxious and willing to hear suggestions, criticisms or comments from any branch or any member of the Institute. He would not like it to be thought that the Technical Council lived in a rarefied atmosphere of technical discussion; it was very important that it should be in touch with the trend of thought and development and

London Branch Annual Meeting

the difficulties in the foundry industry to-day. If members wished to raise any technical problem they should do so through their representative on the Technical Council or the Secretary of the Institute.

THE BRANCH PRESIDENT added that the Branch would always be glad to hear from Mr. Logan about the work of the Technical Council.

Vote of Thanks

MR. A. C. TURNER proposed a hearty vote of thanks to Mr. Lockwood (the retiring Branch President), and to Dr. Hunt and Mr. Cree (who were retiring from the Branch Council), for their excellent work. The Branch appreciated Mr. Lockwood's work very highly, and the members would always look back upon his period of office as President with satisfaction.

MR. BARRINGTON HOOPER, C.B.E. (Branch Past-President), seconding, remarked jocularly that when he had first become a member of the Branch he had looked with awe upon Mr. Lockwood (then hon. secretary), and the ruthless, harsh and determined manner in which he had controlled the affairs of the Branch. The members of the Branch expected very much from their Presidents; in the case of Mr. Lockwood, not only had they expected it, but "they'd had it," and they were indeed sorry that he could not see his way to retain office for another year. It was a pleasure also to support the expression of thanks to Dr. Hunt and Mr. Cree for their good work on the Branch Council.

THE BRANCH PRESIDENT, in his response to the vote of thanks, which was carried with acclamation, said that never in any organisation to which he had belonged had he found such friendliness and support as he had enjoyed in the I.B.F. There must be something special about the industry which engendered that feeling of friendliness, and he expressed appreciation, on behalf of Dr. Hunt and Mr. Cree, as well as himself. He also took the opportunity to express his personal thanks to Mr. Faulkner, who was a tower of strength to the Institute, and who had given him every possible support throughout his year of office.

Presentation of Diplomas

The Institute's Diploma, for Papers of special merit, was presented by the Branch President to the following members:—

MR. W. GLADWELL, for a Paper on the practical application of X-rays to foundry work. (Presented to the London and East Midlands Branches, the East Anglian Section, and to the A.F.A. in New York).

MR. H. G. WARRINGTON, for a Paper on "Indicating the steps to be taken to ensure quality in light alloy castings."

The exchange Paper, from the Metropolitan Chapter, A.F.A., "Controlling the Production of Magnesium Castings," by Mr. Dean Leach (Foundry Control Metallurgist, Sperry Gyroscope Company), was presented on behalf of the author by Mr. Ian Ross. It was printed in our issue of April 27 last.

CAUSES OF LOST TIME

A pamphlet, "Industrial Health and Efficiency," prepared by the Industrial Health Research Board, gives the results of an analysis of records from 60 factories called for in an attempt to discover the chief causes of absence from work. It is shown that lost time among men usually varies from 5 to 10 per cent. of possible working hours. Women often lose 8 to 20 per cent. Married women may lose three times as much time as single women. Absence increases if hours exceed 60 for men and 55 for women. Factories with a week-end break of at least 1½ days have less absence than those with a six- or seven-day week. New factories situated a long way from the homes of the workers show an absence rate twice as high as that of some smaller, old-established works near the workers' homes. It is suggested that attention be directed to problems of fatigue, boredom, hours of work, rest pauses and breaks, and women with home responsibilities.

ALL WELDING MACHINES NOW SUBJECT TO LICENSING

The Minister of Supply has issued a new Direction (No. 4) on the subject of welding machines. It relates to the Control of Machine Tools (No. 13) Order, and makes it necessary for purchase certificates to be obtained for single-operator a.c. arc-welding machines up to and including 250 amps. continuous hand-welding capacity, which have previously been excluded from licensing by virtue of the No. 1 Direction. This new arrangement, by which all welding machines, irrespective of capacity or value, are subject to licensing, has been introduced to ensure that, by the proper allocation of welding machines of suitable type and capacity, welding labour is employed to best advantage. The procedure for applying for purchase certificates for all types of welding machines will remain unaltered.

BRITISH NON-FERROUS SMELTERS' ASSOCIATION

The formation of an association comprising the British smelters of the primary ores of aluminium, antimony, magnesium, tin, zinc, and the precious metals is announced. The object of the association is: "The consideration and furtherance of the common interests in the maintenance and development of the non-ferrous smelting industry in Britain."

The following companies are members of the association:—The British Aluminium Company, Limited; British Tin Smelting Company; Capper Pass & Son, Limited; Consolidated Tin Smelters, Limited; Goodlass Wall & Lead Industries, Limited; Imperial Smelting Corporation, Limited; Johnson, Matthey & Company; Magnesium Elektron, Limited; and the South Wales Aluminium Company.

NEWS IN BRIEF

The Companies Registration Office gives notice that the names of the undermentioned companies have been struck off the register, and such companies are dissolved:— Art Metal Equipment Company, Limited; Birmingham Foundries, Limited; Tindall Drill & Engineering Company, Limited; Tow Law Ganister & Coal Company, Limited.

The Association of Engineering Distributors have formed a Midland and North Midland Area Committee, of which Mr. W. P. Lister, of Wolverhampton, has been elected chairman. A meeting of engineering distributors in the area (open to members and non-members) will be held at 2.30 p.m. to-day (Thursday), at the Imperial Hotel, Birmingham.

Metal Industries Salvage, Limited, has been registered in Scotland as a private company with a capital of £10,000 to carry on the business of marine surveyors, salvage and towage contractors. The board comprises directors of Metal Industries, Limited, along with Mr. Thomas McKenzie, of Lyness, Orkney. The offices are at 145, St. Vincent Street, Glasgow.

A joint meeting of the Chemical Engineering Group (Society of Chemical Industry) and the Institution of Chemical Engineers will be held on Tuesday, May 23, at 2.30 p.m., in the rooms of the Geological Society, Burlington House, Piccadilly, London, W.1, when a Paper on "Improvements in Acid Resisting Silicon Iron Alloys" will be presented by Dr. J. E. Hurst. An informal luncheon, limited to 40 places, will be held at 12.45 p.m. for 1 p.m., at Stewart's Restaurant (corner of Piccadilly and Old Bond Street). Those taking luncheon must notify their intention not later than May 22.

More than 12 per cent. of the Scottish membership of the Iron and Steel Trades' Confederation has been switched to jobs outside the trade in the last six months. The question, "Who should determine redundancy?" was discussed at the annual Scottish conference in Glasgow recently. In a statement afterwards, Mr. Lincoln Evans, national assistant general secretary, said: "It is not a right that can be left in the hands of the employers. We lay it down as fundamental that there should be consultation between workers and employers in determining workers who are to be declared redundant."

A Regional Machinery Repair Organisation has recently been formed to assist machinery dealers and users by offering an inspection and repair service in all parts of the country. It has members in all important districts, who are prepared to act for machinery users and dealers in other districts to avoid expense and delay in travelling or the cost incurred in moving plant to their own works for repairs or alterations. Each member is in a position to carry out repairs and installation work or to arrange for the work to be done at the most convenient point, and, if required, he will see the job right through to the customer's satisfaction. The central office of the R.M.R.O. has been established at 55/57, Banner Street, London, E.C.1.

PERSONAL

Mr. James D. Wolff has been elected chairman of the London Metal Exchange Committee and Mr. Frank Baer re-elected as vice-chairman.

Mr. Gilbert Harvey, managing director of Platt Malleable Castings, Limited, has been elected president of the Walsall Chamber of Commerce for the ensuing year.

Mr. Cecil Kimber has resumed his duties as a director of Specialloid, Limited, of North Finchley, after an illness which had kept him away from business since last August.

Mr. A. T. S. Zealley, joint managing director of Imperial Chemical Industries, Limited, Billingham-on-Tees, has been elected president of the Teesside Chamber of Commerce.

Mr. Frederick Franks has been appointed a director of George Robson & Company (Conveyors), Limited, Sheffield, manufacturers of elevating and conveying machinery, electric grinders, etc.

Mr. F. J. Shotton, managing director, has been appointed chairman of Albion Drop Forgings, Limited, in succession to the late Mr. J. T. Brockhouse. He will continue to act as managing director.

Mr. George Pate, manager of the Carron Company, is retiring. His successor is Mr. A. C. Bernard, at present assistant manager. Mr. Pate completed 50 years' service with the Carron Company in December, 1943.

Sir George Nelson was elected president for a second year of office at the annual meeting of the Federation of British Industries on April 27. He is chairman and managing directer of the English Electric Company, Limited.

Mr. E. B. Burton has been appointed chairman of J. Brockhouse & Company, Limited, in succession to the late Mr. J. T. Brockhouse. Mr. J. L. Brockhouse has been appointed managing director, and Mr. E. P. Ash a director of the company. Mr. Ash will continue to act as secretary.

Wills

Smith, Luther, of Halifax, brassfounder	£8,544
Micklethwait, G. H., of Rotherham, ironfounder...	£59,632
Batchelor, Col. C., of Dundee, iron, steel and metal merchant	£35,871
Russell, F. S., of Cheltenham, formerly chairman of General Refractories, Limited	£36,873
Rigby, Albert, of Bradford, a director of John Rigby & Sons, Limited, wire manufacturers	£76,850
Pilliner, F. A. A., of Highgate, late of the South Wales Tinplate Corporation, Limited	£38,971
Wills, H. A., of Sheffield, director of Thomas A. Ashton, Limited, engineers and founders	£1,432
Blatherwick, Harry, of Sheffield, senior director of the Kiveton Park Steel & Wire Works, Limited...	£7,500
Binns, J., of Bradford, managing director of Binns & Speight, Limited, engineers and boiler-makers	£36,902
Jones, J. J. A., of the Central Research Department of the United Steel Companies, Limited, Sheffield	£7,869
Reid, J. G., of Rotherham, formerly works manager of W. N. Baines & Company, Limited, brass-founders	£1,187
Drake, G. H., of Sheffield, general works superintendent of Davy & United Engineering Company, Limited	£6,747

COMPANY RESULTS

(Figures for previous year in brackets)

British Lead Mills—Interim dividend of 10%.

Broom & Wade—Interim dividend of 7½% (same).

Robey & Company—Dividend of 7½% on the ordinary shares for 1943 (5%).

Humphreys—Net profit to November 30, £58,169 (£41,384); dividend of 10% (same).

Peglers—Net profit for the year to March 31, after providing for E.P.T., £94,394 (£106,640); dividend of 23⅓% (same) on the "A" and "B" ordinary shares.

Glenfield & Kennedy—Net profit to March 31 last, £60,871 (£63,149); final dividend of 5% on the ordinary capital and a bonus of 10%, making 20% (same).

Laurence Scott & Electromotors—Net profit for 1943, £109,504 (£108,202); dividend on the "A" and "B" ordinary shares of 12½%; forward, £5,483 (£4,957).

William Beardmore—Net profit for 1943, £189,668 (£183,709); ordinary dividend of 10% (same), £47,500 net; 5½% preference dividend, £26,125; to war contingencies, £100,000 (same); forward, £250,542 (£234,499).

Engineers & Ironfounders—Profit for 1943, £5,206; dividend, gross, on the 7% cumulative preference shares, £1,805; dividend of 10% on the ordinary shares, plus a bonus of 1s. a share; to general reserve, £1,000; forward, £7,450 (£6,983).

Mellor Bromley—Profit for the year ended February 29, after charging taxation, £22,072 (£13,417); preference dividend of 5½%, less tax, £3,575; dividend on the ordinary shares of 10% (same); reserve, £5,000; forward, £43,683 (£37,686).

Warne, Wright & Rowland—Profit for 1943, including income from investments, after charging all expenses and providing for depreciation and taxation, £18,203 (£15,466); final dividend on the ordinary shares of 15%, plus a bonus of 5%, making 25%.

British Rollmakers Corporation—Trading profit for 1943, after E.P.T., £114,155; income from interest and dividends, £3,579; income-tax, £48,901; depreciation, £29,430; net profit, £33,739; ordinary dividend of 15%, £16,533 net; 5½% preference dividend, £2,058; forward, £15,148.

Victaulic Company—Net profit for 1943, £24,845 (£15,975); to special depreciation, £5,000 (same); to contingencies, £8,000 (nil); final dividend of 3%, making 6%, less tax, and a bonus of 9d. per share, making 1s. 6d., tax free (same); forward, £10,850 (£10,255).

Johnson & Phillips—Net profit for 1943, after tax, depreciation, debenture interest, pensions and fees, £139,873 (£111,454); dividend of 15% (same); to special contingencies reserve, £30,000; to research and development account, £15,000; forward, £116,242 (£81,369).

William Dixon—Net profit for the year to February 29 last, after providing for depreciation and taxation, amounts to £34,359 (£30,604); dividend on the 5% cumulative preference stock, less tax, £7,500; dividend of 7½% (7%) on the ordinary stock; forward, £33,263 (£31,004).

Boulton & Paul—Net profit for the year ended September 30, 1943, after providing depreciation, £123,861 (£94,771); taxation, £90,000; preference dividends, £6,750; to special reserve account, £23,442; to general reserve account, £10,000; dividend of 7½% on the ordinary shares (5%); forward, £21,212 (£16,110).

Steel Barrel Scammells & Associated Engineers—Net income for the year ended June 30, £44,253 (£50,911); dividend on the 5½% preference shares, £3,437 (same); interim dividend of 6% on the ordinary shares, £4,125 (same); E.P.T., £16,500 (£22,500); depreciation, £3,500 (same); general development, £2,000 (same); general reserve, £5,000 (same); second interim on the ordinary shares of 9% (same), together with a bonus of 5% (same), £9,625; forward, £9,625 (£9,559).

British Oxygen Company—Profit for 1943, including dividends from subsidiary, allied and other companies, and after providing for depreciation and E.P.T., £932,165 (£943,465); pensions, £46,804 (£42,586); income-tax, £498,234 (£536,080); net profit, £384,527 (£362,199); 6½% preference dividend, £16,792 (£17,062); 5% second preference dividend, £25,833 (£26,250); ordinary dividend of 15% (same); to general reserve, £100,000 (nil); forward, £87,471 (£113,804).

OBITUARY

Mr. H. W. Kefford, manager of the Sheffield branch of the English Electric Company, Limited, died recently. He was in his 61st year.

Mr. S. C. Harrison, director of Harrison (Birmingham), Limited, brass founders, died recently at Worcester. He was 66 years of age.

Mr. D. J. Barr, managing director of the Coltness Iron Company, Limited, Scottish Non-Ferrous Tube Industries, Limited, and other companies, died suddenly at his home at Giffnock, on April 30.

Sir Christopher Thomas Needham died at his home at Manchester on April 29, at the age of 77. He was chairman of John Needham & Sons (Manchester), Limited, iron, steel and metal merchants, and the National Boiler and General Insurance Company, Limited, and a director of the London & North-Eastern Railway Company. From 1910 to 1918 he was Liberal M.P. for South-West Manchester.

Dr. J. K. Roberts, F.R.S., Fellow of Christ's College, Cambridge, died in London recently, at the age of 47. Born and educated in Australia, he became demonstrator in physics at Trinity College, and during the war was engaged in secret work of the highest importance. By his death scientific research has suffered a severe loss. He will be best remembered by his researches on the surface absorption of gases.

Mr. John Thomas Brockhouse died suddenly in London recently, aged 66. He was chairman and managing director of J. Brockhouse & Company, Limited, and chairman of Albion Drop Forgings Company, Limited. The fourth of the six sons of Mr. John Brockhouse, of West Bromwich, he adopted banking as a career. He was unexpectedly called on to enter the family business when his father was 72, and he joined the company as director and secretary, becoming managing director when his father died in 1922.


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ROTARY FURNACE LININGS
CUPOLA BRICKS

Raw Material Markets

IRON AND STEEL

The proportion of high-grade imported ores available for blast-furnace use is still strictly limited, but there is no shortage of native ironstone, substantial stocks of which have been accumulated. Deliveries of coke to the blast furnaces are also accorded special priority, and aggregate output of pig-iron conforms closely to the fixed standards. Conditions in the foundry trade have undergone no noticeable change during the past few weeks, reduced deliveries of No. 3 iron having made little difference in view of the relatively poor demand for light castings from the building trades. Substantial orders for special castings for a variety of war purposes are still in hand, and these ensure a fairly steady absorption of the output of low-phosphorus, refined and hematite iron. Foundries are not so well placed for coke as the blast furnaces, and many of them have been living from hand to mouth as regards fuel for some weeks past. However, delays en route appear to be less troublesome, and it is hoped that the position will continue to improve. Scrap is none too plentiful, but the Control will not permit additional pig-iron to be used, and the foundries must perforce make the best use they can of the quantities allotted to them.

Re-rolling mills are turning out large quantities of sheets, small bars, special sections, strip, etc., and have orders in hand which will ensure continuity of operations on an undiminished scale for months to come. Hitherto they have not been incommoded by any lack of re-rolling material, but this has only been due to the fact that the Control has been able to provide supplementary tonnages of imported billets. For some time past deliveries from home sources have been on a reduced scale, and it was becoming evident that special measures might ultimately have to be taken to restore deliveries of prime billets, blooms, slabs, etc., to their former proportions. There has been an easing of the position in the last week or so, however, owing to the despatch by the Control of substantial tonnages of billets ex-American stocks, and most of the re-rollers are now comfortably placed for semis once more.

Outstanding features of the finished steel industry are the phenomenal demand for plates and sheets. Mills engaged on this class of work have at least six months' orders in hand, and from a wide variety of sources there is unwavering pressure for deliveries. The call for sections is less insistent, although only orders for heavy sizes can be promptly covered. Builders of rolling stock, collieries, railway companies and the engineering trades provide steady support for the steel trade, and although the call for special steels is not quite so active, big tonnages are still taken up by the aircraft factories and others users.

NON-FERROUS METALS

Stocks of non-ferrous metals now held in this country appear to be quite satisfactory. The position is very different from that of a year or so ago. Reserves should be sufficient to overcome any supply difficulties that may arise in the future. Consumption of non-ferrous metals is still very heavy, but the current demand is considerably below the high levels reached last year. At the moment there are no indications of any substantial upward trend making itself felt while production remains at its present figure; if anything, the opposite is taking place, and it is not improbable that output will be further reduced. All requirements are being met without any sign of stress, and consumers are receiving the grades of metal specified with the minimum of delay. The arrangements made in this direction by the Control seem to be working very smoothly. No deliveries are being made to works other than those essential to the war effort, but at this stage this would appear to be the wisest policy.

Copper supplies are in hand on a good scale, although deliveries arriving in this country may soon be reduced. Tin has provided some difficult problems in the past, and the outlook of two years ago was certainly not encouraging. The quantities now being made available to industry may not be lavish, but most of the difficulties have been overcome and the position is reasonably satisfactory. All really essential needs are covered, and it is to be assumed that sufficient reserves are held to obviate fears of any definite shortage. In certain directions substitutes for tin have been employed, and developments have taken place in production.

Zinc can be considered to be in very easy supply. There is no difficulty in meeting the current demand from munition factories, and the Control are easing restrictions on its use for certain commercial purposes. The galvanising industry is more active than it has been for a long time, but the labour situation is believed to be one of the deciding factors in the release of zinc for civilian undertakings.

CURRENT PRICES OF IRON, STEEL AND NON-FERROUS METALS

(Delivered, unless otherwise stated)

Wednesday, May 10, 1944

PIG-IRON

Foundry Iron.—Cleveland No. 3: Middlesbrough, 128s.; Birmingham, 130s.; Falkirk, 128s.; Glasgow, 131s.; Manchester, 133s. Derbyshire No. 3: Birmingham, 130s.; Manchester, 133s.; Sheffield, 127s. 6d. Northants No. 3: Birmingham, 127s. 6d.; Manchester, 131s. 6d. Staffs No. 3: Birmingham, 130s.; Manchester, 133s. Lincolnshire No. 3: Sheffield, 127s. 6d.; Birmingham, 130s.

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

Hematite.—No. 1 (S & P 0.03 to 0.05 per cent.): Scotland, N.-E. Coast and West Coast of England, 138s. 6d.; Sheffield, 144s.; Birmingham, 150s.; Wales (Welsh iron), 134s. East Coast No. 3 at Birmingham, 149s.

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

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

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

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

Cold Blast.—South Staffs, 227s. 6d.

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

FERRO-ALLOYS

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

Ferro-silicon (5-ton lots).—25 per cent., £21 5s.; 45/50 per cent., £27 10s.; 75/80 per cent., £43. Briquettes, £30 per ton.

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

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

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

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

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

Ferro-chrome.—4/6 per cent. C, £59; max. 2 per cent. C, 1s. 6d. lb.; max. 1 per cent. C, 1s. 6½d. lb.; max. 0.5 per cent. C, 1s. 6¾d. lb.

Cobalt.—98/99 per cent., 8s. 9d. lb.

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

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

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

SEMI-FINISHED STEEL

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

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

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

FINISHED STEEL

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

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

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

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

NON-FERROUS METALS

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

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

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

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

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

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

Brass.—Solid-drawn tubes, 14d. per lb.; brazed tubes, 16d.; rods, drawn, 11⅜d.; rods, extruded or rolled, 9d.; sheets to 10 w.g., 10⅞d.; wire, 10⅝d.; rolled metal, 10¼d.; yellow metal rods, 9d.

Copper Tubes, etc.—Solid-drawn tubes, 15½d. per lb.; brazed tubes, 15½d.; wire, 10d.

Phosphor Bronze.—Strip, 14d. per lb.; sheets to 10 w.g., 15d.; wire, 16½d.; rods, 16½d.; tubes, 21½d.; castings, 20d., delivery 3 cwt. free. 10 per cent. phos. cop. £35 above B.S.; 15 per cent. phos. cop. £43 above B.S.; phosphor tin (5 per cent.) £40 above price of English ingots. (C. Clifford & Son, Limited.)

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

NON-FERROUS SCRAP

Controlled Maximum Prices.—Bright untinned copper wire, in crucible form or in hanks, £57 10s.; No. 1 copper wire, £57; No. 2 copper wire, £55 10s.; copper firebox plates, cut up, £57 10s.; clean untinned copper, cut up, £56 10s.; braziery copper, £53 10s.; Q.F. process and shell-case brass, 70/30 quality, free from primers, £49; clean fired 303 S.A. cartridge cases, £47; 70/30 turnings, clean and baled, £43; brass swarf, clean, free from iron and commercially dry, £34 10s.; new brass rod ends, 60/40 quality, £38 10s.; hot stampings and fuse metal, 60/40 quality, £38 10s.; Admiralty gunmetal, 88-10-2, containing not more than ½ per cent. lead or 3 per cent. zinc, or less than 9½ per cent. tin, £77, all per ton, ex works.

Returned Process Scrap.—(Issued by the N.F.M.C. as the basis of settlement for returned process scrap, week ended May 6, where buyer and seller have not mutually agreed a price; net, per ton, ex-sellers' works, suitably packed):—

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

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

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

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

IRON AND STEEL SCRAP

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

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

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

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

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

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

SITUATIONS

FOUNDRY FOREMAN or Assistant Foundry Manager; Foreman (age 33), at present engaged, would like a change; sound knowledge of modern moulding methods; experienced especially in steel castings for locomotive and general engineering work; M.I.B.F.; good references.—Box 480, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

METALLURGIST desires change; fully experienced manufacture of:—Meehanite, Ni-Tensyl, Ni-Resistant Acicular cast irons; alloy irons; high carbon and alloy steels by cupola converter process; centrifugal castings; sand control; physical testing; accustomed full control.—Write Box 476, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

FOUNDRY MANAGER required; preferably with experience in steel and bronze founding; degree or higher national certificate essential; age not over 35 years; managerial abilities and sound practical knowledge—condition; applicants to supply full particulars as regards education, positions occupied, and salary required, Box 458, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

STEEL FOUNDRY MANAGER; thoroughly capable of taking control, and with up-to-date experience of castings up to 5 tons; also mass production with power moulding machines; output 3,000 tons yearly; full particulars in confidence, and salary.—Box 478, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

FOUNDRY APPRENTICE INSTRUCTOR.—Unique prospects for a real Leader of Youth, with the necessary qualifications to pioneer up-to-date methods of Foundry Training in a new Training Centre. Applicants will be required to train, by actual demonstration, green and dry sand moulding, and coremaking, and be able to teach foundry calculations, elementary metallurgy and foundry practice.

Form of application can be obtained from the Personnel Officer, NEWTON CHAMBERS & CO., LTD., Thorncliffe, Sheffield.

PATENTS

IT is desired to secure the full commercial development in the United Kingdom of BRITISH PATENTS Nos. 408949 and 409310, which relate to Treatment of Silicon Steels, either by way of the grant of licences or otherwise, on terms acceptable to the Patentee.—Interested parties desiring copies of the patent specifications should appply to STEVENS, LANGNER, PARRY & ROLLINSON, 5 to 9, Quality Court, London, W.C.2.

IT is desired to secure the full commercial development in the United Kingdom of BRITISH PATENT No. 536470, which relates to Method and Apparatus for making Alloy Bodies, either by the grant of licences or otherwise, on terms acceptable to the patentee.—Interested parties desiring copies of the patent specification should apply to STEVENS, LANGNER, PARRY & ROLLINSON, 5 to 9, Quality Court, London, W.C.2.

IT is desired to secure the full commercial development in the United Kingdom of BRITISH PATENT No. 535343, which relates to Permanent Magnet Alloy and Method of making the same, either by way of the grant of licences or otherwise, on terms acceptable to the Patentee.—Interested parties desiring copies of the patent specification should apply to STEVENS, LANGNER, PARRY & ROLLINSON, 5 to 9, Quality Court, London, W.C.2.

IT is desired to secure the full commercial development in the United Kingdom of BRITISH PATENT No. 440194, which relates to Corrosion Resistant Alloy Steels and Articles made therefrom, either by way of the grant of licences or otherwise, on terms acceptable to the Patentee.—Interested parties desiring copies of the patent specifications should apply to STEVENS, LANGNER, PARRY & ROLLINSON, 5 to 9, Quality Court, London, W.C.2.

THE Proprietors of the Patent No. 445408, for Improvements in and relating to Flexible Power Transmitting Devices, are desirous of entering into arrangements by way of licence and otherwise, on reasonable terms, for the purpose of exploiting the same and ensuring its full development and practical working in this country.—All communications should be addressed, in the first instance, to HASELTINE, LAKE & COMPANY, 28, Southampton Buildings, Chancery Lane, London, W.C.2.

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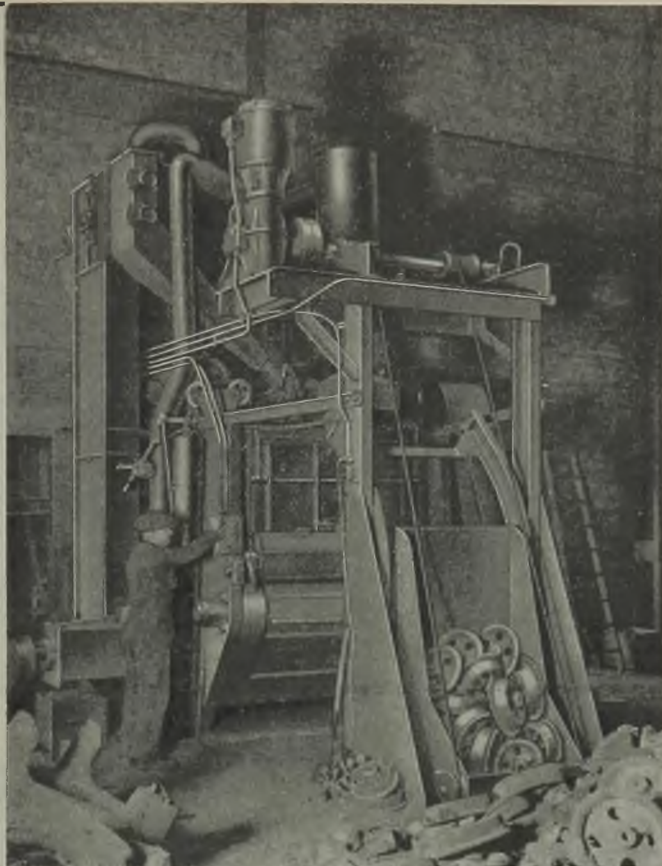

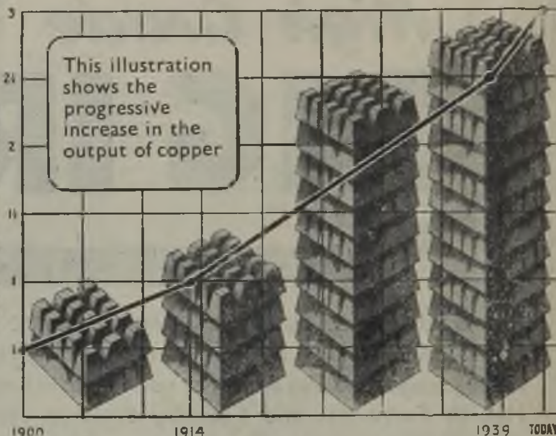

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