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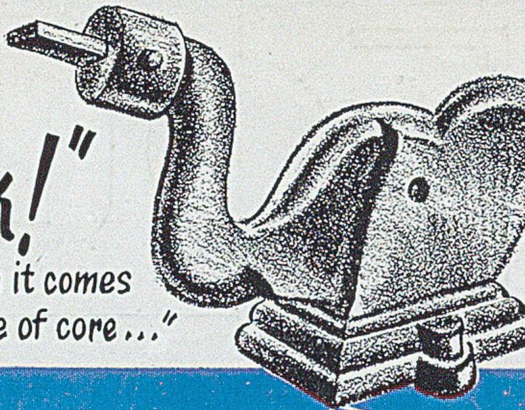

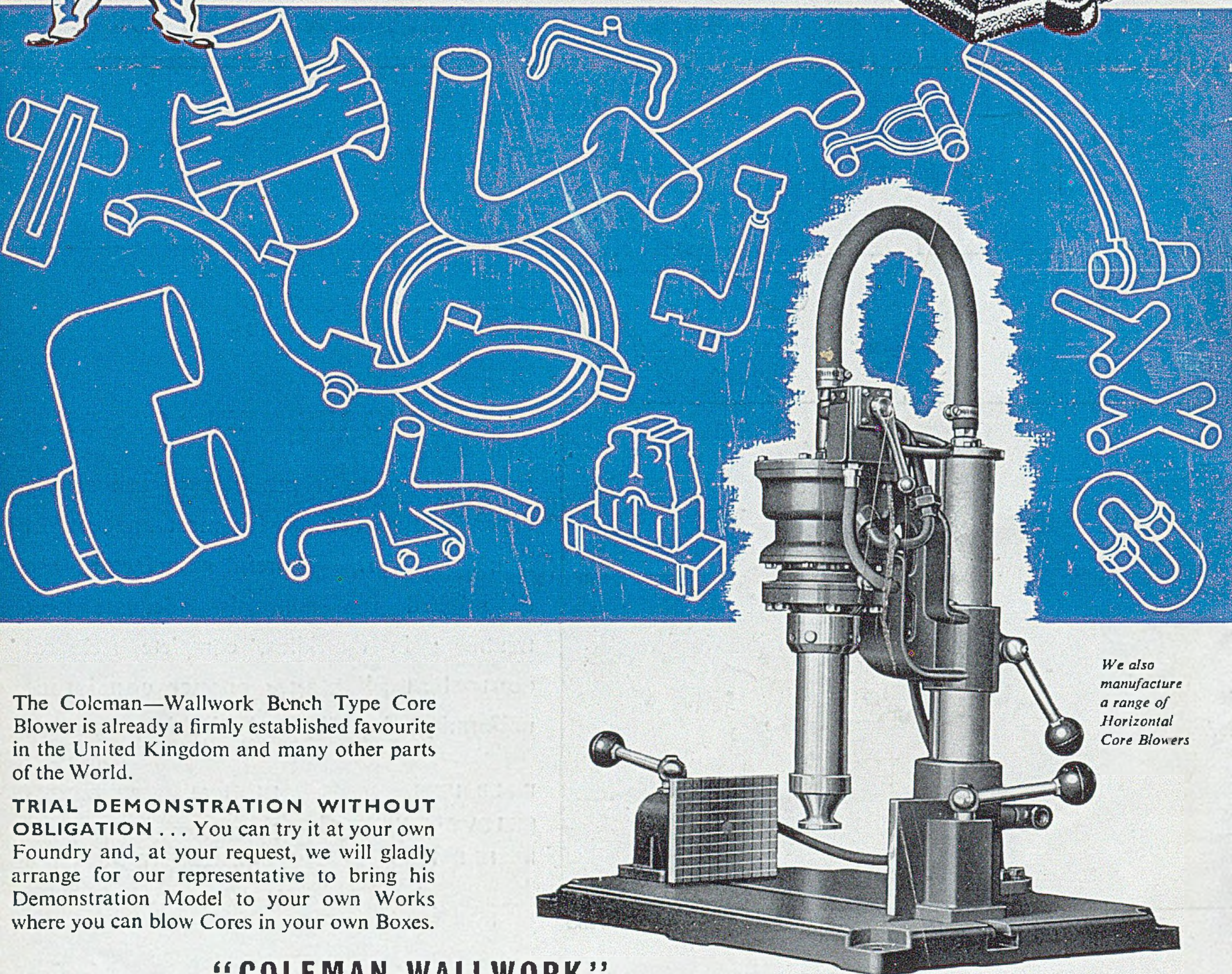

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Bench-type Core Blowing Machine

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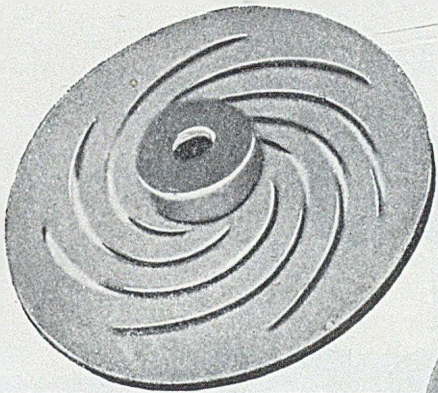
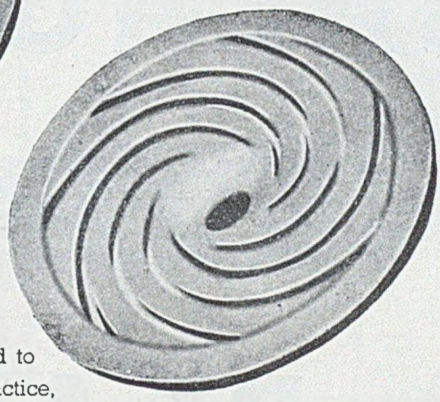


means service to foundries



THE NAME KORDEK is known throughout the foundry industry. Kordek and Kordol were the first cereal binders ever offered to the industry, and modern cereal-binder practice, with its many great advantages for most classes of foundry work, was built up around them.

Today, the makers of the Kordek and Kordol range are still pioneering the development of new uses for cereal binders. An example is the use of G.B. Kordek together with synthetic resins, to supply the green bond that the resins lack.

The binders in the Kordek and Kordol range have been widely imitated, but they are still, by a large margin, the most widely used of all cereal binders.

Naturally, foundrymen prefer to buy their cereal binders from the firm with the widest experience and the largest resources—the firm that performs and controls every manufacturing operation from the grain to the finished product. And the foundrymen are wise, for beside this reassuring background of experience, resources, and control, the Kordek and Kordol range is backed by a service of technical advice which no other manufacturer of cereal binders can equal.

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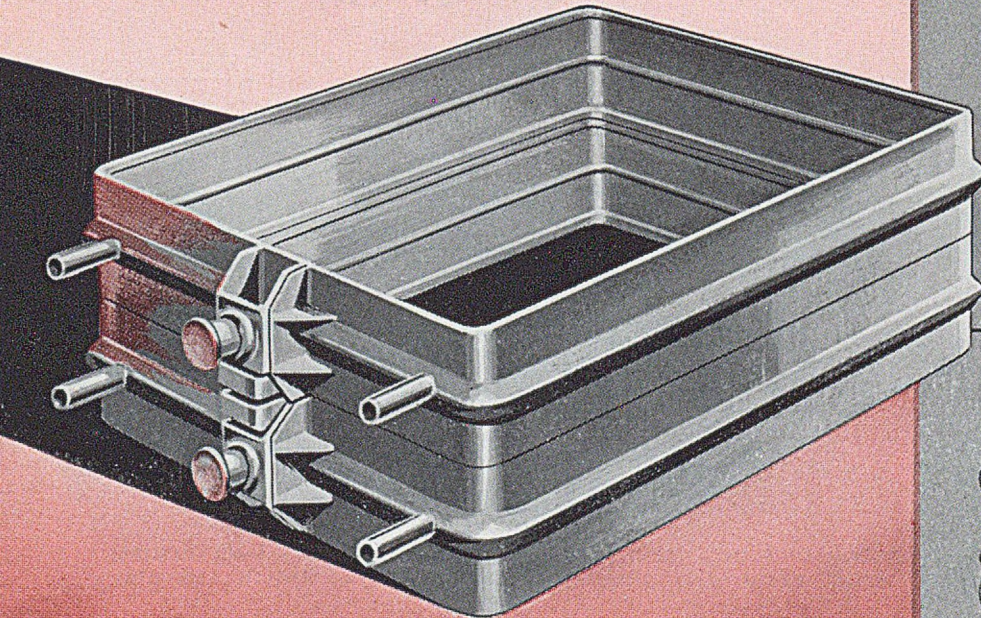

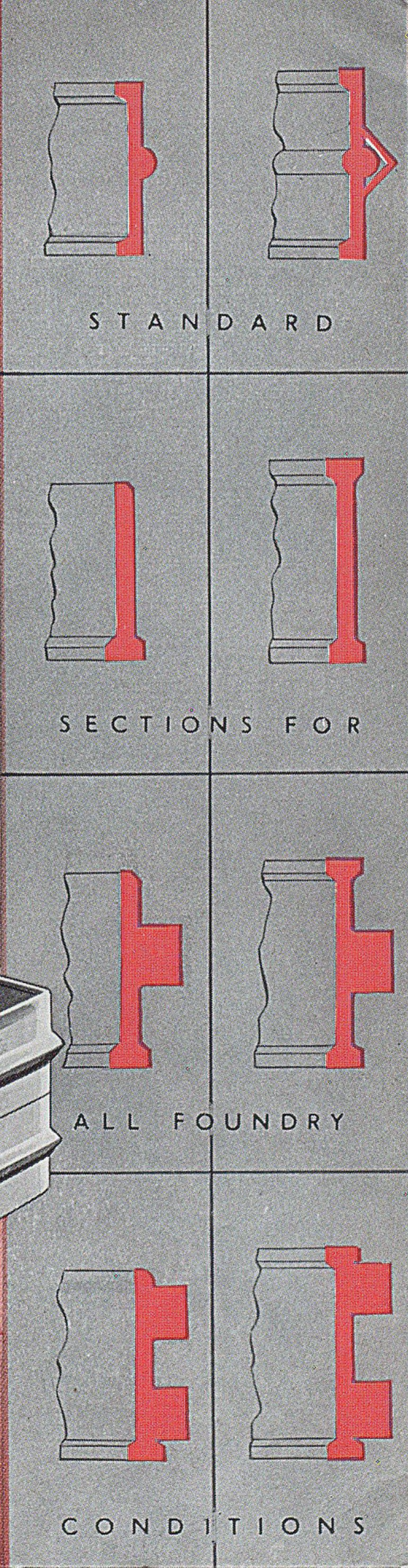

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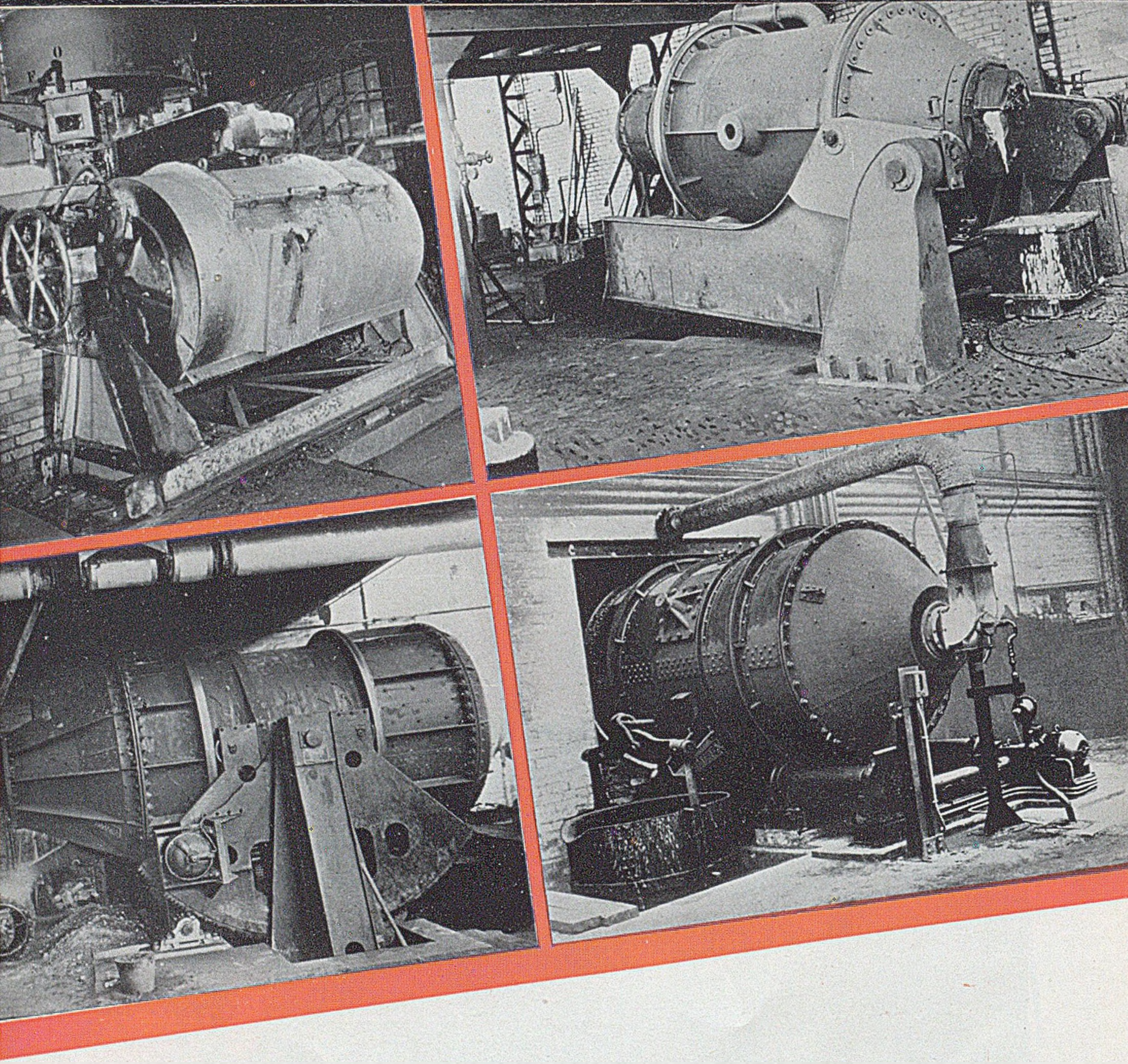

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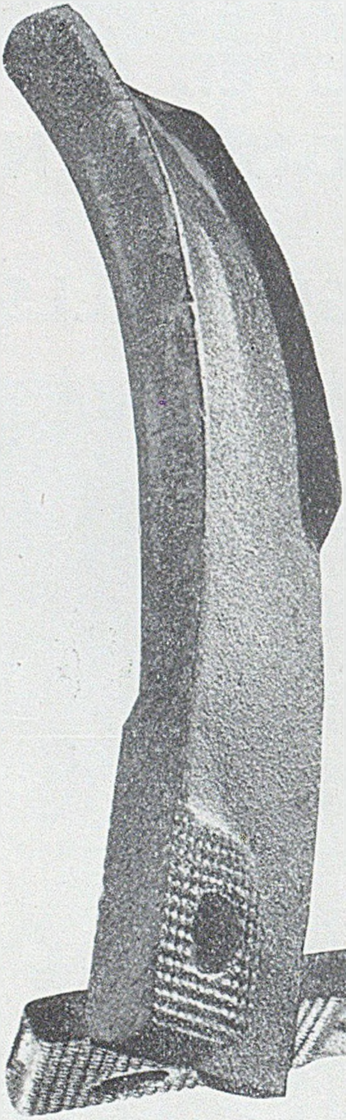
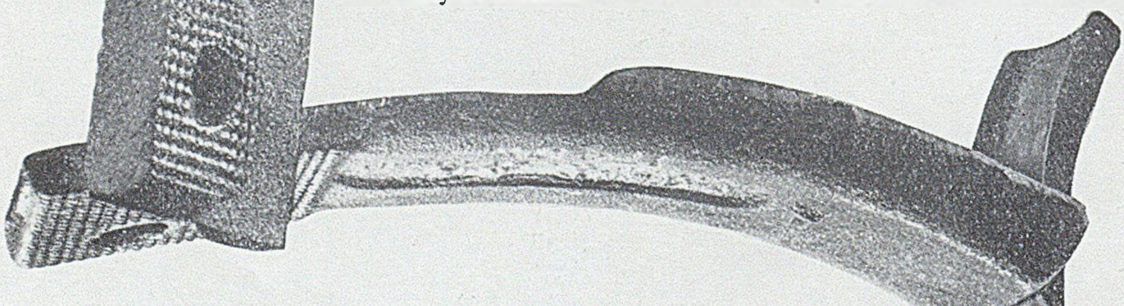
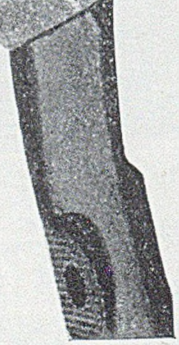


No shot in the dark
to use NI-HARD against abrasion

Ni-Hard, a high hardness, white or chilled nickel cast iron, is being used very successfully in plant handling all kinds of abrasives. It gave from four to ten times the life of plain white iron when used for delivery tubes and shot-impeller blades in an airless cleaning machine—comparative effects can be seen in the lower illustration. The composition of Ni-Hard can be adjusted to give the best combination of properties for the service required; for all this, it is less expensive than other special materials developed for similar service.

Our Development and Research Department will be pleased to advise on any application for which Ni-Hard may be suitable.





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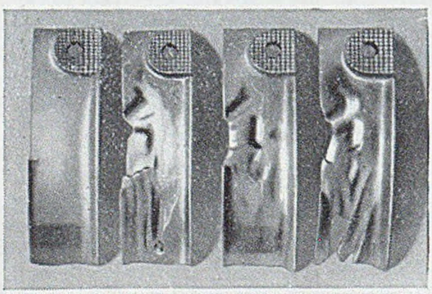

The shot impeller blades shown above were cast in Ni-Hard by Jonas Wells, Ltd., Keighley.

The illustration on the left shows shot impeller blades from airless cleaning machine after use. The blades have been in service as follows:

(1) Ni-Hard after 5½ hours.
(2) Ni-Hard after 81 hours.
(3) White iron after 5½ hours.
(4) White iron after 23 hours.

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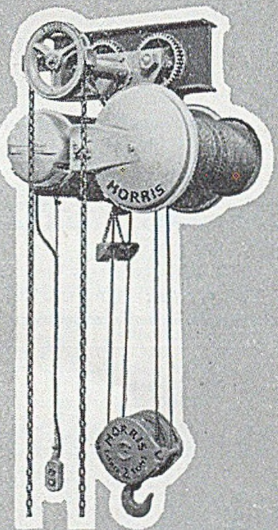

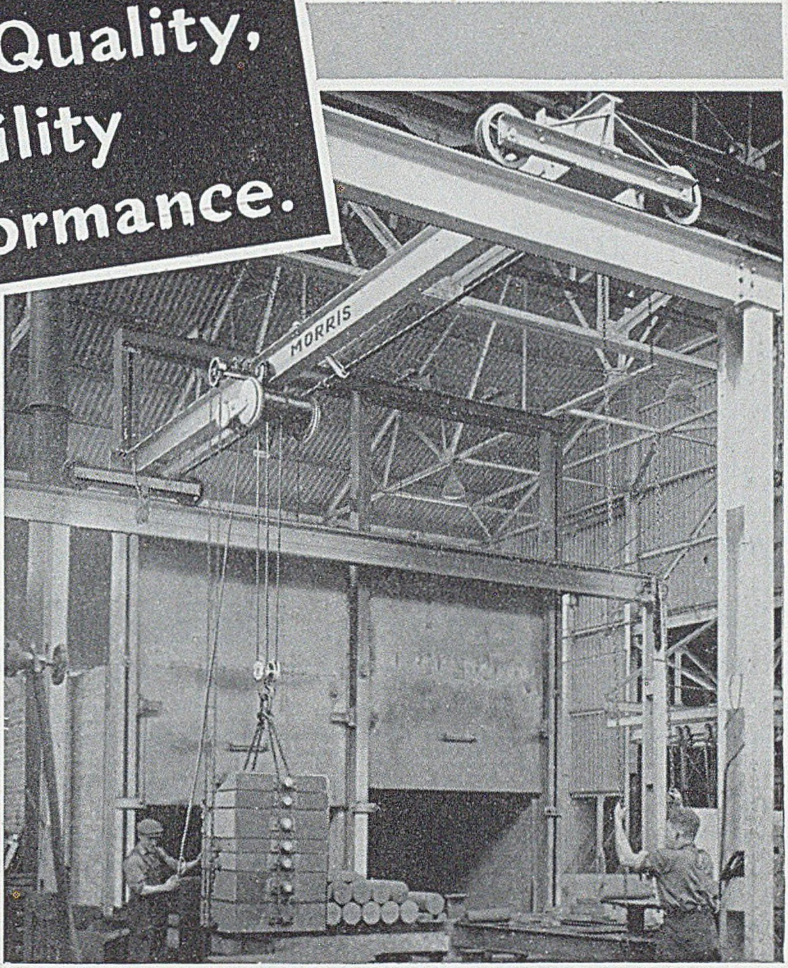

The new Morris electric hoist-block shown above is the lifting unit used on Morris single-girder electric cranes. Built around a welded steel frame, this hoist-block lifts fast, is quiet in operation, and has all its rotating parts driven from splined shafts mounted on high-grade ball-bearings—no keys are used.

The hoist is controlled by a push-button switch and a long-stroke electro-mechanical brake holds the load instantly and securely when the power is cut off.

Means for moving the hoist across the crane bridge is provided by a trolley operated by a hand-chain; a hand chain is also used to move the crane along the gantry.

MORRIS

SINGLE-GIRDER

ELECTRIC CRANES

These cranes are becoming increasingly popular with foundries wise enough to choose a crane of a type and at a price consistent with the *amount of lifting actually required.* For instance, the single-girder crane shown in our illustration is economical in operation and adequate for its work of lifting cores on and off oven trucks. For the more specialized departments of a foundry as well as for small extensions, such a crane is a sound investment.

Write for Book 236

HERBERT MORRIS LTD
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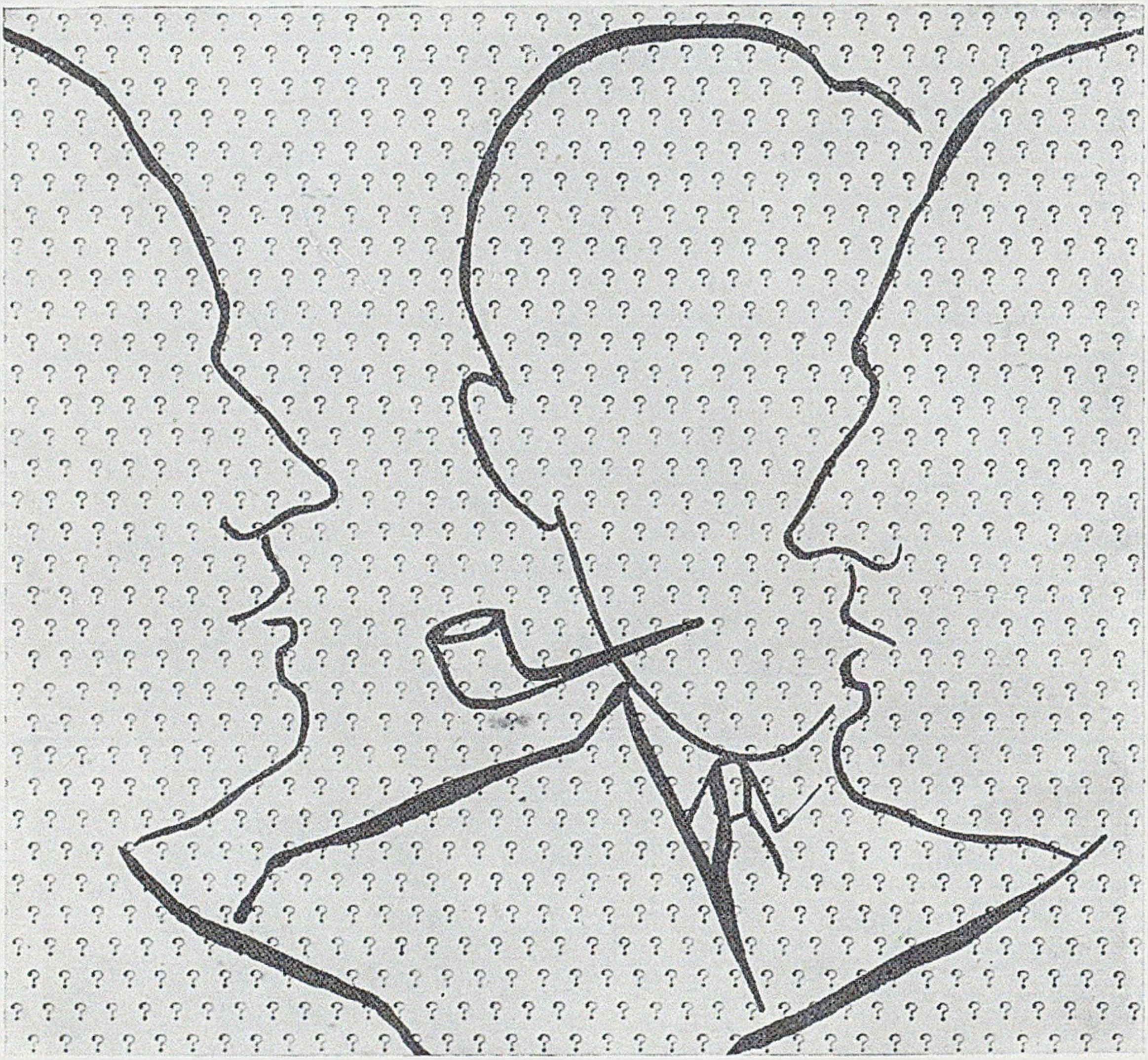

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WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

The FOUNDRY TRADE JOURNAL is the Official Organ of the following :—

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PRINCIPAL CONTENTS

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49 Wellington Street, London, W.C.2. 'Phone : Temple Bar 3951 (Private Branch Exchange) Grams : "Zacatecas, Rand, London"

Ironfounders' National Confederation

The Ironfounders' National Confederation, a "war baby" now thirteen years old, rightly felt the time had arrived when it could take an important place in the ambit of foundry employers' organizations, and decided to hold a convention, which duly took place at Scarborough earlier this month. The Confederation has been outstanding this last year in its fierce opposition to the Iron and Steel Bill, but it is still "playing ball" quite enthusiastically with the other associations and true harmony has been re-established. The only aftermath—and this has spread to other associations, also—is a revision of the constitution to facilitate closer co-operation.

The Confederation is headed by two Scots—Mr. Graham Bisset and Mr. Chisholm, plus an "elder statesman" in the person of Mr. Swift. Under this dynamic leadership, one can be quite sure that ironfounding will no longer be—what we once had occasion to call it—an inarticulate industry. At the recent Scarborough convention, strong views were expressed on the subject of the constantly rising costs of coal. Ironfounders are especially hard hit by increases in the cost of fuel, as two of their main raw materials—coke and pig-iron—immediately reflect any augmentation. Moreover, in common with other industries, they see larger totals at the bottom of their transport, electricity, and gas bills. As a result, they feel that they get the thick end of the stick.

As the activities of ironfounders vary so greatly, there is a much better chance of true co-operation than where competition is rife. Yet there is competition in the areas where a handful of concerns serve the same market. This can be potentially disastrous to the industry by forcing down prices below an economic level. It was just here where the worth of the convention was most marked, as opportunities were afforded to ironfounders from all over the country to become friendly and learn just how difficulties are overcome in other districts. We deem it a good policy to be as friendly with competitors as with customers, but in the foundry there are very many who are not in competition, and who willingly can and do help other founders to overcome their technical and commercial problems. This is where all conventions help, but in these days of a buyers' market, the number of such meetings must be limited to the obviously important ones. Amongst these we would certainly include the Scarborough convention, yet hope that it will not be emulated by kindred associations lest what has been a satisfying broth should be spoilt by a plethora of cooks.

Birmid Golden Jubilee

In the field of aluminium castings manufacture, the celebration of a golden jubilee must rank of equal importance to when an iron and brass foundry concern reaches its centenary, because the virgin metal has only been available in this country since 1894. Thus it is pleasing to be able to congratulate Birmingham Aluminium Casting (1903) Company, Limited, on the attainment of their fiftieth anniversary. There was, however, an earlier concern which for a time made bicycle-frame joints by casting aluminium around the tubes. Some time before 1900, this earlier concern were making automobile castings for the Clement-Talbot concern and by 1901 they were well established as makers of castings for motor cars.

In 1912, the company took up the making of die-castings, and furnished the Aluminum Company of America with samples and drawings. Later on, Mr. Owen, the managing director, called on the head of a leading British motor-car maker, who had previously turned down the idea of a die-cast piston, and produced the American copy with a demand as to why British industry could not produce such a component! With the coming of the 1914 war, the nature of the output changed. Volunteer labour was sought for Sunday work and amongst the helpers were Sir Barry Jackson and Mr. John Drinkwater from the Birmingham Repertory Theatre. In 1919, the company joined forces with the Midland Motor Cylinder Company, Limited, to form the Birmid Industries Group, which, in 1929, was enlarged by a similar arrangement with Sterling Metals, Limited. The group was now in a position to add to the list of its manufactures that of magnesium castings. From that time onward there has been a continuous expansion into numerous fields, one of the most outstanding being that of marine engineering. Whilst the building-up of this great concern has obviously been team work, there has been great leadership and the work of the Maudsleys, Owen, Frank Gower, Percy Pritchard, Edward Player, and J. W. Berry has done much not only to enrich foundry technology but to place the British light-alloy industry amongst the foremost in the world.

Dinner

BIRMINGHAM ALUMINIUM CASTING (1903) COMPANY, LIMITED

As part of the golden jubilee celebrations of this company, a dinner was held at the Grand Hotel, Birmingham, on May 5; Lord Burghley, K.C.M.G., presided. Toasts and responses were given by Mr. J. J. Gracie, C.B.E.; *Air-Commodore W. Helmore*, C.B.E.; Mr. E. Player; Mr. J. W. Berry; Mr. S. F. Barman, M.B.E., and Mr. W. C. Puckey. Amongst those present were Mr. W. A. Baker; Major C. J. P. Ball; Mr. J. Bamford, Brigadier J. A. Barrclough; Mr. E. Carey Hill; Dr. C. J. Dadswell; Mr. R. V. Dowle; Mr. V. C. Faulkner; Mr. R. C. Gregory, Mr. R. Hahn, Mr. E. W. Hancock; Mr. A. L. Heathcote; Mr. J. L. Hepworth; Mr. F. A. Hurst; Dr. J. Jakobi; Mr. F. W. Livermore; Professor A. Murphy; Mr. A. E. Pearce; Mr. J. J. Sheehan; Dr. I. G. Slater; Mr. G. P. Tinker; Dr. E. Weiss; Dr. E. G. West; Mr. G. A. Woodruff; Mr. F. G. Woollard and Dr. R. Wright.

At the conclusion of the dinner, Lord Burghley placed a number of documents, typical products, and the like in a strong box to be opened in fifty years time.

Industrial Engine Prices Cut

Mr. Butler's Budget has inspired Blackstone & Company, the Stamford horizontal and vertical engine makers, to give a lead to industry by making an immediate reduction in their prices. Averaging 25 per cent. and covering the entire range of the company's industrial engines, the cut follows one of 4½ per cent. made in January. This is one of the biggest reductions made in the industrial field. Reductions in the prices of vertical engines vary from £550 to nearly as much as £2,000. The company, of which R. A. Lister & Company, Limited, Dursley (Glos), holds a controlling interest, exports nearly the whole of its output.

Commenting on the cuts, Mr. Robert Lister, a director of Blackstone's said: "We feel that in doing this we are setting an example to the rest of the engineering industry, whether it can afford it or not." Mr. Lister believes that firms should follow the Chancellor's footsteps in "the right direction" by bringing a halt to the inflation of prices and stimulating not only home trade but exports.

Training for Safety and Health

Lord Llewellin is to give the presidential address at the conference on "Training for Safety and Health in Industry," which the Birmingham and District Industry Safety Group (helped by the Royal Society for the Prevention of Accidents) is organizing at Bingley Hall, Birmingham, from June 19 to 21, together with an exhibition of safety equipment. Other prominent speakers include Sir Charles Bartlett, managing director, Vauxhall Motors, Limited, who will take "The Management" for his subject; Sir George Barnett, H.M. Chief Inspector of Factories, with "The Shop Floor"; Mr. S. G. Broom, personnel manager, Sir W. G. Armstrong Whitworth Aircraft, Limited, on "The Supervisor"; and Mr. F. H. Tyrer, Medical Officer, West Midlands Gas Board, on "Industrial Health." Acting as chairmen will be Mr. A. B. Waring, chairman, Joseph Lucas, Limited; Mr. W. G. Tucker, president of the Birmingham Metallurgical Society; and Mr. W. C. Gissane, clinical director of the Birmingham Accident Hospital.

Pig-iron Merchants' Association. At the annual general meeting of the Pig-iron Merchants' Association, held in Birmingham, the following officers were re-elected:—*As chairman*, Mr. F. Arnold Wilson; *as vice-chairman*, Mr. A. Carr; *as hon. treasurer*, Mr. C. A. Parson; and *as hon. secretary*, Mr. S. Owen. Parson & Crosland, Limited, and Hubert Whitfield & Company were re-elected members of committee.

B. & F. Golf Competition. The annual golf competition for the McKenna Trophy organized by Bradley and Foster, Darlaston, Staffs, was played off at the Whittington Golf Course, Lichfield, on Friday last, when Mr. Leslie Bramhall of Church and Bramhall, Darlaston, was acclaimed the winner with a net score of 71. Mr. P. Squire of the Bloxwich Lock and Cartgear Company, Walsall, was second with 72 and Mr. H. Neilson of Richard Thomas & Baldwins, Limited, third with 74. The same evening, Dr. J. E. Hurst, J.P., managing director, presented the trophy to Mr. Bramhall at a dinner held at the George Hotel, Lichfield, which was attended by over 50 competitors and other friends of the company. Many prominent foundrymen were present.

Crystallization of Nodular-graphite Cast Iron

*By A. Wittmoser**

Three earlier hypotheses developed to explain the mode of occurrence of nodular graphite in cast iron are enunciated and discussed. The first is discarded and the second and third are combined and reviewed along with fresh experimental evidence. The rôle of silicon in the graphitization phenomena is also explored. It is concluded that, in the cases cited, the form of the cooling curve for the iron is a major clue—not to the effect of an added element, but to a fundamental change in the mode of crystallization.

Since the development of nodular graphite production in cast iron, investigators have made numerous approaches to the question of the method of formation of this type of graphite, and it has already been shown[1] that the hypotheses may be divided into three categories:

1. Indirect growth of the nodules as a result of cementite breakdown.
2. Direct crystallization of graphite nodules from the melt.
3. Indirect deposition from the supersaturated solid solution.

The first observations regarding the rules governing the production of cast iron with nodular graphite appear to lead one to suspect that its formation is a result of cementite breakdown[2]. In this hypothesis, it appears that the supercooled graphite — sometimes called "quasi-flake" — the presence of which as a result of cementite decomposition is generally accepted, represents a preliminary step in the formation of nodular graphite. There is then a strong tendency for cast iron with nodular graphite to crystallize out of this unstable system. This theory is supported by the fact that graphite nuclei can be obtained by heating for a short time a white cast iron which has been treated with agents that form nodular graphite. These nuclei are undoubtedly formed by cementite decay[3].

Substantiation Required

This directly proves that nodular-graphite growth from cementite breakdown is definitely possible. The next step is to try to obtain this mechanism of growth in grey cast irons, treated with magnesium. The Spanish investigators Alvargonzalez[4] and Corral[5] have recently produced evidence that in "mottled" cast iron treated with magnesium, a number of graphite spheres were deposited directly on the cementite, and partly enclosed by it. In this way, they seem to have succeeded in isolating nodular graphite in a preliminary stage of its growth. Fig. 1, taken from investigations at

* Paper presented to the *Société Française de Metallurgie*. The Author is superintendent of research at Gelsenkirchen Iron Works (Germany).

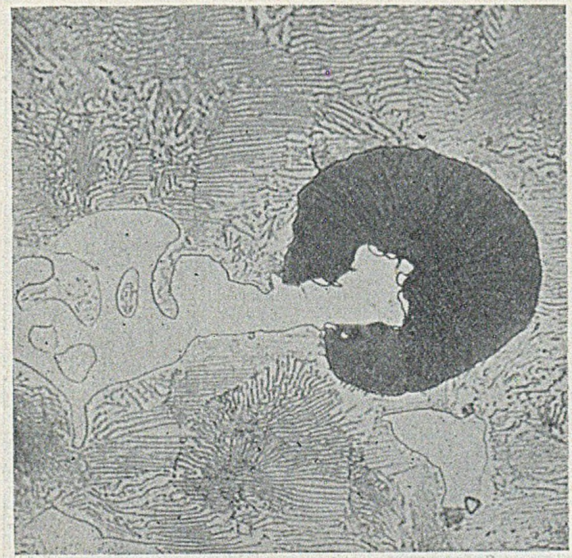

FIG. 1(*a*).—*Cementite Plate partly enclosed by a Graphite Nodule* (× 1,500, *etched*).

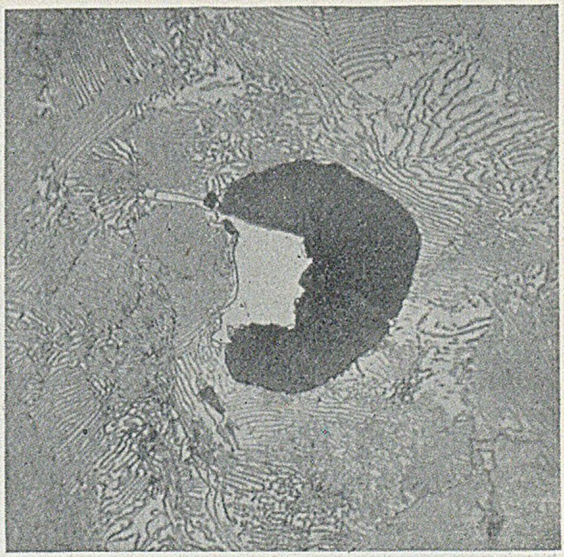

FIG. 1(*b*).—*Another Part of the Same Surface with differently cut Cementite Area* (× 500, *etched*).

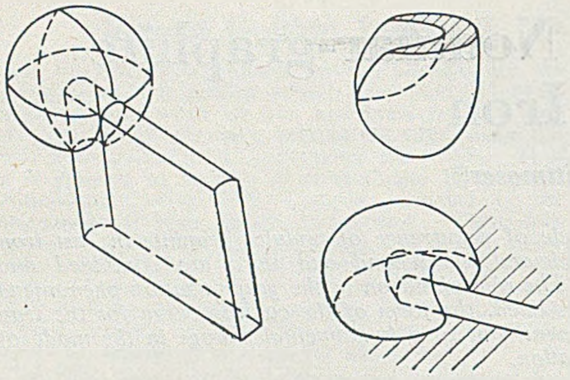

FIG. 2.—*Structure according to Corral (left) and Alvargonzalez (right) of the Interrelation between Graphite and Cementite in Grey Iron. (The Spherical Shapes represent Graphite and the Elongated Shapes the Cementite.)*

Gelsenkirchen, shows a structure similar to that found by the Spanish investigators. The plates of cementite penetrating to the centre of the graphite sphere can be recognized easily. Fig. 2 shows a similar growth: Alvargonzalez and Corral were able to demonstrate this by removing the top surface layer by layer and observing the change of texture revealed, until a clear picture was obtained of the graphite nodules and the surrounding cementite.

They considered these results to be further proof of the formation of graphite nuclei as a result of cementite breakdown. The Author believes, however, that even where these formations of nodular graphite are found (see Fig. 1) this interpretation does not stand close scrutiny. Fig. 3 shows a different place on the same surface, and one can see a graphite nodule disposed between two plates of cementite. The second picture, Fig. 3 (*b*), shows the same region viewed at a higher magnification in partly polarized light, and it is now clear that a darker region exists in the central portion of the nucleus, elongated between the two masses of cementite: the irregular appearance of this part distinguishes it from the rest of the unmodified nodule. This observation and others lead the present writer to the conclusion that nodular graphite originates in these regions, at or slightly below the range of temperatures at which cementite crystallizes, but that it crystallizes entirely separately and, during growth, touches cementite that has recently crystallized and partly surrounds it. The graphite originating from cementite decomposition can be clearly distinguished from nodular graphite in Fig. 3 (*a*). In the case of grey iron, this illustration and other evidence cannot be considered to support the idea that nodular graphite exists as a result of cementite decay.

Direct Crystallization from Melt

Undoubtedly, most workers nowadays accept the hypothesis of direct crystallization of nodular graphite from the melt. However, critical examination shows that some investigators do not explain the growth mechanism, but hold the opinion that nodular and lamellar graphite both grow in the same way directly from the melt.[6-11] The relative possibilities of the direct or indirect origin are not discussed, but it is assumed that the separation of two kinds of graphite can be traced to change of physical properties, *e.g.*, surface tension of the melt, as a result of treatment with graphite-forming substances.

The majority of the investigators hold the opinion that the growth of graphite nodules results from the presence of suitable materials in the residue after primary crystallization of dendrites of austenite. The resulting high concentrations of carbon should

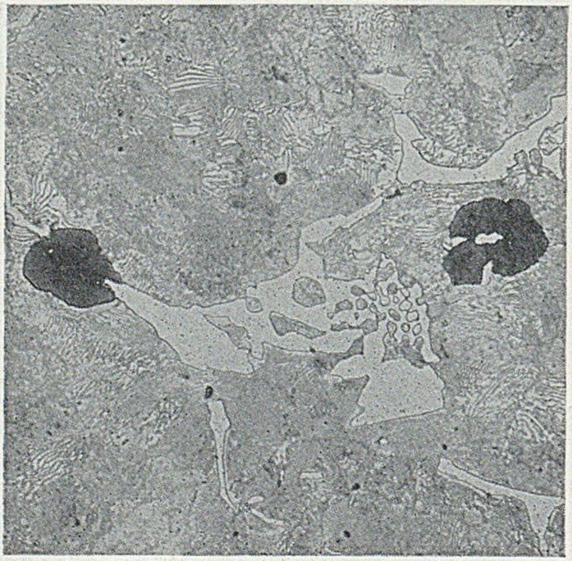

FIG. 3(*a*).—*Graphite Nodule between Two Areas of Cementite* (×500, *etched*).

FIG. 3(*b*).—*As* 3(*a*), *but at Higher Magnification* (×1,500, *etched*).

create especially favourable conditions. Von Halbart[12] discussed this purely as a theory: it was carried further by investigators in the U.S.A., U.S.S.R., and Germany. In an earlier work De Sy[13] showed crystal structures in which graphite nuclei appear to be totally enclosed in ledeburite. Fig. 4 shows a similar structure found during the investigations at Gelsenkirchen. This could be obtained from a hyper-eutectic cast iron. Through rapid cooling of the melt, but without magnesium treatment, clearly-marked graphite nuclei separated in a pure ledeburite ground mass, Dunphy and Pellini[14] investigated this systematically. They found by quenching trials that the growth temperature of graphite nodules is unchanged during complete solidification of the eutectic melt. This applies to hypo- as well as hyper-eutectic alloys. The American investigators explained the crystallization of graphite nodules in the following way:

1. Crystallization of primary dendrites of solid-solution in the melt.
2. Growth of graphite nodules in the interstices of the rest of the melt.
3. Unstable solidification of the eutectic remainder of the melt, followed by disintegration.

Bunin and Iwantzow[15], Scheil and Hütter[16] and others[17-19] drew the same conclusions. But the Russian investigators in particular developed the theory that the growth of the smaller part of a graphite spheroid takes place entirely in the melt. However, soon after their withdrawal from the melt, the graphite nodules become enclosed in austenite, so that their further growth results from diffusion of carbon through the austenite from the carbon-rich melt. On the basis of these investigations, Fig. 6 shows the different growths of lamellar and nodular graphite. Fig. 6 (*a*) shows that the lamellar eutectic graphite is in contact with the melt as well as with the austenite which is growing at the same time. Fig. 6 (*b*) shows how the graphite nodule becomes separated from the melt by being enclosed in austenite.

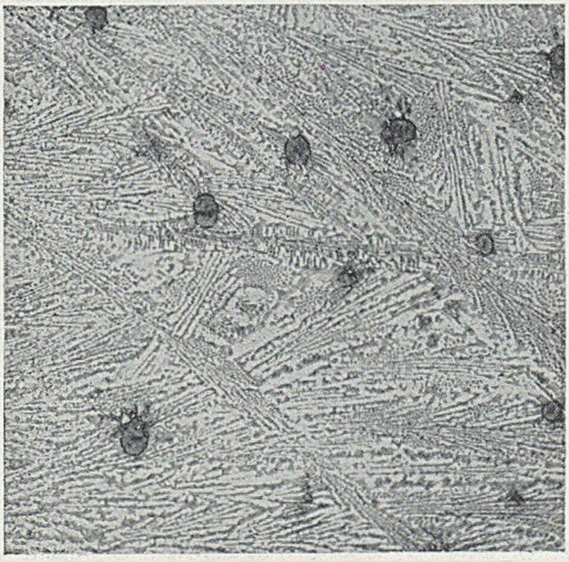

FIG. 4.—*Graphite Nuclei in Untreated Hyper-eutectic Cast Iron after Quenching* (×500, *etched*).

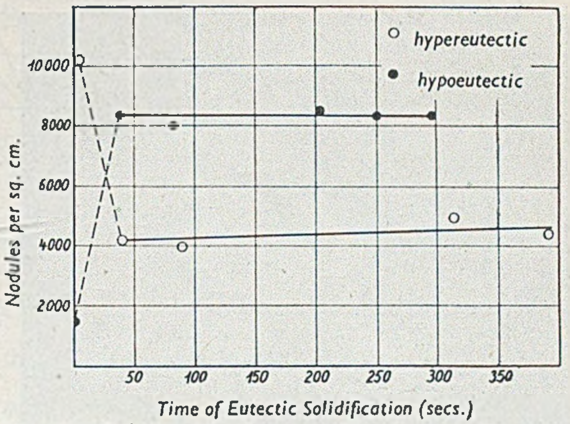

FIG. 5.—*Relationship between Number of Graphite Nodules and Duration of Eutectic Crystallization* (*Dunphy-Pellini*[21]).

Third Theory

The theories outlined earlier have, in general, only confirmed the discussions of foundry research workers about the origin of graphite without taking into consideration the exceptional case of the origin of nodular graphite. The Author is pleased to see that the interpretation of the results of these experiments has been given a new lease of life by a further theory. However, this new theory has so far only been advanced by A. De Sy and the German investigators whose work forms the basis of this report. In mid-1950, De Sy[20] discussed the possibility that graphite nodules would grow as a stable phase out of austenite which has been supersaturated with carbon but he found no experimental proof of this. However, experimental confirmation was supplied from Gelsenkirchen a few months later. The interpretation of this theory led the staff to investigate the growth of nodular graphite from the supersaturated solid solution.

Fig. 7 is a micrograph showing that a basic difference exists between the structures of grey cast iron and magnesium-treated cast iron. In the grey-iron casting, the graphite is evenly distributed and the metallic base material shows little or no

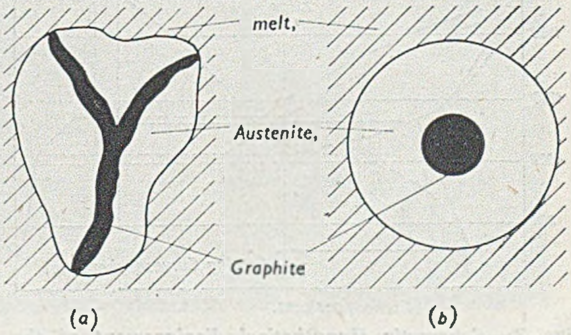

FIG. 6.—*Schematic Growth of* (*a*) *Lamellar and* (*b*) *Nodular Graphite* (*from Bunin, Iwantsow*[26]).

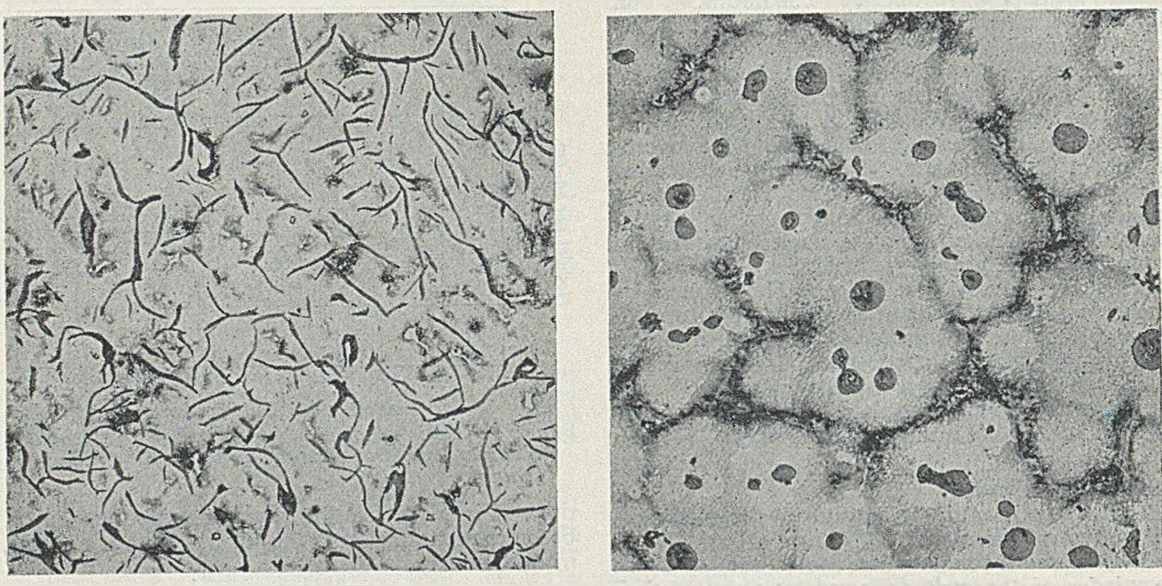

Fig. 7.—*Initial Structure of (a) left, Eutectic, Untreated, and (b) right, Magnesium-treated Cast Iron* (× 100, *primary etching*) (*from* [1]).

separation of the metallic constituents, whereas the graphite nodules in magnesium-treated cast iron are thickly clustered in the central regions of the primary crystals, and also the crystal boundaries are well-marked zones of segregation. This discovery led to the hypothesis of a considerably changed iron-carbon diagram[1] as a result of suppression of the growth of lamellar graphite. Fig. 8 shows that the melts treated with material so as to form nodular graphite show no eutectic crystallization during cooling, but that essentially they pass through a solid-solution state. For this reason, the cooling curve shows no point corresponding to eutectic crystallization, but does show two well-marked points of inflexion. Experimental data were used to formulate the theory of nodular-graphite formation from the primary mixed crystals as follow:—

(1) In the case of hyper-eutectic alloys, primary etching shows a crystallization which is strongly segregated, leading one to infer the growth of solid-solution crystals.

(2) The nodular graphite generally lies in the centre of these zones, and therefore of each crystal.

(3) The strong tendency of nodular-graphite cast iron to segregate opposes its eutectic character, and leads one to expect a crystallization diagram with large regions of solid solution.

(4) Cooling curves of nodular-graphite cast iron show the predicted course of crystallization. New experiments by De Sy and his colleagues at the Centre des Récherches de Gand [22, 23] and investigations at Gelsenkirchen[24] corroborate these results.

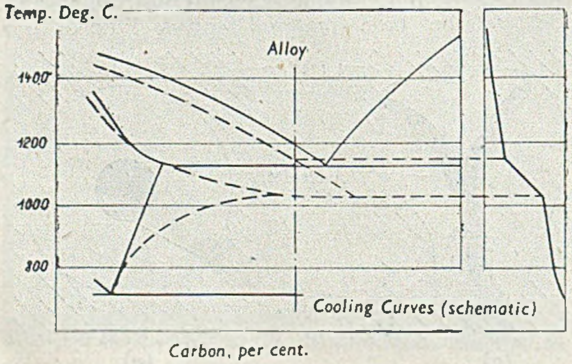

Fig. 8.—*Schematic Hypothetical displacement of the Equilibrium Lines of Iron/Carbon Alloys after Magnesium Treatment* (*from* [1]).

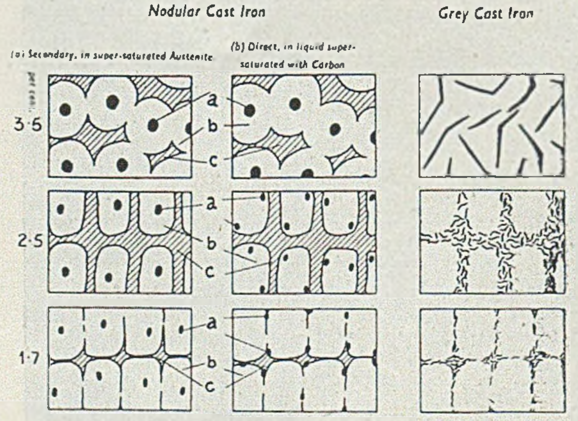

Fig. 9.—*Structures of Grey Iron and Nodular-graphite Cast Iron, in relation to Carbon Content.*

(*a*) *Nodular graphite;* (*b*) *pearlite/ferrite and* (*c*) *segregated zone.*

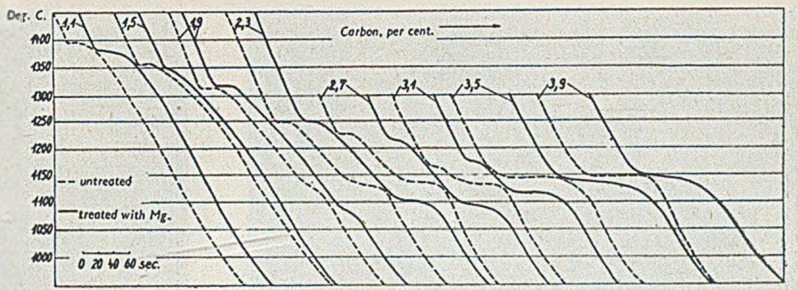

FIG. 10.—*Relation between Cooling Curves for Grey Iron and Nodular-graphite Cast Iron for Carbon Concentrations in the Range* 1.1 *to* 3.9 *per cent.*

Points of Similarity and Divergence

At this stage it appears more profitable to demonstrate the most-widely-supported theories rather than show their contradictions. The exponents of the respective theories of direct origin of nodular graphite in the melt, and of separation from the supersaturated solid solution, can to-day explain most of the facts. When the merits of their two theories are considered, it can be seen that they agree to a considerable extent. According to both theories, once the graphite nodules have originated, they grow from the liquid or partly-solidified melt by diffusion of carbon through the austenite surrounding them. The significant difference between the two theories concerns the beginning of the process. The Russian investigators, who advance the first-named hypothesis may be nearest to the conception of the second theory.

The difference between the two theories boils down to this very important point—does a small nucleus of graphite grow directly out of the melt, and then become surrounded by austenite, or does a small solid-solution crystal form which is supersaturated with carbon, from which the carbon separates in spherical form with further drop of temperature? Answers to the following questions are needed in order to obtain further proof:—

(*a*) Can the nodular graphite be separated in the melt?

(*b*) Can the primary austenite be supersaturated above point E of the iron/carbon diagram?

Until now, there has been no convincing evidence on either of these questions.

New Work

With the encouragement of Prof. Houdremont of Essen, the Author and his colleagues sought a means of indirect attack on the problem. The following explanation leads one to expect a structure shown diagrammatically in Fig. 9. In the case of high carbon content, a usual condition for cast iron with nodular graphite, there are scarcely any differences of structure according to either theory. If it is agreed that separation occurs at the hyper-eutectic edges of the austenite dendrites, the graphite nodules may be expected to appear in the same way in the centre of the austenite areas, since this must be their mode of separation from the supersaturated solid solution. However, Fig. 9 shows that, with a reduced carbon content, a difference in the crystal structure occurs. The lower

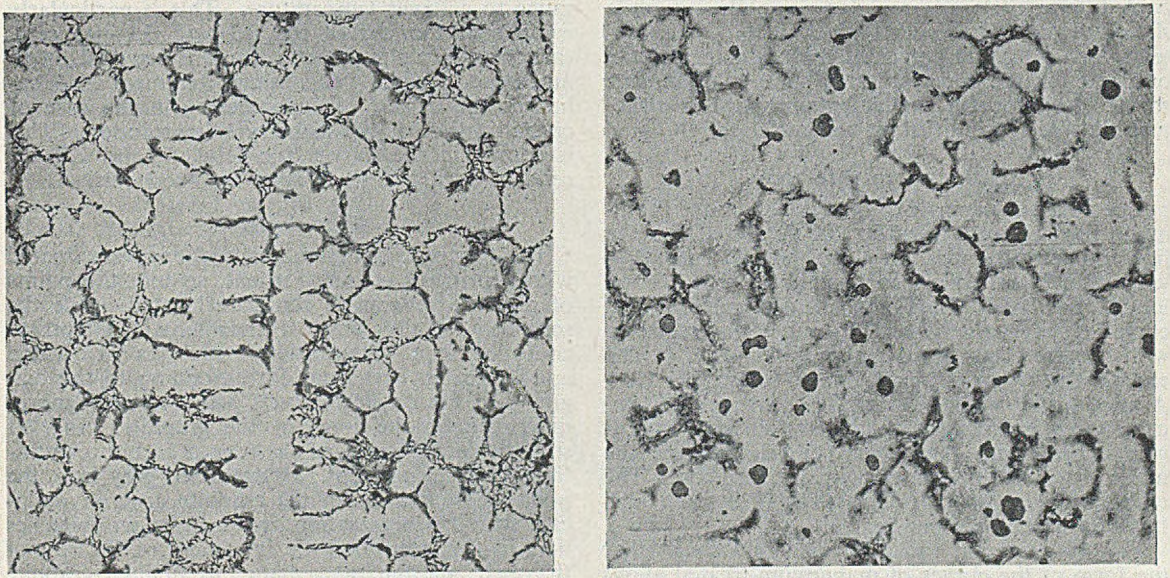

FIG. 11.—*Structures of* (*a*) *left, Grey Iron and* (*b*) *right, Nodular-graphite Cast Iron* (2.3 *per cent. carbon,* × 100, *as revealed by Primary Etching.*

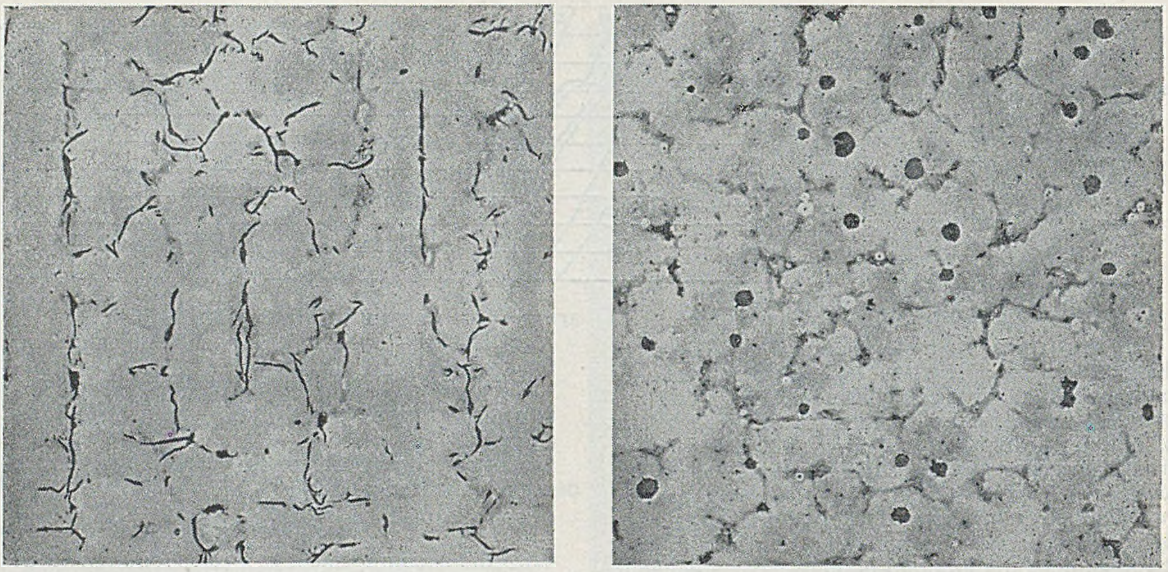

FIG. 12.—*Similar Material and Treatment as in Fig. 11, but containing 1.9 per cent. Carbon.*

the carbon content of the melt, the more the austenite dendrites can grow (according to the direct-origin theory) before graphite deposition occurs at the edges due to attaining supersaturation. As a result of this, the nodular graphite will gradually be crowded out of the solidified mass of the crystal, towards the austenite dendrites.

In the case of treated hypo-eutectic cast iron, the same arrangement of graphite is to be expected as in ordinary hypo-eutectic grey iron; the graphite would be separated in an inter-dendritic formation. The only difference would be in the form of graphite, as both in the case of lamellar supercooled graphite and nodular graphite, graphite should form at the points of contact of the austenite dendrites. However, if the nodular graphite originates in the supersaturated solid solution, one should not expect a fundamental change in structure with decreasing carbon content.

Experimental Method

The melts used in this investigation in a Tammann furnace were taken to 200 deg. C. above the liquidus temperature and were poured into dry-sand moulds as test-pieces 15 mm. dia. by 30 mm. long. The melt remaining in the crucible was cooled slowly and the cooling curve was recorded with a photocell-compensator instrument. The experiments were arranged in two series. In Row A, pure nickel was added to the usual melt of grey iron, and was inoculated with ferro-silicon. Row B was treated with magnesium/nickel alloy in the usual way, and inoculated with ferro-silicon. The carbon content was varied in steps of 0.4 per cent. between 1.1 and 3.9 per cent.

Fig. 10 gives the cooling curves and shows that the form of the curves of magnesium-treated alloys was changed in the characteristic way. This change is particularly pronounced at high carbon concentrations. It can be deduced that the degree of supercooling of cast iron with nodular graphite increases with decreasing carbon content. This is reflected in a lowering of the effect due to eutectic crystallization compared with the untreated material. The conclusion can be drawn that magnesium-treated alloys having a high degree of saturation, begin to produce graphite nodules in the centre of the first dendrites of austenite soon after their origin. After magnesium treatment, the alloys deficient in carbon show first a pronounced kink in the curve denoting growth of solid solution, followed by a strong displacement of the eutectic range to a lower temperature. This is particularly evident in the curves for 2.3 and 3.1 per cent. carbon, where the eutectic range is lowered by as much as 50 deg. Magnesium treatment also enhances the degree of supercooling in the case of crystallization of the primary solid solution. This is shown in the curves for 1.1, 1.5, and 2.7 per cent. carbon, but the results are inconclusive.

Microstructures

To investigate structure, test sections were treated with a primary etching reagent, so that the points of graphite separation could be located inside the solid-solution regions. Fundamental differences could be seen between the structures of treated and untreated cast iron, corresponding to the diagrams of the cooling curves, provided one ignores differences in the form of the graphite. Fig. 11 shows this difference of form at a carbon concentration of 2.3 per cent. In untreated grey iron, the points of separation of the graphite generally coincide with the segregation zones. The graphite lies here in the inter-dendritic interstices of the rest of the melt; on the other hand, in nodular-graphite cast iron the nodules almost always lie in the central region of the austenite lying between the

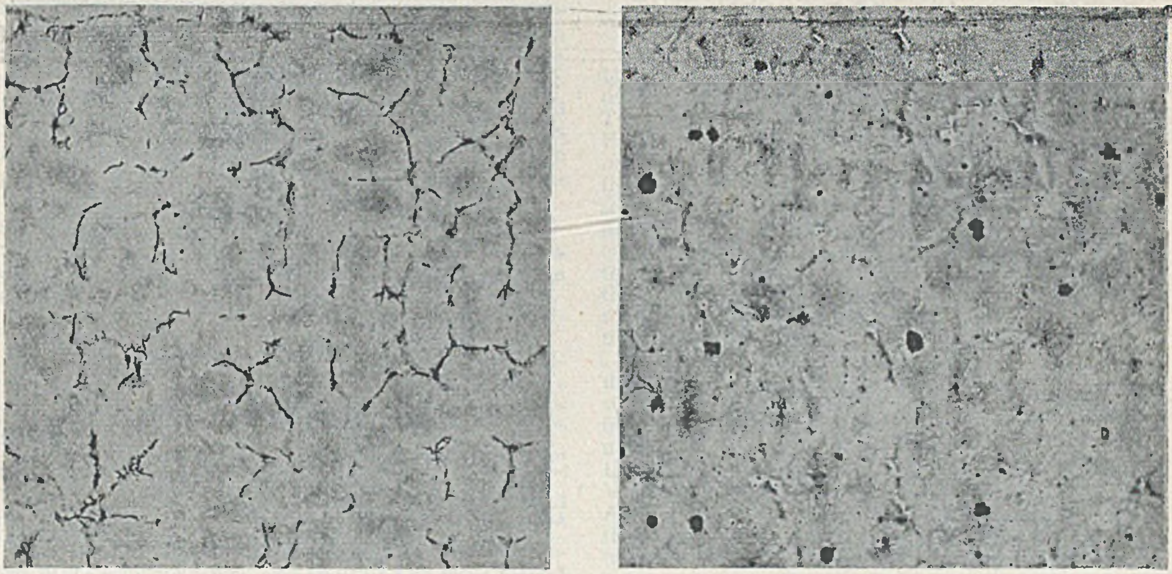

FIG. 13.—*Similar Material and Treatment as in Figs.* 11 *and* 12, *but containing* 1.5 *per cent. Carbon.*

segregation zones. For carbon contents from 3.9 to 1.1 per cent. the two rows of melts completely maintained their characteristic difference in structure.

Fig. 12 shows this for a carbon content of 1.9 per cent. It should be noted that magnesium-treated iron occasionally deposits graphite in lamellar form in the segregation zones; this occurs particularly with low carbon content. Fig. 13 shows that with a carbon content of 1.5 per cent., the graphite nodules still lie in the central regions of the austenite, which is shown here only by the weakly-marked segregation zones. However, in untreated grey iron, the graphite has clearly separated among the dendrites. With further reduction of carbon content to 1.1 per cent., no graphite separation could be seen in the melt.

This confirms an arrangement in low-carbon magnesium-treated iron which could have been anticipated from the previous illustration, when the graphite separates in a solid condition out of the supersaturated solid solution. Therefore it is believed that the theory of graphite-nodule formation from solid solution receives further support from these experimental results.

Effect of Silicon

In a number of new researches, an important influence has been ascribed to the effect of silicon on the growth of nodular graphite.[25-27] The present investigators have followed this up and applied the same experimental technique as in investigating the influence of carbon content. Once more a series each of untreated and magnesium-treated melts were prepared, with silicon content varying in eight steps from 0.0 to 2.2 per cent.

Fig. 14 shows the cooling curves, and again demonstrates the characteristic change in the curves for magnesium-treated alloys. The curves for melts containing up to 0.2 per cent. are similar for each alloy. The change of curve formed with rising silicon content is evident in the treated melts; this can be understood if the structure of corresponding melts are compared. Fig. 15 shows that the melts up to 0.2 per cent. are almost completely white and

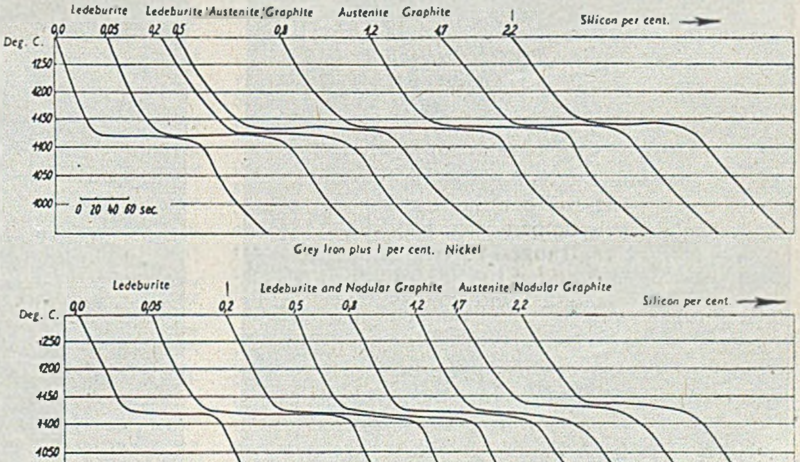

FIG. 14.—*Cooling Curves of Grey and Nodular-graphite Cast Irons having* 0.0 *to* 2.2 *per cent. Silicon.*

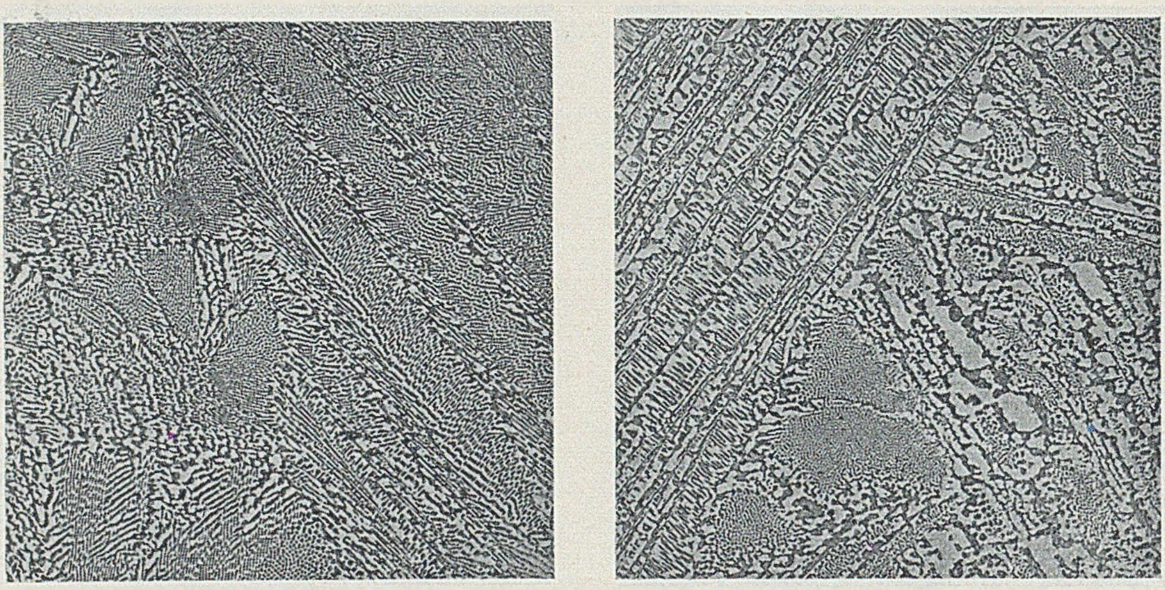

FIG. 15.—*Structure of (a), left, Untreated, and (b), right, Magnesium-treated Cast Irons* (0.05 *per cent. Si,* × 100, *etched*).

crystalline as expected, due to their low silicon content; their cooling curves therefore correspond with that for the crystallization of ledeburite. Fig. 16 shows that with higher concentrations of silicon of 0.2 and 0.5 per cent., nodular graphite appears in the solid-solution areas, and increases at the expense of ledeburite until eventually with 1.5 per cent. silicon, the alloy is completely grey.

It follows from this that the characteristic form of the cooling curve can be related directly to the appearance of the primary mixed-crystal dendrites and the growth of graphite nodules. This seems to prove that the characteristic change of form of the curve in magnesium-treated cast iron does not represent a simple alloying effect due to magnesium or any other element, but is a sure indication of a fundamental change in the process of crystallization, leading to the formation of graphite nodules.

Summary

A summary can be made as follows: There are several main theories of the origin of graphite nodules, which differ in several ways. These hypotheses share so many similar concepts that only a few basic problems need be solved to decide between the different explanations. The present

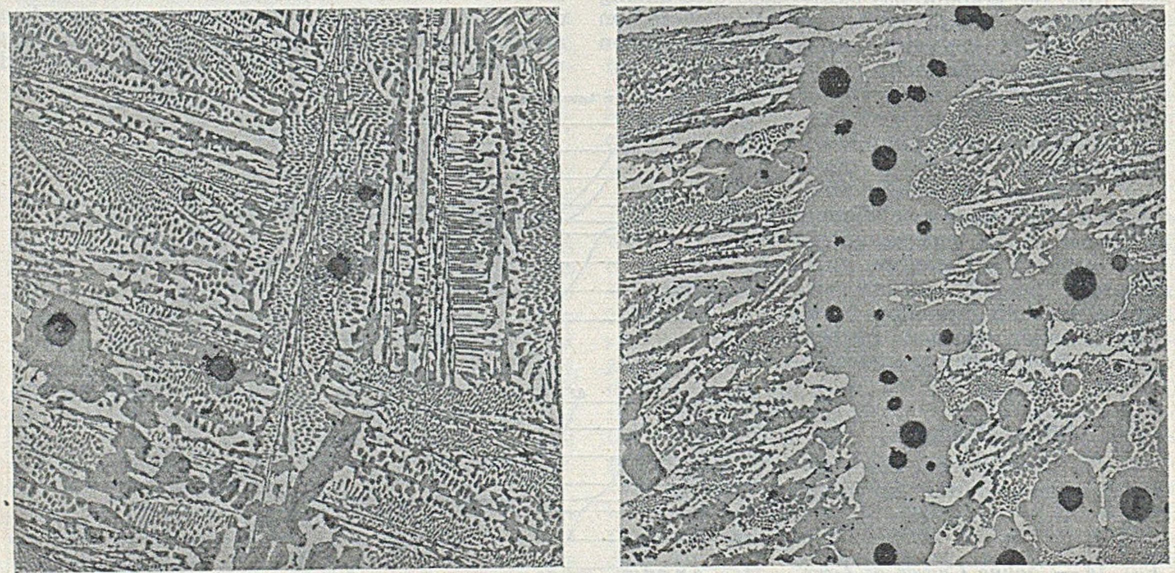

FIG. 16.—*Structure of Nodular-graphite Cast Iron with (a), left,* 0.2 *per cent., and (b), right,* 0.5 *per cent. Silicon* (× 100, *etched*).

research workers believe that they have made a contribution to these investigations. Their results on the growth of nodular graphite in cast iron from supersaturated solid solutions have so far been confirmed only by Prof. De Sy and themselves. It is important not to make a choice between the various mechanisms of growth, but to consider the evidence produced. However, on the basis of extensive investigations, the solid-solution theory is still considered to be the most probable, but many investigations are needed to consolidate all the observations on nodular-graphite growth into a comprehensive theory.

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[20] A. De Sy, "La contribution Belge dans l'étude des Fontes Nodulaires," *Rev. Univ. Mines*, 9 serie, VI, No. 8 (Aug., 1950).

[21] A. Wittmoser, "Die Primärkristallisation des Gusseisens mit Kugelgraphit," *Vortrag auf der Tagung der Gesellschaft fur Metallkunde* (Feb., 1951), in Stuttgart.

[22] A. De Sy and J. Vidts, "Précisions et données complémentaires sur le mécanisme de formation des sphérolites de graphite," *Fonderie Belge*, **3** (1952), 41-48.

[23] A. De Sy and R. Colette, "Dislocation et recristallisation des sphérolites de graphite par recuit et par autorecuit," *Fonderie Belge*, **3** (1951), Mars, 49-52.

[24] A. Wittmoser, "Zum Gefügeaufbau des Gusseisens mit Kugelgraphit," *Giesserei* (1952), **6-8**, 323-334.

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International Magnesium Show

The first all-magnesium exhibition in Washington, U.S.A., was open to the general public from March 31 to April 2 and was attended by over 26,000 visitors. Two British firms, Magnesium Elektron, Limited, and Essex Aero, Limited, were represented with commodious stands so that, apart from the stimulus it gave to the magnesium industry in general, the exhibition also served to make known British progress in the magnesium field to American technicians, and to introduce American achievements to British experts. Moreover, since the Magnesium Elektron stand contained specimens of the work of nearly all this group's licensees, including those on the Continent, it represented to some extent the magnesium industry of Europe.

Magnesium Elektron featured a research exhibit of their new ZT1 alloy. On this stand much interest was shown in the Ferguson tractor and its magnesium castings, in castings for Napier's, the Dowty Z5Z main undercarriage leg casting (both by Sterling Metals, Limited), and in the canopy of the De Havilland Sea Venom made by J. Stone & Company, Limited. Essex Aero, Limited, amongst many other exhibits, featured the Allard car with a magnesium body, a hospital bed, magnesium crates, containers, tanks, and coiled strip.

American Exhibits

American firms displayed an impressive array of cast and wrought applications. Items of special interest included an army ordnance trailer embodying 4,600 lb. of magnesium (one casting alone, weighing 1,630 lb., was said to be the largest magnesium casting in the world); a freight pod for attachment to the XC-120 Fairchild aircraft; the cast aircraft wing, for Northrop; a sheave in Z5Z alloy to replace the cast-steel sheaves used in catapult launching gear for aircraft; a large all-magnesium truck body and a comprehensive selection of ladders. In addition there was the usual wide range of trucks, roller conveyors, textile accessories, etc. In the course of the opening ceremony, which was attended by officials of the U.S. government and armed forces, it was stated that the annual consumption of magnesium in the U.S.A. might be expected to reach 107,000 tons by 1960 (compared with about 45,000 tons at present).

Annual Meeting

The annual general meeting of the Aluminium Development Association was held at 33, Grosvenor Street, London, W.1, on April 10, with the retiring president, Mr. H. G. Herrington in the chair. Introducing the report for 1952, he noted the continuing progress of the Association as shown, for example, by statistics of enquiries answered (2,750), publications distributed (132,000), and film shows given (over 400), and also by short-term and long-term development and research investigations pursued during the year, particularly in structural engineering, naval architecture, large riveted joints, welding and finishing.

The year under review had opened uncertainly owing to supply difficulties, but at its close there was fabricating capacity available, and this change had some effect on the Association's programme. There was likely to be more competition in the future, but the A.D.A. would be regarded as a spearhead of the aluminium industry's competitive efforts.

Mr. R. D. Hamer, vice-president and director of Aluminium Laboratories, Limited, was then elected president of the Association for the ensuing year.

European Steel Price Schedule

The High Authority of the European Coal and Steel Community has announced plans for dealing with possible price-fixing cartels in connection with the steel pool. There are to be no maximum prices to start with, but the authority will watch for signs of levelling upwards and use its powers, if necessary.

All steel firms are required to publish their price schedules by May 20. Arising out of this, managers of German steel companies met on April 30 to discuss ways of overcoming the resistance of their customers, who are delaying new orders for rolling-mill products in the hope of obtaining cheaper deliveries after May 20. The mills agreed to offer to charge retro-actively all through May the prices to be published on May 20 if they should prove lower than present German prices.

When published, the prices will be binding as maxima and as minima, all special prices being excluded, except the cutting of prices to the levels charged for local supplies in any local market in the six-nation pool. A special watch is to be kept for signs of steels firms' "harmonizing" their charges for extras, for which a common list has been prepared.

A committee of steel consumers of the Community will meet from the end of May onwards to report on any signs of cartel formation.

Another decision published when the pool commenced on May 1, specially defines and forbids discriminative practices.

A further clause forbids the inclusion in prices of taxes on which a seller is entitled to claim a refund or rebate. Recognizing, however, that difficulties arise under the present system of charges and rebates of turnover taxes when steel passes particularly between France and Germany, the High Authority is to open the question immediately with a view to improving the system by which these rebates and refunds are made.

Last week the Lower House of the German Parliament authorized the Government to levy a production tax of up to 12 per cent. on the value of all iron and steel products manufactured in other countries of the pool.

Canadian Steel Prospects

In his presidential address to the annual meeting of the Dominion Steel & Coal Corporation, Mr. L. A. Forsyth said in Montreal recently that the future prospects of the steel industry in Canada should be viewed with caution, but not necessarily pessimism. A reduction in defence demands would, he stated, make additional supplies available for civilian consumption, but whether the requirements of the rapidly expanding Canadian economy would bridge the gap was a debateable question. Moreover, competition from abroad was increasing.

Production of ingot steel in Canada during March reached the record figure of 356,890 tons. This was 12.6 per cent. above the February total of 316.741 tons and 8.8 per cent. above the March, 1952, output of 327,885 tons. The March tonnage raised output in the first quarter to 1,012,846 tons, this being 9 per cent. above the total of 927,952 tons in the first quarter of 1952.

SIEMENS BROS. & COMPANY, LIMITED—Sir William Morgan has been appointed chairman in succession to Sir Hubert Gough.

B. THORNTON, LIMITED—Mr. J. Harold Wood has been elected a director, and Mr. I. W. Henderson secretary of the company.

Electrons in the Examination of Metals

A summer school in the use of electrons in the examination of metals will be held in the Cavendish and Goldsmiths' Laboratory at Cambridge during the period July 20 to 31.

Summer schools have been held previously in Cambridge on electron microscopy. The subject has become so diverse that, in co-operation with the Institute of Metals, a more specialized course has now been arranged. This will consist of lectures, demonstrations, and practical classes in the principles of the electron microscope and electron diffraction camera and their practical applications to the study of metals. Practice will be provided in the standard methods of replica and specimen preparation and the new technique of deflection electron microscopy for the direct examination of metals will be discussed and demonstrated.

Future of the Gas Turbine

Motive power for industry and all forms of transport would, within the foreseeable future, be provided by gas turbines, said Mr. W. E. P. Johnson, managing director of Power Jets, Limited, the Government-owned turbine research company, speaking in London recently.

Gas turbines could bring great economies in steelworks by making blast furnaces self-driving, he said. In coal mines they were to be tried for the generation of power, using the methane in the coal-ventilation air; and they could be used at power stations to generate power by running on waste and primary gases. They would be used to provide the power in ships and railway engines and already they were on their way into road transport where, he believed, they would beat the Diesel engine in many important respects.

G.K.B. Acquires Iron Ore Company

The Iron and Steel Corporation of Great Britain recently announced that it had transferred its direct ownership of the Glamorgan Hematite Iron Ore Company, Limited, to Guest Keen Baldwins Iron and Steel Company, Cardiff, on agreed terms. Both companies are subsidiaries of the Corporation.

According to a spokesman of the Corporation, the transfer had been made solely in order to facilitate administration by the two companies, since G.K.B. takes most of the ore supply of Glamorgan Hematite. This particular change in direct ownership did not form part of a scheme to incorporate smaller firms with larger, more economic units, which would be more easily disposed of when undertakings are returned to private ownership.

Railway Carryings. The latest figures for iron and steel traffic show that in the week ended April 25, 220,469 tons were despatched from the principal steelworks, and 325,000 tons of iron ore were conveyed during the same period.

RICHARDSONS WESTGARTH & COMPANY, LIMITED—Mr. E. Butler-Henderson has been appointed a director.

VICKERS, LIMITED—Mr. W. B. Motum, special director, is succeeded as chief accountant of the company and of Vickers Armstrongs, Limited, by Mr. M. G. Spriggs.

Institute Elects New Members

At a meeting of the Council of the Institute of British Foundrymen, held at the Royal Station Hotel, York, last month, the following applications for membership were accepted:—

First List

As Subscribing-firm Member

De Havilland Engine Company, Limited, Precision Foundry, Stag Lane, Edgware, Middlesex, aero-engine manufacturers and founders. (Representative: G. W. Paget.)

As Members

S. Attwood, director, Patterns (Derby), Limited; V. D. Griffiths, A.M.I.MECH.E., assistant ironfoundry manager, Sterling Metals, Limited, Coventry; C. R. Gwilt, chief metallurgist, Duport Foundries, Limited; J. A. Hatton, foundry manager, Birco Motor Cylinder Co., Ltd., West Bromwich; A. E. Hawley, foreman patternmaker, Hadfields, Limited, Sheffield; D. R. Jones, managing director, Commercial Patterns, Limited, Rugby; F. A. W. Le Duc, managing director, Edgware Foundry, Limited; E. C. Mantle, M.SC., A.I.M., liaison officer, British Non-Ferrous Metals Research Association; C. Newberry, die-caster, E.S.A., Herts; W. A. Newbold, works manager, H. W. Lindop & Sons, Limited, Walsall; G. W. Paget, A.I.M., investment foundry manager, De Havilland Engine Company, Limited; W. T. Pell-Walpole, PH.D., B.SC., research fellow, metallurgy department, Birmingham University; L. Sharp, foundry manager, Hamworthy Engineering Company, Limited; K. W. Belcher,* manager, N. M. Rothschild & Sons, London; D. W. Berridge,* foundry technical manager, S. Russell & Sons, Limited, Leicester; E. C. M. Neale,* foundry manager, W. A. Baker & Company, Limited, Newport, Mon; W. Wilson,* foundry metallurgist, Clarke, Chapman & Company, Limited, Gateshead.

As Associate Members

W. E. Ambler, refractory technologist, Wm. Cummings & Company, Limited, Chesterfield; G. Barber, B.SC. (MET.), assistant metallurgist, Brightside Foundry & Engineering Company, Limited, Sheffield; A. J. D. Binstead, works chemist, Britannia Iron & Steel Works, Limited, Bedford; C. Blackburn, foundry chargehand, T. H. & J. Daniels, Limited, Stroud; W. H. Bond, chargehand, Enfield Foundry Company, Limited; D. W. O. Dawson, B.SC. (MET.), foundry research metallurgist, A.P.V. Company, Limited; J. T. Duell, teacher, Luton County Secondary Technical School; A. Eggo, development technician, English Steel Corporation, Limited, Sheffield; T. Foley, foundry superintendent, Ford Motor Company, Limited; J. Gibbin, technical process engineer, F. Perkins, Limited, Peterborough; J. Hague, assistant to manager, Turton Bros. & Matthews, Limited, Sheffield; D. F. G. Hampton, metallurgist, J. Stone & Company, Limited; J. P. C. Harris-Edge, inspector, Ministry of Supply; D. H. Houseman, M.A., research worker, Cambridge University; T. B. L. Jones, foundry engineer, Guest Keen & Nettlefolds, Limited, Cwmbran; M. N. Khanna, technical officer, Council of Scientific and Industrial Research, India; S. Lloyd, draughtsman, Stanton Ironworks Company, Limited, Nottingham; B. S. Mantle, metallurgist, S. Mole & Sons, Stourbridge; C. H. Merritt, senior assistant engineer, John I. Thornycroft & Company, Limited, Southampton; J. A. Musk, foundry foreman, Hayward Tyler, Limited, Luton; D. R. G. Nash, senior draughtsman, Birmidal Development, Limited, Birmingham; E. W. Langley, assistant foreman, Wear Winch Foundry Company, Limited, Sunderland; J. D. Pennack, foundry supervisor, N. M. Rothschild & Sons, London, E.1; W. D. Pritchard, metallurgist, Richard Thomas & Baldwins, Limited; A. Taylor, assistant metallurgist, Bristol Aeroplane Company, Limited; R. Taylor, senior draughtsman, Birmidal Developments, Limited; J. Thewlis, machine production supervisor, Kaye & Company, Huddersfield; A. E. Stockdale, foundry foreman, East Sussex Engineering Company, Limited; C. I. Thomas, manufacturer's agent, Coleman-Wallwork, Limited; G. R. Vaughan, assistant metallurgist, Hale & Hale, Limited, Tipton; C. H. Wilkins, foundry manager, Serck Radiators, Limited, Birmingham; D. Worth, B.SC. (MET.), chief metallurgist, Gould's Foundries, Limited, Newport, M. Burfoot,* coreshop foreman, Ruston & Hornsby, Limited, Lincoln; I. T. Powell,* metallurgist, Simmonds Aerocessories, Treforest; H. E. Williams,* B.SC., assistant foundry manager, John Williams & Sons, Limited.

As Associates (over 21)

G. Addey, foundry methods engineer, English Steel Corporation, Limited; H. T. Affley, time-study supervisor, J. Williams & Sons, Limited, Cardiff; D. F. Allen, metallurgical assistant, Dartmouth Auto Castings, Limited, Smethwick; G. R. Burridge, moulder, John I. Thornycroft & Company, Limited; R. Chand, laboratory assistant, Sterling Metals, Limited, Coventry; J. A. R. Doyle-Davidson, purchasing department, Crane, Limited; P. E. Durrant, chief chemist, Montgomery Plating Company, Limited, Coventry; J. Gibson, coremaker and loam moulder, Wear Winch Foundry Company, Limited; D. P. A. Haynes, metallurgist, Hard Metal Tools, Limited, Coventry; S. Jones, technical representative, Foundry Services, Limited, Birmingham; T. McBryde, moulder, Wear Winch Foundry Company, Limited; R. Milliner, patternmaker, Webster & Bennett, Limited, Coventry; F. A. Muscutt, moulder, Sterling Metals, Limited; L. G. Nicholls, patternmaker, Sterling Metals, Limited; E. Redfearn, methods engineer, David Brown Foundries Company, nr. Sheffield; G. Saul, pattern estimator, English Steel Corporation, Limited; A. W. Scott, technical assistant, Sir W. G. Armstrong Whitworth & Company, Limited, Newcastle-upon-Tyne; G. Skelton, foundry technician, Stanton Ironworks Company, Limited; H. E. Smith, draughtsman, John Bolding & Sons, Limited, London; K. C. Westley, laboratory assistant, Dartmouth Auto Castings, Limited; K. Whiteley, apprentice chemist, Wilsons & Mathiesons, Limited, Leeds; R. J. Wilson, moulder, Wear Winch Foundry Company, Limited.

As Associates (under 21)

B. Ball, apprentice patternmaker, Sterling Metals, Limited; A. E. Barrow, moulder and coremaker, Anti-Attrition Metal, Limited, Maidenhead; A. Brown, apprentice, metallurgical laboratory, C. A. Parsons & Company, Limited, Newcastle-upon-Tyne; S. F. Chaplin, apprentice patternmaker, London Engineering Pattern Company, Limited, Surrey; K. F. Dawkin, apprentice patternmaker, London Engineering Pattern Company, Limited; P. M. Farrell, moulder, Gillett & Johnston, Limited, Surrey; J. W. E. Fisher, apprentice iron moulder, Renshaw Foundry, Limited, Staines; G. B. Foster, patternmaker, London Engineering Pattern Company, Limited; L. G. Higgs, foundry apprentice, Hayward-Tyler, Limited; J. S. Leppington, student apprentice, Hale & Hale, Limited; M. Lucas, laboratory assistant, Leicester Lovell & Company, Limited; R. A. Mackinlay, engineer's patternmaker, London Engineering Patternmakers Company, Limited; R. G. Milligan, patternmaker, Alvis, Limited, Coventry; M. J. Powis,

* Transferred.

Institute Elects New Members

apprentice, Hope Works, Limited, Walsall; W. Scarfe, apprentice moulder, J. W. Thompson, Limited, Sunderland; J. E. Simpson, moulder, Gillett & Johnston, Limited; F. G. Snuggs, apprentice patternmaker, Masson, Scott & Company, Limited, London; J. M. Teasdale, apprentice patternmaker, Sterling Metals, Limited; K. N. Trumper, foundry apprentice, J. Thompson (Castings), Limited, Wolverhampton.

Second List

As Subscribing-firm Members

Distington Engineering Company, Limited, Chapel Bank, Workington, Cumberland, ironfounders and engineers. (Representative: A. A. H. Douglas.) Henry Brown & Company (Irvine), Limited, ironfounders. (Representative: R. Brown.)

As Members

R. Brown, director, Henry Brown & Company (Irvine), Limited; G. Crabtree, foundry manager, Schofield's Foundry Company, Littleborough; H. C. Cross, technical sales manager, John Dale, Limited; A. A. S. Dickson, B.SC., A.M.I.MECH.E., works engineer, Shaw Glasgow, Limited; A. A. H. Douglas, B.SC.(ENG.), A.M.I.MECH.E., director and general manager, Distington Engineering Company, Limited; E. R. Phillips, works manager, Roevac Air Extractors (1952), Limited, Cheshire; E. H. Wheatley, director, Patterns (Derby), Limited; F. G. Colledge,* head foreman, Enfield Foundry Company, Limited; P. Graham,* foundry manager, C. M. Hesford & Company, Ormskirk; J. B. McGregor,* foundry manager, North British Locomotive Company, Limited, Glasgow; J. Merryweather,* director and general manager, Sykes & Harrison, Limited, Manchester; G. W. Reid, foundry manager, Kay & Company (Engineering), Limited, Bolton.

As Associate Members

W. Bowering, assistant foreman, Henry Wallwork & Company, Limited, Manchester; E. D. Bruwer, technical assistant, Union Steel Corporation of S.A., Limited, Vereeniging, South Africa; D. Carr, assistant foreman, British Railways, Crewe; J. Cunningham, moulder, R. Taylor & Sons, Larbert; J. Dick, assistant inspector, Bonnington Castings, Limited, Leith; A. McArthur, chief castings inspector, Bonnington Castings, Limited; J. Pilkington, branch manager, Wolverhampton Metal Company, Limited; J. Stagey, foundry foreman, Distington Engineering Company, Limited; J. Stewart, foundry foreman, A. F. Craig & Company, Limited, Paisley; A. W. Thackeray, managing partner, East Anglian Patterns, Ipswich; H. R. W. Thresh, B.SC., metallurgist, Glacier Metal Company, Limited, Kilmarnock; D. W. S. Hurst,* departmental manager, Bradley's (Darlaston), Limited; J. W. S. Johnstone,* foundry superintendent, Alley & MacLellan, Limited, Glasgow.

As Associates (over 21)

W. F. Cox, loose-pattern moulder, Linotype & Machinery, Limited, Altringham; J. Orrell, moulder, Entwistle & Glass, Limited, Bolton; W. J. C. Ritchie, die-cast foundry foreman, Perfection Piston Manufacturing Company, Transvaal, South Africa.

As Associates (under 21)

D. Hunter, apprentice metallurgist, Shanks Ironfounders, Limited, Arbroath; W. J. Martin, iron moulder, Mirrlees Watson Company, Limited, Glasgow.

Third List

As Members

F. Brunt, refractories engineer, General Refractories, Limited, Sheffield; J. Howarth, foundry manager, Geo. Richards & Company, Limited, Broadheath; R. F. Seymour, managing director, Seymours' Castwell Foundry, Limited, Derby; J. Taylor, M.I.MECH.E., F.I.M., technical superintendent, David Brown Foundries Company.

As Associate Members

Major B. Armeson, senior coreshop foreman, English Steel Corporation, Limited; A. W. Cheeseman, sales manager, Coventry Malleable & Aluminium Company, Limited; A. F. Easom, foundry superintendent, Loughborough College; R. W. Firth, B.SC., works metallurgist and assistant technical director, Sagar-Richards, Limited, Halifax; G. W. B. Hanna, foundry technician, Morris Motors (Engines Branch), Limited, Wellingborough; J. K. Jaffri, B.SC., F.B.I. scholar, English Steel Corporation, Limited; A. G. Jeune, G.I.MECH.E., materials handling engineer, J. Harper & Company, Limited, Willenhall; A. H. Meese, joint general manager, Sandwell Casting Company, Limited, West Bromwich; P. Walters, assistant manager, Brockworth Engineering Company, Limited, Gloucester; T. H. Dawson,* G.I.MECH.E., foundry foreman, Catton & Company, Leeds; G. V. Jones,* personal assistant, I.G.I. foundry, general manager, Qualcast, Limited, Derby; E. Saunders,* foundry metallurgist, Fozel Castings Company, Limited, Coventry.

As Associates (over 21)

A. C. Barr, foundry and metallurgical student, Keighley Laboratories, Limited; S. R. Drake, metallurgical chemist, Hepworth & Grandage, Limited, Bradford; M. B. Driver, iron moulder, Smith's & Company, Limited, South Shields; S. J. Fairy, castings inspector, Morris Motors (Engines), Limited; A. A. Jennison, Her Majesty's Forces; R. L. Langham, student, National Foundry College, Wolverhampton; P. A. MacDonald, engineers' patternmaker, Morris Motors (Engines), Limited; H. Pack, engineers patternmaker, Morris Motors (Engines), Limited; D. R. Smith, foundry technician, English Steel Corporation, Limited; F. Watson, chargehand moulder, Hepworth & Grandage, Limited; R. A. Whitehouse, student, National Foundry College; S. F. Yeomans, pattern moulder, Ley's Malleable Castings Company, Limited, Derby.

As Associate (under 21)

R. Webber, patternmaker apprentice, Silley Cox & Company, Limited, Falmouth.

Fourth List

As Associate Members

R. Brocklehurst, patternmaker, Eclipse Engineering, Benoni, South Africa; E. Chedel, technical assistant, West Yorkshire Foundries, Limited, Leeds; C. A. Hanslow, assistant works manager, Vowles Aluminium Foundry Company, Limited, West Bromwich; M. B. Spencer, general manager, Precision Patterns, Limited, Old Mill, Staffs.

* Transferred.

Beneficiation of Taconite Ores in U.S.

Developments are going ahead in the United States to erect plants for the beneficiation of taconite which is a low-grade ore containing only 24 to 30 per cent. Fe. It is regarded as a substitute for the ores of the Mesabi iron range which are rapidly approaching exhaustion. Seven of the large steel producers are backing three concerns mining taconite. Present annual output of concentrated ore, states *Iron Age*, March 12, is about 1,000,000 tons with an Fe content of 64 to 65 per cent. By 1958, capacity is expected to expand to 8,800,000 tons and later to 25,000,000 tons per annum.

Tunnel-type Continuous Core Stove

New Design Incorporated at Head Wrightson's Foundry

For some time, the majority of continuous core stoves installed in foundries in this country have been of the vertical-loop type. Considerable interest, therefore, attaches to a recently-built horizontal stove at the Thornaby-on-Tees steelfoundry of Head, Wrightson & Company, Limited. This is a gas-fired, tunnel-type, continuous unit designed and constructed by John Mathison, Limited, of Guisborough. It differs from most horizontal stoves in that the inlet and outlet points are at the same end.

Design Features

A simplified plan view of the new stove is reproduced in Fig. 1, and Fig. 2 shows the loading and unloading point. As is clear from these illustrations, the plant is a refractory lined steel tunnel, suitably reinforced, approximately 30 ft. long, 10 ft. wide, and 8 ft. high (external dimensions), from which the loading and unloading arrangements project some 12 ft. at one end. The charge of cores to be dried is carried on trays suspended pendulum-wise from a continuous chain-conveyor loop, driven by a variable-speed motor. The 18 yokes carrying the trays are underslung from an I-beam, and each runs on four rollers fitted with self-oiling bushes, two on each side of the web of the beam. These take the load and keep the trays remarkably steady, the malleable chain conveyor merely providing the motive force. The drive is imparted to the chain by a 5 ft. dia. sprocket wheel outside the open end of the tunnel, and a second sprocket of similar size but arranged as an idler is suspended from the roof at the far end of the stove. This idler sprocket constitutes the only hot lubrication point, its bearing being force fed with grease every three hours. The driven end is powered by a 3 h.p. motor driving through a Varatio-Strateline gear-reduction unit to give conveyor speeds of approximately 18 in. per min. The chain conveyor is designed for a maximum load of 700 lb. at 4 ft. centres and incorporates 18 yoke carriers each of which is 5 ft. high and clears the floor by 6 in. Each yoke carries five trays, spaced at 9¾ in., 9¾ in., 1 ft. 3½ in., 9¾ in. and 11½ in. from each other respectively, starting from the lowest so that single cores up to 30 in. by 18 in. by 12 in. can be accommodated. The loop is so arranged that four tray carriers are outside the open end of the stove at any time, two for unloading and two for loading. The drive mechanism and sprocket at the open end is adjustable so as to take up any slack on the chain. Inside the steel shell, the whole stove is lined, first with slag-wool mattress-type heat-insulating slabs, 2 in. thick, and then with 4½-in. Fosalsil insulating bricks. The floor and all the flues and ports are lined with Scotch firebrick.

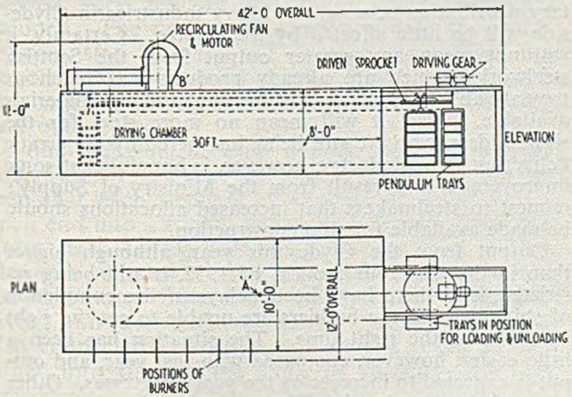

FIG. 1.—*Continuous Horizontal Core-drying Stove of the Mathison Recirculating Type.*

Heating System

The heating system of the stove consists of six cast-iron, box-type burners fired by clean town's gas and arranged along one side only, as shown in Fig. 1, the gas being burned in flues under the stove at right angles to the direction of conveyor travel. Hot gases, substantially diluted by cooler secondary air, pass into the body of the stove through ports arranged underneath each side of the conveyor carrying the trays of cores. The burners are supplied with primary air from a low-pressure fan, each being ignited separately at the commencement of the run. The whole of the heating system can be set for automatic regulation, to build up and maintain a constant temperature at the controlling thermocouple, which is situated on the roof at point *A*, Fig. 1—11 ft. from the open end of the stove. This is arranged through a Foster recording controller, which cuts-in automatically after the stove is operating, gas and air valves being operated by an electric monitoring device actuated from the pyrometer. A remarkable straight-line time/temperature graph is plotted at the recorder, despite quite drastic load changes in the stove.

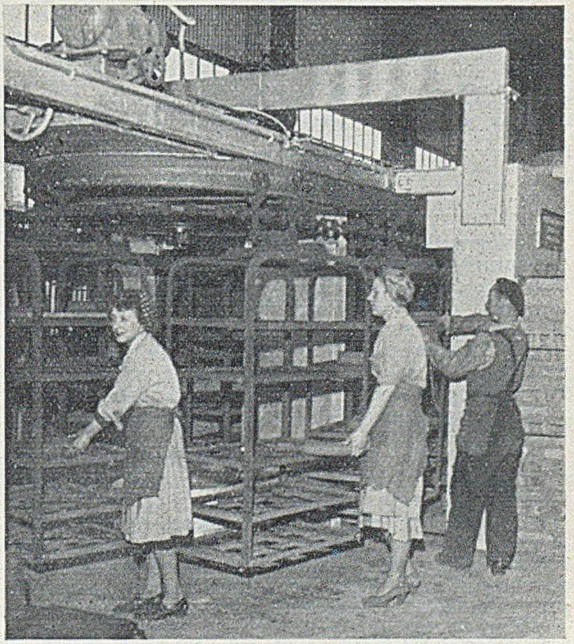

FIG. 2.—*Loading and Discharge Point of the Horizontal Continuous Core-drying Stove made by John Mathison, Limited.*

Tunnel-type Continuous Core Stove

Recirculation. The stove works on a balanced recirculatory system by which combusted gases are collected and re-fed in controlled quantity to the rear of the stove. Collection is arranged by a duct 2 ft. 9 in. wide by 9 in. high, running along the underside of the roof of the stove, and constructed by iron plates laid across the webs of roof channel irons. This duct has its open end or collection point 3 ft. from the mouth of the stove and from it a suction fan on the top of the stove (at *B*, Fig. 1) supplies the hot gases through a diversionary valve either to a Y-piece and two sets of louvres re-entering the rear of the stove or alternatively to the chimney.

Operating Details

At Head, Wrightson's, where the stove has now given complete satisfaction over a working period of six months, a 35- to 45-min. cycle is at present used for core-baking. The stove is lighted daily at 5 a.m. and loading begins at 7.30 a.m., a temperature of 240 to 250 deg. C. being maintained at the thermocouple throughout the day. There is never any burning of cores, which range from ½ cub. in. up to cores 6 in. thick weighing 40 to 50 lb. The largest cores are given a double circuit through the stove, and the capacity of the stove *vis-à-vis* the core requirements of the shop is arranged to cater for this double cycle on certain cores. In all, about 3 tons of cores are dried per day for an average gas consumption of 3,500 to 4,000 cub. ft. per hour of town's gas at 500 B.T.U. per cub. ft. and 4 in. w.g. pressure, most of the cores being in a straight oil-sand mixture, typical particulars of which are quoted in Table I. The total h.p. of the stove's driving motors and fans is eight.

TABLE I.—*Typical Core Mixture in Use for Cores Dried on the Tunnel Oven at Head, Wrightson's Steel Foundry.*

Mixture.		Properties.
Chelford sand (dried)	336 lb.	Moisture, 3.5 to 4.3 per cent.
Yorks fine sand (dried) (12 per cent. clay)	50 lb.	Green-permeability, 95 to 111.
Dextrin compound	5 lb.	Dry-permeability, 170 to 198.
Proprietary semi-solid	10 pints	Green-compression, 3.5 to 4.9 lb. per sq. in.
Proprietary oil	2 pints	Dry-compression, 600 to 900 lb. per sq. in.
Water	6 pints	

If required, cold secondary air can be introduced to the burner flues to enter the furnace chamber under the discharge side of the conveyor trays, this for cooling the cores before they emerge, when desired. When drying cores containing much moisture (*e.g.*, some "oil-sand" cores are made, initially containing 7 per cent. water) the bleed-off valve on the recirculating main flue leading to the stack is opened further, so as to avoid re-supplying gases heavily laden with moisture backing to the stove.

One man unloads cores and generally tends the stove, while the loading is done by the girl coremakers themselves, though provision has been left for a band conveyor to run between their benches to the loading point. The firm chose a horizontal stove because they considered the operating details to offer worthwhile advantages over other types and because a vertical stove would have restricted travel of the shop crane. Although at first sight it might be considered that much valuable floor space is occupied by the stove, this space is not idle. Indeed, outside the oven, core-storage racks have been built along the sides to conserve the warmth still more.

Worthwhile features found with the Mathison stove are that many types of top-heavy cores can be dried standing on end in the new plant without sagging or distortion, whereas on the old vertical continuous stove they had to be dried on shells. So steady is the conveyor that T-shaped cores, up to 5 in. high and of varying diameters from ½ to 1½ in. and some even with considerable overhang, are dried in this way, standing on their bases on the trays. Only the usual sprigs and ¼-in. iron reinforcement wires are used and no core-gum is required on these.

For Head, Wrightson's, the same firm are now engaged in building two coal-fired, bogie-type mould-drying stoves (22 ft. 7 in. by 9 ft. wide), also of the recirculating design, as well as an oil-fired annealing oven, size 32 ft. by 16 ft. by 14 ft. 3 in. from the bogie to the spring of the door arch.

Steel "Free" after 13 Years

The end of iron and steel rationing, announced by the Minister of Supply last week, will be welcomed by that industry and the allied trades. The shortage of steel plates alone, apart from tinplate, which is excluded from the Order, necessitated the continuation of global allocations. It was in 1940 that users started filling in "M" forms and the like in order to get their allocations, and the scheme went on for 10 years until, in May, 1950, control over the distribution of all forms of iron and steel, with the exception of non-alloy steel sheet and tinplate, ended. The heavy needs of the rearmament programme, coupled with a shrinkage of scrap supplies from Germany, led to a temporary allocation measure, and the Conservative Government reintroduced a rationing scheme, in February of last year, endorsing a decision made by the Labour Government at the end of 1951, before it went out.

The reimposition of the scheme on an industry whose pattern had changed greatly since the beginning of the war caused initial difficulties, mainly owing to the rigidity of the scheme in the face of a steadily increasing steel production. However, that increase has paved the way to the long anticipated freedom from allocation.

Scottish Views

The freeing of steel from control is likely to have less effect on Scottish steelmakers than on those in other parts of the country. It is welcomed, however, largely because it will dispense with a considerable amount of the paper work which has had to be done by both consumer and producer.

As the major portion of the steel produced in Scotland is plating, which is to be controlled by a voluntary distribution scheme, the heavy industries in Clydeside will be little affected by the change. Certainly, it will not mean any greater output from the Scottish steelworks, which are already producing as much as they are able to, with the existing plant and raw materials available. Also, it will mean no more steel for the shipbuilders, who are still being hampered by the erratic deliveries. This industry, however, is hopeful that some improvement will result from the Ministry of Supply's request to steelmakers that increased allocations should be made available for ship construction.

Output from the Clyde this year, although higher than in the first four months of 1952, is still being restricted, and there have been delays in the completion of ships because the builders are unable to get the right materials at the right time. The situation has been a little easier, however, compared with last year, and output is expected to increase as the year progresses. Other heavy industries in the Glasgow area also report an improvement in the supply position compared with last year.

Design, Installation and Operation of a Water-cooled Cupola*

By J. W. Dews

(*Continued from page 522*)

SECOND PROJECT

At this stage in the experiments, two standard 24-in. i.d. mechanically-charged Roper cupolas had been installed to service a fully-mechanized plant which was in course of erection at the foundry. It was expected that the cupolas would be required to work on alternative days from 8.0 a.m. to 6.0 p.m. with a 30-min. lunchtime shut-down and it was feared that this programme, together with the fact that with cupolas of this size really efficient patching is difficult, serious burn-outs would be experienced. Attention was therefore given to converting this pair of cupolas, which at that time had not been in production, for water-cooling.

Basically, the segments for these cupolas were of the same design as those for the 38-in. cupola, that is, with top and bottom headers and connecting vertical flow pipes. One or two modifications, however, were made and these are shown in Fig. 5. The top and bottom headers were fabricated from sheet steel with the bottom inlet pipe set in the centre of the bottom header on a radius of the circle of the cupola, and making a right angle with the plane of the segment itself. The two outlets were taken off from the top face and from the ends of the top header. These outlet pipes were made of sufficient length so that when the casting was complete, they could be bent through 90 deg. to bring their centre-line or axis exactly parallel to and in the same plane as the inlet pipe.

Two difficulties had arisen on the previous installation. Having the outlets on a radius involved the cutting of a series of large holes in the shell of the cupola to get the segments into place. In order to overcome this, the outlets were made very short and water connections were made between the segments and the shell. These, however, proved very difficult to get at when leaks developed. The new arrangement enabled the maintenance staff to make all connections outside the cupola and also avoid cutting holes in the shell any larger than the outside dimension of the inlet and outlet pipes.

Four segments in each cupola were again used and installed as shown in Figs. 6 and 7. It will be seen that each segment discharges its water at an open end into a funnel which then gravity feeds the water back to the 1,250-gall. storage tank. This idea was included so that the cupola operator could see the water flow from each segment, thereby giving him increased confidence. Mains water was also connected in such a way that it could be fed either into the storage tank or directly into the circulating system. Figs. 8, 9 and 10 show the tubular structure of a segment, a finished casting, and the cupola pipework respectively, for the 24-in. dia. cupolas.

Operation

These cupolas had previously been brick lined, but had never been used for production melts, so very little information on their operation was available. They were converted for water-cooling and put into operation early in January, 1952, melting a high-phosphorus grey iron and serving the fully-mechanized unit of 12 moulding machines designed to produce up to 25 tons of light castings per week.

Early melts gave trouble due to severe bridging above the tuyeres. Tuyere poking and increasing the flux charge were all resorted to without any marked improvement. It was felt that perhaps there was a critical ratio between the total area being cooled and the diameter of the cupola and it was at first feared that this ratio had been overstepped in the attempt to water-cool a cupola of but 24 in. dia., which was required to be in operation for at least 8 hrs. However, it was found that the condition was arising from the use of dirty scrap, which contained an undue proportion of retained cores. Relatively clean scrap was substituted and the trouble disappeared. Since this time the pair of cupolas have given every satisfaction, working on alternate days.

They are small cupolas, and, being so, are not particularly liked by the operating staff; but the complete absence of any chipping or fettling and the small amount of work to be done to maintain the cupola has more or less eliminated labour difficulties. A cupola is put into operation at 8.0 a.m., and, except for a 30-min. shut-down at lunch-time, is kept in operation until shortly before

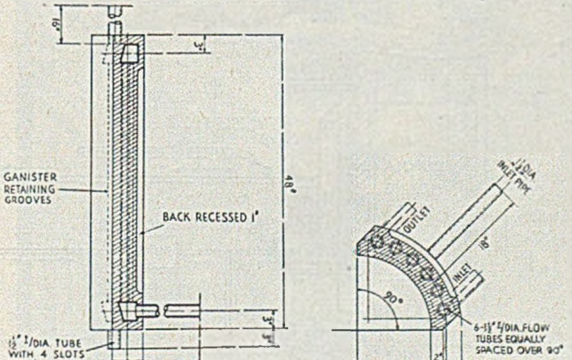

FIG. 5.—*Design of a Cooling Segment for the 24-in. dia. Cupolas.*

* Paper read before the Birmingham branch of the Institute of British Foundrymen. Mr. E. Hunter presiding. The Author is chief metallurgist John Harper & Company, Limited.

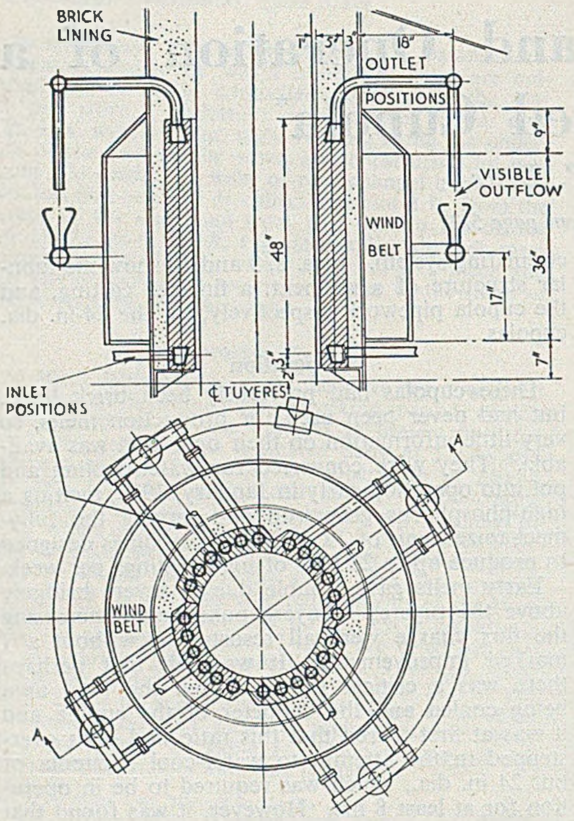

FIG. 6.—*Arrangement of the Return Systems for Cooling Water on the 24-in. dia. Cupola; the Positions of the Inlets are also indicated.*

6.0 p.m. The bottom is then dropped and the walls of the cupola drain down, and are left as straight as when melting began, the segments being covered with a vitrified slag. Conditions inside the furnace are then similar to those shown in Figs. 3 and 4 for the 38-in. cupola.

Heat Losses

This installation had been fitted with thermometers on the inlet and outlet streams, so that it was possible on any day to take a complete record of the temperature rise throughout the melt. It was observed that at the start of the melt there was a rise of 10 deg. F. which gradually increased to 20 deg. F. This was maintained for the greater part of the melt irrespective of the inlet temperature. Towards the end of the melt, the temperature difference rose to 25 deg. F. and on occasions approached 30 deg. F. just before the bottom was dropped. The average temperature rise is now 20 deg. F.

Under the present arrangements, 40 gall. of water per min. are pumped through the installation. This, of course, means using hot water from the storage tank, and keeping the outlet temperature below 130 deg. F. This, for an 8-hr. melt, totals 8 × 60 × 40 = 19,200 gallons per day. Now, 1 lb. of water requires 1 B.T.U. to rise by 1 deg. F. Therefore, 192,000 × 20 = 3,840,000 B.T.U. are absorbed by the water in rising 20 deg. F.

During an 8-hr. melt, 10 cwt. of slag is removed from the cupola (which it is estimated is 50 per cent. less than for a brick-lined cupola of similar size). There is, therefore, a saving of heat loss represented by 10 cwt. of molten slag. It is known (A.F.S. Cupola Handbook) that 900 B.T.U. are required to melt and superheat 1 lb. of slag to 2,800 deg. F. 10 cwt. of slag, therefore, absorbs: 1,120 × 900 = 1,008,000 B.T.U. This is the amount of heat that is saved by the reduction of slag volume. Therefore, total heat loss from the cupola is given by subtracting this saving from the heat lost in the cooling-water.

i.e., 3,840,000 − 1,008,000 = 2,832,000 B.T.U.

From the equation $C + O_2 = CO_2$ it is known that 1 lb. of carbon produces 14,550 B.T.U. Thus, the equivalent weight of carbon lost is $\frac{2,832,000}{14,550}$ = 195 lb. or, assuming perfect combustion and 90 per cent. fixed carbon, 216 lb. of coke. This, other things being equal, for an average of 52 to 56 charges per day, means that an approximate weight of 4 lb. coke per charge is required to replace heat lost through water-cooling. The present cupola charge is 504 lb., with a coke charge of 60 lb. Deducting the coke required to cover the heat loss of 4 lb., gives 56 lb. of coke required for actual melting, or a coke ratio of 9:1 or just over 11 per cent.

This coke ratio is somewhat higher than in the firm's normal grey-iron practice (12:1 or 8.4 per cent.), but agrees with the general pattern of coke consumption revealed in literature covering the operation of small cupolas supplying metal for mechanized plants and making light iron castings suitable for vitreous enamelling.

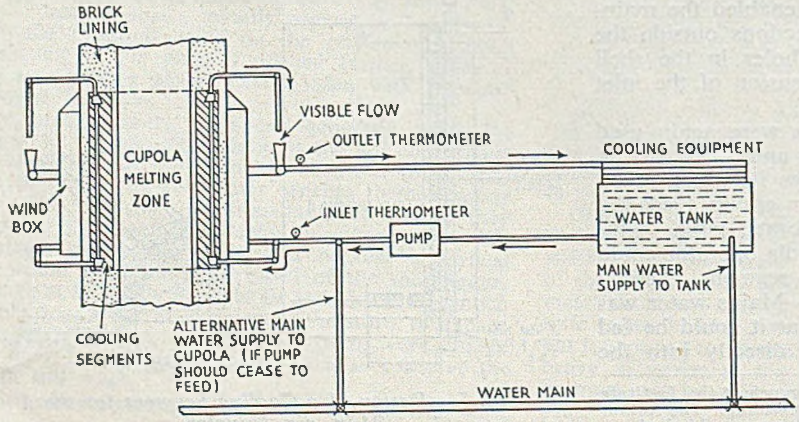

FIG. 7.—*Schematic Layout of the Circulating System showing the Arrangement of the Mains Water Supply.*

The calculation as worked out above caused the Author to reconsider his impression that on the 38-in. cupola no extra coke had been needed to maintain metal temperature. Accordingly thermometers were fixed in the inlet and outlet pipes of the earlier installation, and it was observed that over a period of four hrs. the average temperature rise was 15 deg. F. Therefore $4 \times 60 \times 40 = 9{,}600$ gall. circulated per heat, or $96{,}000 \times 15 = 1{,}440{,}000$ B.T.U. were absorbed by water. Again there was 10 cwt. less slag being produced which meant a saving of 1,008,000 B.T.U. which leaves 432,000 B.T.U. (or 30 lb. carbon; or 34 lb. coke) actually wasted in heating water. With an average of 24 charges for a melt, this represents that less than $1\frac{1}{2}$ lb. coke per charge was required for replacing heat lost through water-cooling.

This 38-in. cupola was and still is running on a 12:1 iron to coke ratio (actual) *viz*:—12 cwt. metal charge and 1 cwt. coke charge, so that the $1\frac{1}{2}$ lb. required for replacing heat lost in the water is only just above 1 per cent. of the 112 lb. coke charge. This explains why no noticeable extra coke was needed on this cupola to maintain the metal temperature.

Conclusion

From the experience gained on the operation of three water-cooled cupolas the writer feels justified in drawing the following conclusions:—

1. The quantity of repair material—ganister and bricks—is considerably reduced.
2. Parallel with this reduction, labour costs for maintenance are also reduced.
3. The periods during which the cupola is out of operation for patching are considerably reduced.
4. This implies that prolonged heats can be operated—again reducing costs.
5. It is possible to obtain very close control over slag composition. Slag can be controlled by charge additions and the effect of dilution from the refractory of the cupola wall is almost entirely eliminated.
6. Cupola melting zone diameter is closely maintained, giving greater uniformity of melting rate and the ability to maintain a constant bed height.
7. There is no loss of metal temperature.
8. The cupola walls are left clean and straight, requiring no fettling when the cupola is "dropped."
9. Tuyeres remain cleaner and require very little poking or burning.
10. No increase in coke consumption has been noticed.
11. The life of the water-cooling system would appear to be unlimited.

There is no doubt that the installation of these water-cooled zones is a somewhat difficult operation, and teething troubles are many, but once the operation has settled down to normal routine the full benefit is realized and the cupolas are remarkably easy to operate. It is particularly reassuring, too, to know that even on the longest heats, the burn-out is under control.

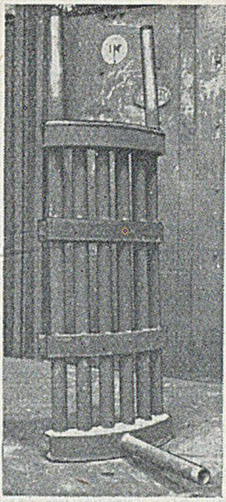

FIG. 8.—*Tubular Cooling Segment for a 24-in. dia. Cupola.*

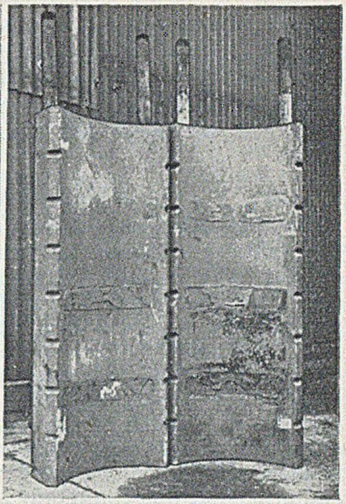

FIG. 9.—*Finished Cooling Segments in the As-cast Condition.*

The Author wishes to acknowledge the permission given by the management of John Harper & Company, Limited, for the writing and publishing of this Paper and also to acknowledge the help given by Mr. E. Smith (works engineer) and his staff without which this development work would not have been possible. The Author would also acknowledge the assistance gained initially from

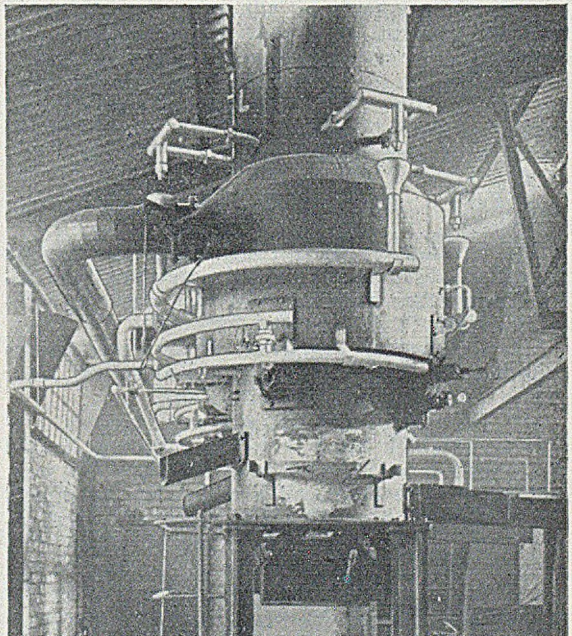

FIG. 10.—*External Pipework on the 24-in. dia. Cupolas, during construction, showing Open Discharge Points.*

Design, Installation and Operation af a Water-cooled Cupola—Discussion

reports of the International Meehanite Metal Company and the help and encouragement of their staff.

DISCUSSION

MR. FRANCIS, who proposed the vote of thanks to Mr. Dews, considered the lecture most useful because it was an actual account of what had been done in a foundry under practical working conditions by the man who had been largely associated with it and had worked the plant. Without any doubt a very good case had been made out for installing a water-cooling system, more particularly perhaps on cupolas which were required to work over long periods and where perhaps cutting back would be obtained with ordinary bricked linings, and also what was commonly called " blushing " of the shell. This was completely eliminated, apparently, with water cooling. One question was just what happened during the shut-off period, say, the luncheon break. Was the water cooling kept going or stopped, or operated at a slower rate?

MR. TAFT, seconding the vote of thanks, considered the Paper a very courageous effort. There was one point he said he had wondered about, and that was the apparent lack of development troubles in the first instance, which, he said, only went to prove that a tremendous amount of prior consideration had been given the job before work commenced. He asked if there was any trouble with the joints between the segments or with expansion. He said he could confirm Mr. Dews' remarks about small cupolas and the changes of section across the superheating zone, in that they were usually greater than for large cupolas. Mr. Taft said he was also interested in the reduction of slag and did not think it would have any adverse effect on the quality of castings.

[Members' appreciation was enthusiastically accorded.]

MR. HUNTER (president), in opening the meeting for general discussion, extended a welcome to members from other branches who were present, especially to Mr. P. A. Russell.

MR. ROWBOTHAM wondered whether any serious consideration had been given to making the inner shell of steel rather than in cast iron.

MR. DEWS said that this was not seriously considered, although being grey-iron founders, he and his colleagues might have been biased. With steel, he might have experienced trouble when the cupola was in operation. There was about ½-in. gap between the segments which was usually packed with ganister and any expansion was thus allowed for. There was not much expansion, because it was assumed the face of the segments would operate at a temperature of about 400 deg. C. When the cupola was actually being " blown down," it was sometimes possible to stand on the platform and look inside the shaft, and it could then be seen that the top of the segments appeared quite black, not even cherry red.

In reply to the question put by Mr. Francis, Mr. Dews said that the water cooling was kept running during the luncheon break, just as if the cupola was in operation.

MR. FORD asked, if Mr. Dews were starting the installation again from scratch, would he instal a single water-cooled cupola, or would he still require to work alternate cupolas on alternate days?

MR. DEWS said that the ideal was always to have a duplication of plant and it was a comforting thought to have another cupola which could be turned to in an emergency, but one cupola could fill the bill for one plant. He said he had sufficient confidence in the system, to put a cupola into operation on Monday morning and run it until Friday night.

Water System

MR. RUSSELL said he would also like to express his personal thanks to Mr. Dews; it was a real treat to get a Paper of this type, when a foundryman himself told members what he had done in the foundry from a practical point of view. His personal interest in the lecture that evening was that he was in process of installing a water-cooled cupola. He had learned a great deal from Mr. Dews' remarks and had gained a great deal of confidence. Three questions he would like to put were:—(1) How " hard " was the water which was being used, and was there any risk of pipes getting furred up; (2) was the pump capable of giving a variable output; and (3) how soon was the water system started when lighting-up the cupola?

MR. DEWS replied as follows:—

(1) The water used was quite " hard " and a certain amount of furring did occur. This was overcome by adding soda ash to the system periodically, and in fact no trouble had been experienced after two years' working. In this connection, a cooler was helpful because with re-circulated water only losses due to evaporation would have to be made up and thus the amount of deposit would be very limited.

(2) The pump had a variable output and between the pump and the cupola a valve was fitted, the setting of which controlled the amount of water passing into the segments.

(3) The pump was started as soon as the bed coke was ignited and continued running for one or two hours after the bottom was dropped. This was done to allow the segments to cool slowly and prevent undue stresses being set up.

DR. ANGUS asked whether there was any difference in melting losses or in the composition of the metal after a shut-down. Was there any effect on the carbon and silicon values in the initial stages of re-commencing a " blow " due to the heat lost from the melting zone during the break. He assumed that there was very little movement due to expansion of the cast-iron segments themselves, but he would expect some movement of the brickwork above and below the segments.

MR. DEWS said he could not give much information on chemical changes. His experience with intermittent melting had so far only covered phosphoric grey irons and no marked chemical changes had been noticed. He did not consider that heat losses during shut-down periods were appreciable. Movement of the brickwork did not seem to occur. The segments were placed immediately on top of the tuyere boxes and the normal brickwork was made good both above and below. No trouble had been experienced with any movement.

MR. MORGAN asked how thick was the lining of ganister on the face of the segments. Why were steel tubes used in the cooling blocks instead of simply cored passages?

Segment Design

MR. DEWS replied that the lining was ½-in. thick. Regarding the design of the segments, his firm had experience of this type of casting and considered it was easier to cast the job with a tubular structure as an insert than make a sand-cored casting of similar dimensions. Furthermore, the steel tubes gave immense strength and rigidity to the casting and if and when a casting cracked internal leaks did not appear. If the water passages had been cored every slight crack in the casting would represent a leak.

MR. HIRD asked whether the ½-in. lining on the segments was a calculated value or arrived at by trial and error.

MR. DEWS replied that ½ in. was the minimum thickness that could be applied which would stay.

MR. TWIGGER said from the illustration of two segments for use in the smaller cupolas, it appeared that these segments were chamfered where they would back on to the cupola shell, what was the purpose of this? Also, the segments seemed rather long in relation to their diameter, was this the reason for the increased coke ratio? If a new start was made, would shorter segments be used?

MR. DEWS said the design of these segments was such that replacement could be carried out easily. The length of 48 in. was standardized so that the cooled zone would always come above the bed coke, irrespective of the height of the bed.

Other Methods

MR. GRANT said that he knew of an installation where cooling was effected by allowing water to flow down the outside of the cupola shell. He understood that the lining, starting from about 6 in. thick, burned back to ½ in.; after this there was no further reduction and the cupola ran for several days quite efficiently. He asked whether Mr. Dews considered that there were any snags to this and whether there was any objection to this arrangement, as it seemed a very simple one.

MR. DEWS replied that he was aware of the system referred to and the fact that it cooled effectively was sufficient comment. Care would have to be taken, however, that all of the shell surface was covered with water the whole of the time or hot spots would develop locally, with possible burning through. In view of the rapid burn back of the lining there did not seem much point in lining to a depth much greater than ½ in. in the first place. In the system described in his Paper no lining was removed, and consequently the melting-zone diameter remained constant throughout the melt.

MR. PEARSON said he had two questions:—(1) Had any attempt been made to check the temperature gradient from the point of entry of the water to the outlet, *i.e.*, did the 20 deg. C. rise occur fairly early; and (2) was there any inspection of the segment casting which was scrapped? Was it broken up to see the condition of the tubes after fifty melts?

MR. DEWS answered the first question in the negative. All attempts to break the segment that was scrapped had failed, although it was cracked across the middle to such an extent that the steel tubes could be touched through the crack.

MR. WALTON asked the reason for the reduction of slag.

MR. DEWS said that was solely due to the fact that the walls of the cupola were no longer burned away.

At this point the president had to bring the discussion to a close, and again thanked Mr. Dews for his lecture and for the very frank and honest way he had presented it. Everyone, he was sure, was very grateful to him.

Birmingham Museum

Birmingham City Museum of Science and Industry, which is already achieving an international reputation, has been invited to send an exhibit to the International Convention of Museums at Milan in June. It is to send three display stands of aluminium sheet and veneered wood, bearing reproductions of James Watt, with drawings and pictures of the museum's work. Another project in hand is the preparation of replicas of historic Midland trades' workshops, which it is hoped to put on show to the public by the end of the year. The workshops represent only one of the ways in which the museum authorities plan to use part of these premises—the former Elkington works—which have not yet been open to the public. Other sections in preparation included a heavy-engine shop, which will house an Aveling Porter traction engine built in 1892, a lighthouse optic of 1883, an early Diesel engine made by the inventor himself, a lathe with a 10-ft. face-plate installed at the Soho Foundry probably in the 1840's and a 200-yr.-old tilt hammer for making edge tools.

Textile Machinery Exports

For a number of years since the war the progress in exporting textile machinery has been remarkable. Whereas total earnings from these goods in 1946 were £14,650,000, by last year they had risen to over £50m.

In the first quarter of the current year, however, there have been indications that the peak has been passed. The volume of exports at 23,576 tons valued at £11,281,645 compares with 28,406 tons worth £12,448,128 in the same period of 1952. The average price per ton has been £479, compared with £448 in 1952 and £415 in 1951. The chief consumers of textile machinery made in Britain have, for a considerable time, been India and Pakistan, although in the past year or two there has been a sharp increase in the quantity of plant taken by Italy.

Parliamentary

Steel Rationing Ended

Mr. G. R. Strauss (Vauxhall, Lab.), who was Minister of Supply in the last Labour Government, asked if the Government did not realize that the increased production of home steel, which made this step necessary, destroyed the whole case of its denationalization Bill and showed that it had no economic but only a doctrinaire justification. Would the Government now take the next logical step of saying that it would not pursue any further this measure to dislocate this magnificently successful publicly-owned industry?

Mr. Sandys replied that he had been answering that question for a number of weeks in the debates on the Iron and Steel Bill.

Replying to further questions, the Minister said that there were bound to be, even in normal times, shortages of particular specialized types of steel. Those shortages and difficulties could be dealt with only by detailed administrative arrangements. The maintenance of a general global steel allocation scheme would not in any way deal with those specialized difficulties.

Mr. Martin A. Lindsay (Solihull, C.) said that the decision to free iron and steel and copper would be greatly welcomed, both in Birmingham and the Black Country.

Mr. F. Lee (Newton, Lab.) asked the Minister whether, as production in the engineering industry was down and not up, as the Chancellor of the Exchequer had prophesied, and in view of the fact that there might be a shortage of steel in that industry, he was prepared to keep in reserve some type of allocation scheme in order to make certain that the most important products got priority.

Mr. Sandys said that some time ago, before ending rationing, the Government felt it desirable to make quite sure that there was not only enough steel but a little more than enough. In estimating demand, an increase of at least 6 per cent. in the consumption of steel by industry this year was assumed.

He told Mr. Douglas Jay (Battersea, N., Lab.) that nothing would affect the legal powers under the Supplies and Services Act.

Steel Bill in the Lords

When the House of Lords concluded the report stage of the Iron and Steel Bill, Lord Mancroft, on behalf of the Government, accepted an amendment moved by Lord Hawke which, Lord Hawke said, made it clear—in conjunction with another section of the Bill—that a whole-time member of the Board could not have a substantial financial interest in the iron and steel industry, and, secondly, recognized that a whole-time member of the Board might, in fact, hold some other appointment. Earlier, an amendment moved by Lord Wilmot, providing that the chairman and at least three other members of the Board would be whole-time members, was negatived.

Lord Mancroft gave an assurance that when the iron and steel industry was returned to private enterprise the Treasury would require large and important disposal operations by the Realization Agency to be referred to it for its consideration before approval was given. The Treasury, he said, would lay particulars of any such disposal operation before each House of Parliament in some convenient form as soon as practicable. This, he pointed out, could not be before the contractual obligation had been finally made between the Agency and the other parties to the operation.

The assurance arose from an Opposition amendment which was withdrawn.

An amendment moved by Lord Wilmot to extend the Board's duty concerning the supply of raw materials to include the supply of manganese ore as well as iron ore was accepted. He said that a number of people in the iron and steel industry were surprised when the Government resisted this proposal in committee because over 90 per cent. of the manganese ore imported was used by the industry.

The Bill was read a third time and passed on Tuesday. The amendments now return to the House of Commons. Earl Jowitt, Leader of the Opposition, said that he agreed with Lord Wilmot on the need for another Bill dealing with the industry if Labour were returned to power.

Lord Mancroft expressed the hope that the Bill would be accepted by industry with the same "goodwill and tolerance" that it had met with in Parliament.

Among bills to receive the Royal Assent last week was the Transport Bill—the first denationalization legislation to reach the statute book. The Minister of Transport is expected to announce the names of the members of the Disposal Board shortly.

It is expected that the Lords' amendments to the Iron and Steel Bill will come before the House of Commons this week.

A.E.U. Supports Engineers' Wage Claim

In his presidential address to the national committee of the Amalgamated Engineering Union, on May 4, Mr. Jack Tanner, president, confirmed that the union supported the decision made by the Confederation of Shipbuilding and Engineering Unions to claim a 15 per cent. increase in wage rates. At the same time he warned delegates that they should consider the matter very carefully in the light of the national and international situation. The resolution was unanimously approved by the national committee later last week.

In his speech, Mr. Tanner suggested that some machinery for the co-ordination of the nationalized industries should be set up so that the more profitable sections could assist in the capital investment necessary to increase the efficiency of other sections.

On May 5 the national committee unanimously decided to instruct the executive council to press for the introduction of a 40-hour week without loss of earnings, in place of the 44-hour working week as at present. A resolution calling for 16 days' paid holiday was carried.

B.R. Power Units Orders

Power units for 85 Diesel-electric, shunting locomotives to be built in 1954 and 1955 have been ordered by British Railways. Diesel engines, generators, traction motors, control gear, and instruments are included in the equipment.

Contracts are for 45 sets of equipment from the English Electric Company, Limited, which will include engines of the company's manufacture, 15 sets each from British Thomson-Houston Company, Limited, Rugby, and the General Electric Company, Limited, with Blackstone engines, and 10 sets from Crompton Parkinson Limited, Guiseley, with Crossley engines.

The official opening ceremony at the new ground of the Staveley Works Sports Club of the Staveley Iron & Chemical Company, Limited, at Handley Wood, near Chesterfield, will be performed by Lord Burghley on Saturday, May 16.

Personal

MR. F. H. BEASANT has been appointed a director of Anti-Attrition Metal Company, Limited.

MR. A. R. WIZARD, M.I.B.F., was last Thursday elected as a (Conservative) member of the City of Westminster Council, representing St. John's Ward.

MR. JOHN H. SMITH, secretary of John Lund, Limited, grinding machinery manufacturers, of Cross Hills, Keighley (Yorks), has been appointed a magistrate for Keighley.

MR. JOHN ALCOCK, chairman and managing director of the Hunslet Engine Company, Limited, Leeds, has been elected president of the Locomotive Manufacturers' Association.

MR. G. H. THORNLEY, technical manager of the group of companies controlled by C. C. Wakefield & Company, Limited, London, W.1, has been elected vice-president of the Institute of Petroleum.

MR. J. M. A. SMITH and MR. C. THACKER have been appointed directors of Ford Motor Company, Limited. Mr. Smith has hitherto been the company's director of finance and administration, and Mr. Thacker the director of manufacture.

MR. F. W. NEILD, secretary of the Lancashire branch of the Institute of British Foundrymen, has resigned his position as metallurgist with H. Wallwork & Company, Limited, and become techncial development manager to Foundry & Metallurgical Supplies, Limited.

MR. D. G. BROWN, managing director of the Redheugh Iron & Steel Company (1936), Limited, Teams, Gateshead, has been re-elected chairman of the Tyneside advisory committee of the Northern Regional Board for Industry. MR. W. HEPPELL, divisional organizer of the Amalgamated Engineering Union, has been re-elected vice-chairman.

Northern Aluminium Company, Limited, announce that MR. B. N. H. THORNELY, B.A., M.I.MECH.E., has been appointed to their Board of directors. Mr. Thornely has been successively assistant works manager, sales manager, on the staff of the director of operations of Aluminium, Limited, in Montreal, Canada, and returned to this country at the end of last year as chief engineer.

MR. WALTER COOPER, of Leicester, a foundry worker, employed by Pegson's Engineers, Coalville, has received a cheque for £50 from the directors of the company on completing 50 years' service with the firm and its predecessors. The presentation was made in the canteen by Mr. W. L. James, chairman of the company, who said Mr. Cooper was the first employee of Pegson's to complete 50 years' service.

MR. GEORGE P. JOSEPH, who has relinquished the chairmanship of Murex, Limited, metallurgists, etc., of Rainham (Essex), and of Murex Welding Processes, Limited, Waltham Cross (Herts), will continue as a director of Murex and its subsidiaries. He has been associated with the firm since its inception in 1908 and chairman since 1915. SIR ARTHUR SMOUT has accepted an invitation to fill the vacancies.

MR. GEOFFREY M. FLATHER, in 1951 the 312th Master Cutler, has now been elected president of the Sheffield Chamber of Commerce in succession to Mr. W. G. IBBERSON, whose association with the Chamber and the city is also of long standing. The new vice-president of the Chamber is MR. FRANK ARNOLD HURST, chairman of Samuel Osborn & Company, Limited, Sheffield, and other steel concerns. He is a founder member of the Sheffield Metallurgical Association, and was president of the Sheffield and District Rollers' and Tilters' Association from 1945-46, and a vice-president of the Sheffield and District Engineering Employers' Association.

Obituary

COLONEL C. H. LUMLEY, a director of Sigmund Pumps, Limited, Gateshead, has died at the age of 64.

MR. THOMAS YOUNG, chairman and managing director of Thomas Young & Sons (Shipbreakers), Limited, Sunderland, died on May 2 at the age of 76.

MR. JOHN PLEWS, director and secretary of Plews & Turner, Limited, textile engineers and ironfounders, of Elland (Yorks), died on May 3 at the age of 40.

FOUNDER of the Church Lane, West Bromwich, firm of Vowles Bros., Limited, aluminium and iron founders, Mr. Charles Vowles, died on Monday last, following a long illness. He was 80.

MR. ROBERT WILSON, who has died at the age of 57, was for 28 years shore superintendent of Metal Industries (Salvage), Limited, of Shandon (Dumbarton), and its predecessor, Cox & Danks, Limited.

MR. CHARLES B. TAYLOR, superintendent of the King Edward Factory of British Thomson-Houston Company, Limited, at Thorne, near Doncaster, has died at the age of 47. He joined the test department of the B.T.-H. Coventry works in 1927, becoming, in 1935, assistant chief tester and in October, 1951, transferred to the King Edward Factory, Thorne. Mr. Taylor was a member of the Coventry Engineering Society.

MR. LEONARD BRAIN, a director of Hale & Hale, Limited, Tipton, and an authority on the production of malleable iron in this country, has died at the age of 54. Born and educated in the Black Country, Mr. Brain joined the firm 25 years ago, after having been with grey-iron founders in the same area. Five years later he was appointed works manager and his co-directors attribute much of the company's success to his efforts. He became a director of the firm and its subsidiaries when it became a public company in 1936.

Mr. T. H. Summerson Honoured

A man of high distinction in the industrial life of the north has been chosen to succeed the late Sir Andrew Common as High Sheriff of the County of Durham. Mr. Thomas H. Summerson is, however, not only well known in the north, but all over the country in the foundry industry.

Thos. Summerson & Sons, Limited, of Darlington, of which he is chairman and joint managing director, is believed to be the oldest firm in the world engaged in the manufacture of switches and crossings, having been established by Mr. Summerson's forebears in 1840. Under his leadership the scope of the company's activities has been widely extended and, in addition to the extensive steel foundry at Darlington, the company now operates a big factory at Spennymoor.

Mr. Summerson, who was educated at Harrow, and played cricket for Durham County, is chairman of the British Steel Founders' Association. During the war he was director for steel castings in the Iron and Steel Control of the Ministry of Supply. Last year he was appointed chairman of the Home Affairs and Transport Division and an honorary vice-president of the British Chambers of Commerce. He is chairman and joint managing director of Summerson's Foundries, Limited, and chairman of three other companies, including Copelaw Engineering Company, Limited. He is also on the Boards of other companies.

News in Brief

So FAR the ex-German battleship Tirpitz has yielded 16,000 tons of scrap metal. The Tirpitz is lying at Tromso, North Norway. Another 40,000 tons of scrap remain to be salvaged and work is likely to go on until 1956.

THE GEORGE E. DAVIS memorial lecture of the Institution of Chemical Engineers is to be given by Mr. Norman Swindin, M.I.Chem.E., in the Reynolds Hall, College of Technology, Manchester, at 3 p.m. on Saturday, October 10.

THE FACTORIES of George Kent, Limited, at Luton, Resolven and London, will be closed for the annual works holiday from Friday evening, July 17, to Tuesday morning, August 4. Offices at all factories will remain open and staffed during the holiday.

THE EIGHTH ANNUAL DINNER and ladies' night of the Wolverhampton branch of the Institute of Welding was held in the Civic Hall, Wolverhampton, earlier this month. After eight years the branch remained the only one in the Institute to hold such a function.

IT HAS BEEN ANNOUNCED by the Argentine Ministry of Foreign Trade that the Central Bank will issue permits for the importation from various unnamed countries of goods worth over 2,200 million pesos, including refractory materials, wire and wire goods, and iron and steel.

MR. R. A. MACLEAN, chairman of the successful Scottish Industries Exhibition in 1949, is again in command for the 1954 exhibition, which is to be held in Kelvin Hall, Glasgow. Buyers from all over the world are expected to attend to place orders for Scotland's products.

MR. A. B. WARING, president of the Birmingham Chamber of Commerce, said, on May 4, that foreign representatives who had visited the B.I.F., Castle Bromwich, in the first week of the Fair, were emissaries from more than half the 112 territories abroad to which invitations had been sent.

C. A. PARSONS & COMPANY, LIMITED, Newcastle-upon-Tyne, have delivered to A. Reyrolle & Company, Limited, switchgear manufacturers, of Hebburn, the first of three 110-ton transformers for the new short-circuit test station due to be in full operation in the autumn. The other two will be delivered at intervals of six weeks.

THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY is organizing a special conference on the Casting of Light Metals. This is to be held from August 31 to September 4. Further information and application forms may be obtained from the Director of the Summer Session, Room 3-107, Massachusetts Institute of Technology, Cambridge 39, U.S.A.

A NEW FACTORY is to be erected at Thornliebank industrial estate, near Glasgow, for Vertimax, Limited, machine-tool producers. It is expected that building will begin in September, and that the firm will eventually provide employment for some 150 workers. The firm is a subsidiary of Andersons (Newton Mearns), Limited, motor engineers.

JOHN LEWIS & SONS, LIMITED, Aberdeen, have received orders for the construction of five vessels, four of which will be Diesel-engined trawlers, each 100 ft. long, for the West Hartlepool Steam Navigation Company, for which Crossley Bros., Limited, will supply the propelling machinery, and the other is a pontoon dock, 200 ft. long, for Aberdeen Harbour Commission.

DRIVEN "almost to distraction" by the constant thefts of metal from their premises, G. & R. Thomas, Limited, Hatherton Blast Furnaces, Bloxwich, Walsall, have decided to introduce Alsatian guard dogs, which will patrol the factory and grounds at night and during week-ends, in an effort to discourage the thieves. The first of the dogs is expected to be "on duty" within the next few days.

DEVELOPMENT OF THE AERO ENGINE INDUSTRY in Scotland and progress in the setting up of new research laboratories at East Kilbride were being studied on May 5 by the Earl of Home, Minister of State for Scotland, during a visit to the new town and to Hillington Industrial Estate. At the Rolls-Royce factories he was shown the rapidly-expanding production of Avon jet engines which are being turned out for the Canberra bombers, maintenance work on engines for the Comet airliner, and the recently-started Diesel-engine production.

I.T.D., LIMITED, 95/99, Ladbroke Grove, London, W.11, have been appointed sole world distributors for the "Wheelerweigh" automatic weighing device. This is a precision instrument designed for installation integrally with the Stacatruc fork-lift truck, on which, by simply depressing a small lever, the actual net weight of the load on the forks is instantly and clearly visible on a large dial. The Wheelerweigh is built in accordance with the latest recognized weighing machine practice, and indicates all weights to fine limits of accuracy. It is fully approved by the British Board of Trade Standards Department, and should therefore satisfy the official regulations laid down by all national bodies governing the use of weighing machines for trading purposes.

INSPECTORS OF TECHNICAL EDUCATION from three of the five Brussels Treaty countries visited the Midlands on May 4 and after a tour of the Birmingham College of Technology, they went on to the National Foundry College, Wolverhampton, and the Wolverhampton and Staffordshire Technical College. The inspectors are studying the connection between industry and technical education in this country. On May 5, the party of eight, consisting of four inspectors from France, three from Belgium, and one from Holland, were the guests of the British Thomson-Houston Company, Limited, Rugby, where they investigated apprenticeship schemes, and toured Rugby Technical College. The leader of the French party, Mr. Reneaudau, was particularly impressed by Britain's system of providing opportunities for youths to start at the bottom in engineering and work their way up.

UNDER THE RECENT AGREEMENT between English Steel Corporation, Limited, and General Steel Castings Corporation, of Granite City, U.S.A., the British concern will produce in quantity special railway castings of a type which they have already been developing, such as one-piece bogies, locomotive frames, etc. The benefits of the joint enterprise are clear. There will be an interchange of "know-how" on design and foundry technique, and a consequent expansion of the scope of production and sales, particularly in the field of exports. Already this work has begun. Senior officials of English Steel Corporation are in the United States, five foundry technicians recently sailed in the Queen Mary and more are to follow this year. They will study the practices and techniques of the General Steel Castings Corporation relevant to the agreement and will also visit other works in connection with products already made by English Steel Corporation, Limited. The importance of the work done by the firm's personnel in the U.S.A., Canada and the other important world markets can be measured by the fact that four out of every five of the Corporation's products are directly or indirectly exported.

Raw Material Markets

Iron and Steel

Last week's announcement by the Minister of Supply concerning the ending of the control on the distribution of iron and steel means that all grades of foundry and forge pig-iron, including hematite and refined irons, can now be obtained without a licence. Fears that decontrol might result in a spate of buying are believed to have deterred the Government from making an earlier decision regarding the ending of control. In trade circles, however, it is generally felt that only a revival in business will lead to any marked rise in the demand for pig-iron, as for some time past, many foundries have not been taking up their licensed quantities. It is unlikely that they will now buy additional tonnages to place into stock.

The current level of production of all descriptions of foundry iron is not excessive, so that the furnaces would be able to despatch unlimited quantities. This applies particularly to hematite and the low- and medium-phosphorus grades, which are not too plentiful even at today's restricted demand. It applies also, if to a lesser degree, to high-phosphorus iron, the production of which is reduced because of the prior claims of the steelmakers.

The present demand for castings is well below that of a year ago, particularly in the first half of 1952 when producers of all types of casting were heavily engaged, their combined outputs resulting in record figures. Since that time business has continued to decline, resulting in short-time working and redundancy of labour. This position has not yet been arrested, but there now appears to be a slightly more optimistic feeling in the trade that conditions are not likely to worsen and, in fact, that there is a prospect of some early improvement.

Foundries are reaping some benefit from the seasonal demands of such trades as agriculture and building, in which both the jobbing and light foundries participate, and the further incentive which has been given to buyers of domestic equipment, etc., by the reduction in purchase tax is expected to bring in its train a greater demand for castings from the light foundries. Some improvement, if only slight, is also evident in the textile industry, and the engineering and speciality foundries producing castings for the trades chiefly concerned with the export markets, including the motor, tractor, and Diesel-engine makers, as well as the light foundries making baths, cisterns, heating and cooking apparatus, etc., anticipate improved buying from oversea with the better financial position of some countries abroad.

Raw materials for the foundries are, in the main, easy to obtain, as pig-iron supplies, coke, and scrap are at hand to satisfy current requirements. Most foundries are content to buy iron only for immediate needs, and stocks, where they exist, are being utilized. Producing furnaces are chiefly engaged in supplying the steelworks with basic pig-iron, the melting furnaces being still mainly dependent on pig-iron in view of the present shortage of scrap.

The allocations of cupola and furnace coke for the summer period May 4 to October 31 have now been made. These cover estimated consumption requirements and, in addition, make provision for an end-of-summer stock equal to six weeks' winter consumption in the case of furnace coke (for heating and core-oven purposes) and four weeks for foundry coke.

Non-ferrous Metals

It cannot be said that the decision to free copper has given a fillip to business; on the contrary, buyers are more inclined than ever to hold off for they feel that the free market will certainly bring about a sharp fall in the price. How right they are in this conjecture remains to be seen, but, obviously, the extent of the decline must depend upon what happens to the Ministry's price in the interim. That in turn depends on the course of values in the United States, for our price is now linked to the U.S. domestic quotation, which, at the moment, is almost dead on 30 cents. There is doubtless the odd seller at 29½ cents, and for July and August lower than this would be accepted, say, 28 cents.

There is certainly a tendency to talk copper down both in the United States and on this side, but, so far as one can tell, business in non-ferrous metals in the States is still quite good, although consumers there are not buying far ahead. On the contrary, in the U.K. demand is not at all good and the rate of consumption is poor and likely to remain so, for nobody appears to trust the price. Many people feel that the three months' interval before the free market opens is not any too long for all that has to be done, not only in getting the Metal Exchange contract ready, but also in arranging for supplies to consumers, who will no longer have the Ministry to turn to for their copper.

Markets of late have been steady to firm. Business in zinc is not too good in the U.K; users are buying hand to mouth, and seem determined to stick to this policy. The lead market last week showed no change for May, but August gained 15s. so that at the close the backwardation was no more than 10s., a noteworthy and satisfactory change which will be welcomed by all concerned with this metal. The tin market is still unstable and liable to wide fluctuations, while the underlying tone of the market is rather weak. Most people, in fact, look for a lower level later in the year.

Official tin quotations:—

Cash—May 7, £770 to £775; May 8, £750 to £755; May 11, £730 to £735; May 12, £730 to £740; May 13, £740 to £745.

Three Months—May 7, £767 10s. to £772 10s.; May 8, £745 to £750; May 11, £730 to £735; May 12, £730 to £735; May 13, £730 to £735.

Official zinc prices were as follow:—

May—May 7, £68 10s. to £68 12s. 6d.; May 8, £68 12s. 6d. to £68 15s.; May 11, £68 5s. to £68 7s. 6d.; May 12, £68 to £68 2s. 6d.; May 13, £68 7s. 6d. to £68 12s. 6d.

August—May 7, £68 12s. 6d. to £68 15s.; May 8, £68 15s. to £69; May 11, £68 15s. to £69; May 12, £68 to £68 5s.; May 13, £68 15s. to £69.

Official prices of refined pig-lead were:—

May—May 7, £79 to £79 5s.; May 8, £79 to £79 10s.; May 11, £78 15s. to £79; May 12, £77 7s. 6d. to £77 15s.; May 13, £79 5s. to £79 10s.

August—May 7, £78 15s. to £79; May 8, £78 15s. to £79; May 11, £78 to £78 5s.; May 12, £76 15s. to £77; May 13, £78 to £78 5s.

Design, Installation and Operation of a Water-cooled Cupola

An error appeared in the caption to Figs. 3 and 4 of the first section of this Paper, which was printed last week. It should have read:—"*Fig. 3 (left)—View of the Cupola Shaft showing Melting Zone after dropping the Bottom of the 38-in. Cupola. Fig. 4 (right)—View from the Same Position after Re-lining with Ganister.*

METAL PROCESSES, LIMITED, Erdington, Birmingham, are celebrating their coming-of-age this month, having been founded in May, 1932, by Mr. W. J. Turner, the present managing director.

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

(Delivered unless otherwise stated)

May 13, 1953

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2 :—Middlesbrough, £13 18s.; Birmingham, £13 11s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £16 14s. 6d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £17 0s. 3d.

Scotch Iron.—No. 3 foundry, £16 11s., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £18 3s.; South Zone, £18 5s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £19 3s.; South Zone, £19 5s. 6d.

Hematite.—Si up to 2½ per cent., S. & P. over 0.03 to 0.05 per cent. :—N.-E. Coast and N.-W. Coast of England, £16 12s.; Scotland (Scotch iron), £16 18s. 6d.; Sheffield, £17 13s.; Birmingham, £17 19s. 6d.; Wales (Welsh iron), £16 18s. 6d.

Basic Pig-iron.—£14 6s. 6d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered).

Ferro-silicon (6-ton lots).—40/55 per cent., £57 10s., basis 45 per cent. Si, scale 21s. 6d. per unit; 70/84 per cent., £86, basis 75 per cent. Si, scale 23s. per unit.

Ferro-vanadium.—50/60 per cent., 23s. 8d. to 25s. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 10s. to 11s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £204 to £210 per ton; 38/40 per cent., £235 to £265 per ton.

Ferro-tungsten.—80/85 per cent., 22s. 10d. to 23s. 6d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 25s. 9d. to 28s. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent. C, £85 4s., basis 60 per cent. Cr, scale 28s. 3d. per unit: 6/8 per cent. C, £80 17s., basis 60 per cent. Cr, scale 26s. 9d. per unit; max. 2 per cent. C, 2s. per lb. Cr; max. 1 per cent. C, 2s. 2½d. per lb. Cr; max. 0.15 per cent. C, 2s. 3½d. per lb. Cr; max. 0.10 per cent. C, 2s. 3¾d. per lb. Cr; max. 0.06 per cent. C, 2s. 4d. per lb. Cr.

Cobalt.—98/99 per cent., 20s. per lb.

Metallic Chromium.—98/99 per cent., 6s. 5d. to 7s. 6d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £262 to £275 per ton; 96/98 per cent., £280 to £295 per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 40s. to 70s. per lb., Nb + Ta.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 12s. 6d.; tested, 0.08 to 0.25 per cent. C (100-ton lots), £26 2s. 6d.; hard (0.42 to 0.60 per cent. C), £28; silico-manganese, £33 16s.; free-cutting, £28 16s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £32 12s.; case-hardening, £33; silico-manganese, £34 17s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 16s.; basic, hard, over 0.41 up to 0.60 per cent. C, £30 16s.; acid, up to 0.25 per cent. C, £33.

Sheet and Tinplate Bars.—£25 11s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £30 6s. 6d.; boiler plates (N.-E. Coast), £31 14s.; floor plates (N.-E. Coast), £31 15s. 6d.; heavy joists, sections, and bars (angle basis), N.-E. Coast, £28 9s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £32 4s. 6d.; flats, 5 in. wide and under, £32 4s. 6d.; hoop and strip, £32 19s. 6d.; black sheets, 17/20 g., £41 6s.; galvanized corrugated sheets, 24 g., £50 13s. 6d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £51 14s. 3d.; nickel-chrome, £73 3s. 6d.; nickel-chrome-molybdenum, £80 18s. 3d.

Tinplates.—57s. 9d. per basis box.

NON-FERROUS METALS

Copper.—Electrolytic, £253; high-grade fire-refined, £252 10s.; fire-refined of not less than 99.7 per cent., £252; ditto, 99.2 per cent., £251 10s.; black hot-rolled wire rods, £262 12s. 6d.

Tin.—Cash, £740 to £745; three months, £730 to £735; settlement, £740.

Zinc.—May, £68 7s. 6d. to £68 12s. 6d.; August, £68 15s. to £69.

Refined Pig-lead—May, £79 5s. to £79 10s.; August, £78 to £78 5s.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £95 7s. 6d.; rolled zinc (boiler plates), all English destinations, £93 12s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £99.

Other Metals.—Aluminium, ingots, £161; magnesium, ingots, 2s. 10½d. per lb.; antimony, English, 99 per cent., £225; quicksilver, ex warehouse, £70 10s. to £71 (nom.); nickel, £483.

Brass.—Solid-drawn tubes, 23d. per lb.; rods, drawn, 32⅜d.: sheets to 10 w.g., 255s. 3d. per cwt.; wire, 30¼d.; rolled metal, 242s. per cwt.

Copper Tubes, etc.—Solid-drawn tubes, 28⅞d. per lb.; wire, 282s. 9d. per cwt. basis; 20 s.w.g., 311s. 9d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £165 to £218; BS. 1400—LG3—1 (86/7/5/2), £175 to £238; BS. 1400—G1—1 (88/10/2), £255 to £375; Admiralty GM (88/10/2), virgin quality, £275 to £380 per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £275 to £385; L.P.Bl, £215 to £275 per ton.

Phosphor Bronze.—Strip, 368s. per cwt.; sheets to 10 w.g., 389s. 9d. per cwt.; wire, 43⅜d. per lb.; rods, 40d.; tubes, 38¼d.; chill cast bars: solids 3s. 3d., cored 3s. 4d. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 2s. 5¾d. per lb. (7 per cent.) to 3s. 8⅞d. (30 per cent.); rolled metal, 3 in. to 9 in. wide × .056, 2s. 11⅜d. (7 per cent.) to 4s. 2⅞d. (30 per cent.); to 12 in. wide × .056, 3s. to 4s. 3d.; to 25 in. wide × .056, 3s. 2d. to 4s. 5d. Spoon and fork metal, unsheared, 2s. 8¾d. to 3s. 11⅝d. Wire, 10 g., in coils, 3s. 6½d. (10 per cent.) to 4s. 8⅜d. (30 per cent.). Special quality turning rod, 10 per cent., 3s. 5½d.; 15 per cent., 3s. 11½d.; 18 per cent., 4s. 4d. All prices are net.

Forthcoming Events

MAY 18

Incorporated Plant Engineers

Liverpool branch:—Plant Maintenance Team's visit to U.S.A., report by Colin Troup, B.Sc., 7.15 p.m., at Radiant House, Bold Street.

MAY 19

Herts Discussion group:—"Sound Control in Industry," by W. A. Hines and D. G. Smart, 7.30 p.m., at the Peahen Hotel, St. Albans.

MAY 21

Purchasing Officers' Association

Yorkshire branch:—Works visit to Imperial Chemical Industries, Limited, Bradford. Branch meeting and social at the Great Northern Hotel, Leeds.

MAY 22

Institution of Production Engineers

Yorkshire graduate section:—Works visit to Wm. Asquith, Limited, High Road, Halifax, 6.45 for 7 p.m.

MAY 27

Shrewsbury section:—"Electronics as an aid to Productivity," by R. McKennell, 7.30 p.m., at the Shrewsbury Technical College.

Institute of British Foundrymen

Birmingham branch:—"Some Practical Aspects of Aluminium Founding," by E. Raybould, 7.15 p.m., at James Watt Memorial Institute.

MAY 29

Incorporated Plant Engineers

Birmingham branch:—"Dust Control," by R. J. Pitt, 7.30 p.m., at the Imperial Hotel.

IN HIS ANNUAL REVIEW the chairman of Beyer, Peacock & Company, Limited, locomotive engineers, and iron and steel founders, of Gorton, Manchester, states that in 1952 the group showed a profit before tax of £448,364—a reduction of £56,374 gross compared with the previous year.

AN EXPERIMENTAL ATOMIC POWER STATION—the first in the world—is to be built on the Calder Hall site adjoining the Ministry of Supply Atomic Energy Establishment at Windscale, Sellafield (Cumberland). Making this announcement in the House of Commons recently Mr. Duncan Sandys, Minister of Supply, said that work on the preparation of the site would start "in a few days' time."

CLYDE SHIPBREAKERS have obtained two oil tankers for breaking up; one is British Architect, of 7,388 tons, owned by the British Tanker Company, Limited, which is to be reduced at Port Glasgow by Smith & Houston, Limited. The other vessel is British Commodore, owned by the same company and built 30 yrs. ago. It is of 7,000 tons and will be broken up at Faslane by Metal Industries, Limited.

THE SPECIAL CRIME SQUAD of experienced detectives which has operated in Birmingham since February, 1952, has succeeded in breaking up a number of high-organized groups of metal thieves in the Midlands, the Chief Constable of Birmingham (Mr. E. J. Dodd) states in his recently issued report for 1952. The results of establishing the special squad to combat that type of crime have far exceeded expectations, and lengthy terms of imprisonment have been imposed on leaders of the gangs.

FIVE NEW ELECTRODES for electric-arc welding are announced by Murex Welding Processes, Limited, Waltham Cross, Herts. These electrodes are "Speedex," "Deepex," "Ferex B," "Contex" and "Cinnifex." The last named is a new type of electrode for welding cast iron, and is produced essentially for the welding of nodular and other types of cast iron with high ductility. The deposit has a composition of 55 per cent. nickel and 45 per cent. iron. The electrode is also suitable for welding ordinary cast iron where high strength is required.

CLASSIFIED ADVERTISEMENTS

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

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

SITUATIONS WANTED

FOUNDRY PLANT ENGINEER, young, energetic, executive experience of design, development, maintenance, and technical sales, seeks working Partnership.—Box 3454, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER (44), M.I.B.F., desires progressive post. Experienced full control of jobbing, engineering, and mechanised foundries. Capable organiser; good profit record; sound experience costing, estimating, for competitive markets.—Box 3433, FOUNDRY TRADE JOURNAL.

PURCHASING OFFICER, M.P.O.A., with large concern Ironfounders and Vitreous Enamellers, desires change. Excellent knowledge of trade and valuable connections.—Box 3465, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order 1952.

FOUNDRY FOREMAN required for Iron Foundry in South Wales. Output up to 20 tons per week, max. 2 tons. Experienced in floor and mechanical work. State age, experience and salary required. House available.—Apply Box 3452, FOUNDRY TRADE JOURNAL.

FOREMAN for Foundry in North Wales. Able to take charge of section producing castings up to 3 tons.—Reply, stating age, experience, and salary required, to BERSHAM FOUNDRY, LTD., Rhostyllen, near Wrexham.

WELL-KNOWN Malleable Iron Foundry in the Midlands, producing castings from a few ounces to 5 cwts. for the motor, engineering, agricultural, shipbuilding and electrical trades, requires REPRESENTATION in Scotland. Apply Box 3482, FOUNDRY TRADE JOURNAL.

HOOVER (ELECTRIC MOTORS), LTD., Cambuslang, Scotland, invite applications for the post of METALLURGIST. Candidates must possess a Degree or Higher National Certificate in Metallurgy. Experience of pressure die-casting and chemistry preferred. Salary will be commensurate with training and experience. — Applications should be addressed to the PERSONNEL MANAGER.

FOUNDRY MANAGER required, to take charge of Pattern Shop and Foundry manufacturing Cast Iron and Non-ferrous Castings for Machine Tools. Age 32 to 50. Only applicants who have excellent practical and technical qualifications and who have held a similar position of authority will be considered.—Applications in writing to THOMAS WHITE & SONS, LTD., Laighpark Works, Paisley.

SITUATIONS VACANT—*Contd.*

TECHNICAL REPRESENTATIVE wanted for E. London and Eastern Counties. Metallurgical knowledge covering ferrous and non-ferrous metal forming processes. Car owner. Salary, expenses and commission. Replies in confidence.—Box 3480, FOUNDRY TRADE JOURNAL.

LEAD Refining FOREMAN SUPERVISOR required by Birmingham Refiners. Must be energetic, with sound knowledge of Lead Refining operations, etc., and fully capable of all labour control. Full details of age, experience, and salary required.—Box 3475, FOUNDRY TRADE JOURNAL.

THE DAVID BROWN FOUNDRIES COMPANY, Penistone, near Sheffield, require a METALLURGICAL ASSISTANT in the Research Laboratory. Applicants should preferably be of graduate standard with experience of Metallography.—Reply, stating age and full particulars, to PERSONNEL SUPERINTENDENT.

WORKS SUPERINTENDENT for large Vitreous Enamel Plant, Birmingham district. Experience in processing cast iron, control of labour, and piece work pricing essential. Good prospects. Staff superannuation.—Apply Box 3477, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN (35/45) required for Iron Foundry producing castings in grey and high duty iron up to 3 tons in weight. Sand Slinger and Machine Moulding experience essential. Gloucestershire; modern house available. Applicants should state in confidence their complete experience, age, and salary required.—Box 3476, FOUNDRY TRADE JOURNAL.

SOUTH AFRICA.—An important concern in the Midlands requires a METALLURGIST, with a knowledge of chemical analysis, aged about 25 to 30, for a permanent position in Johannesburg. There is considerable scope for advancement for a keen young man. A knowledge of general foundry practice is desirable but not essential.—Reply Box 3472, FOUNDRY TRADE JOURNAL.

SALES MANAGER.—Applications are invited for the post of Sales Manager for modern foundry producing ferrous and non-ferrous castings. South of England. Experience of Sales in foundry and engineering industry essential. Mechanical or metallurgical background an advantage. Housing available. Good salary and excellent prospects.—Box 3473, FOUNDRY TRADE JOURNAL.

DEPUTY CHIEF RADIOLOGIST required for large X-ray Laboratory examining aircraft castings. Applicants should have sound knowledge of radiology and metallurgy and must possess drive, initiative and organising ability. Applicants will be treated in strict confidence. Salary according to experience and ability. —Apply to Box 3467, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

METHODS ESTIMATOR RATEFIXER wanted. Wide, practical, technical and commercial experience on semi-mechanised plant—High Duty and Grey Iron. Job offers scope for man with initiative.—Write, giving full particulars of experience, and salary, to SYKES & HARRISON, LTD., Port Penrhyn, Bangor, North Wales.

REPRESENTATIVE required for first-class Non-ferrous Foundry in the London area. Able to introduce substantial business. Good connections essential. Excellent possibilities and remuneration to right man. State full particulars in the first instance in confidence.—Apply Box 3478, FOUNDRY TRADE JOURNAL.

A FIRM manufacturing Precision Aircraft Instruments in South Wales require young ASSISTANT METALLURGIST, H.N.C., L.I.M., or degree standard, preferably with some experience of physical testing, heat treatment, and metallographic examination of ferrous and non-ferrous alloys.—Apply Box 3474, FOUNDRY TRADE JOURNAL.

DRAUGHTSMAN (PLANT).—Experienced Mechanical Draughtsman required, with knowledge of foundry layout. Prospects of taking charge of Works Drawing Office of large well-known Engineers and Founders in South London area. Applicants should be between 25 and 40 years of age. Give details of experience.—Box 3479, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN required for Steel Foundry at a salary of £700 per annum. Knowledge of modern methods of production and mechanisation are essential together with the ability to control labour. Housing accommodation will be provided for the successful applicant. Full details of age and experience to date should be sent to Box 3460, FOUNDRY TRADE JOURNAL.

WELL-KNOWN Midland Ironfounders require SALES REPRESENTATIVES for Greater London area, South and South-Eastern Counties and West Country. Only applicants with established connections with Engineers and real knowledge of Grey Iron and High Duty Castings from 1 lb. to 2 tons in weight will be considered. Company also operates Shell Moulding Process producing castings of extreme accuracy.—Box 3469, FOUNDRY TRADE JOURNAL.

BOMBAY.—FOUNDRY MANAGER required for progressive company. Must be familiar with the production of High Grade Cast Iron for Glass Moulds. A good all-round man is sought who can contribute to the development of the Foundry; it would be an advantage for him to possess technical ability. A high salary will be paid. All travelling expenses fully covered, and living accommodation commensurate with the position included.—Box 3481, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

SYNTHETIC RESIN MANUFACTURERS require Representatives to handle sales of their Core and Shell Moulding Resins. Apply giving full details of age, qualifications and Foundry experience.—Box 3431, FOUNDRY TRADE JOURNAL.

TIME AND MOTION STUDY. Man required for Repetition Foundry to carry out all duties of Time Study work. Applicant should have held similar position and be fully conversant with foundry practice. Excellent opportunity for young man, with possibility of advancement. Please reply giving full particulars of past experience and salary required to Box 3450, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER required for medium sized foundry producing Blackheart Malleable Iron. Applicant should be fully experienced and have the necessary technical knowledge to control all branches of the foundry. This is a good opportunity for a man capable of producing results. Please reply giving full particulars of past experience and salary required to Box 3463, FOUNDRY TRADE JOURNAL.

DRESSER (Foreman) for Steel Foundry in Scotland. Must be experienced in Heat Treatment, Dressing and Welding of medium weight castings, the output of which is approximately 300 tons per month. Applicant should be a good disciplinarian and must possess initiative and ability to organise. Must have had previous control of labour. House available. Superannuation Scheme operates. Apply stating age, salary expected and full particulars of experience to Box 3444, FOUNDRY TRADE JOURNAL.

NON-FERROUS FOUNDRY.—Fully experienced FOREMAN required, to take complete control of small, modern, Non-ferrous Foundry situated in Birmingham district. The advertisers, who are specialists in the Industrial Gearing trade, will only consider an applicant who has had previous similar experience as a Foreman and who is fully practical as well as technical. Staff position.—Apply in first instance, with full details of past experience, age, and salary required, to Box 3456, FOUNDRY TRADE JOURNAL.

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IRONFOUNDRY PREMISES and plant for sale; Yorkshire, (W.R.); freehold; 2-ton Cupola; 2-ton Crane, Pneulec Royer, etc.—Box 3470, FOUNDRY TRADE JOURNAL.

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MORRIS Screenarator Sand Conditioner.—Box 3411, FOUNDRY TRADE JOURNAL.

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TENSILE TEST MACHINE required for non-ferrous test bars. Capacity up to 10 tons load. Must be in good condition in view of subsequent A.I.D. Approval. Full particulars to Box 3446, FOUNDRY TRADE JOURNAL.

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TWO-ROLL MORTAR MILL required. 9 ft. or 10 ft. dia. pan. Rotary pan type. Second-hand. Must be in reasonable condition. Price and full particulars to Works Engineer, DARTMOUTH AUTO CASTINGS LTD., Dartmouth Road Smethwick, 40.

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M55 Pressure Zinc Die Casting Machine; as new.—'Phone CALPER, LTD., ENT. 4327.

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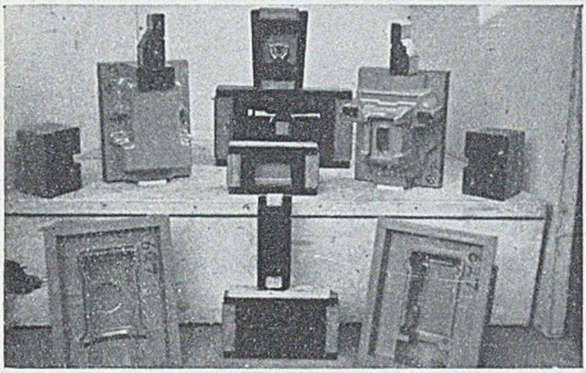

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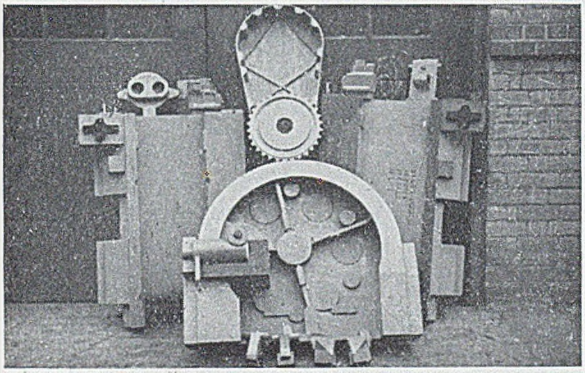

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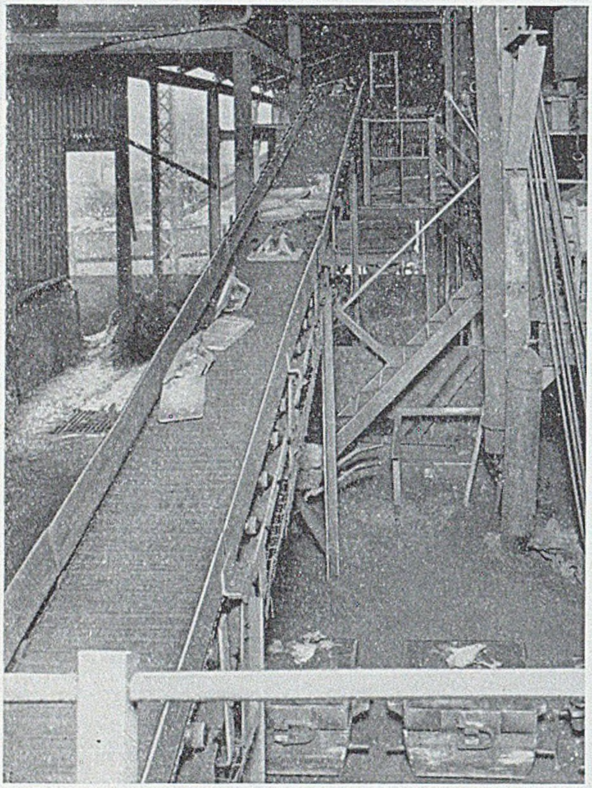

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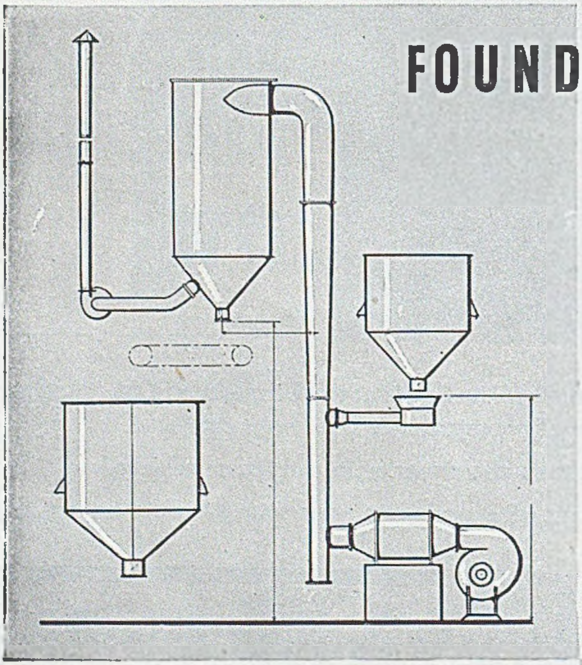

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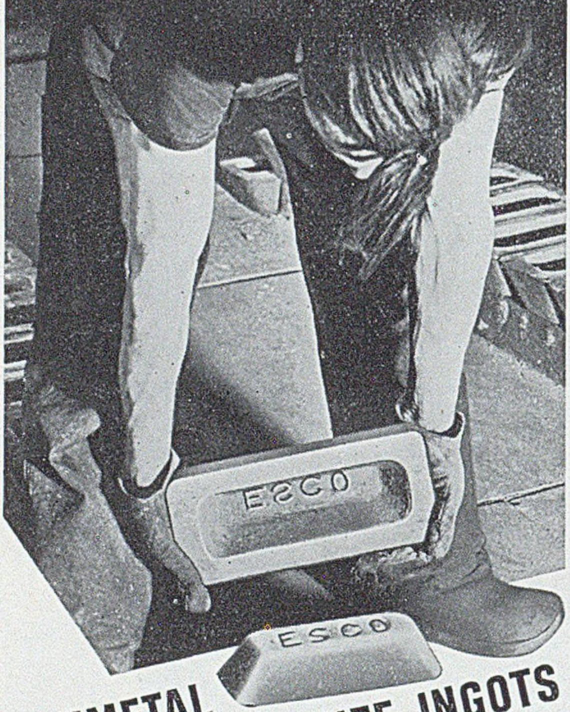

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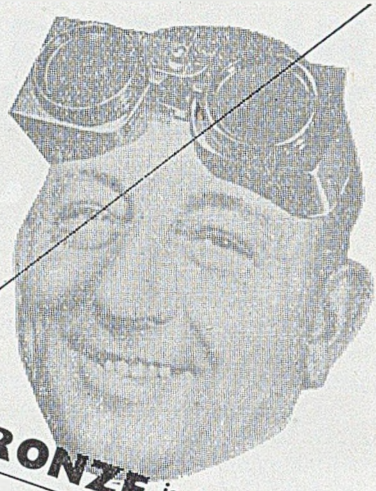

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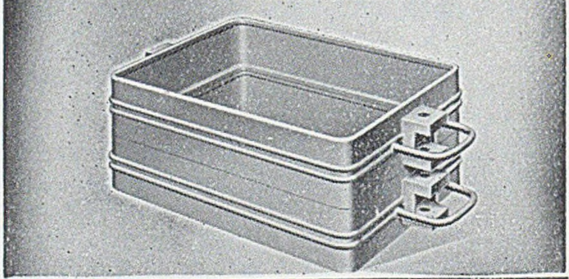

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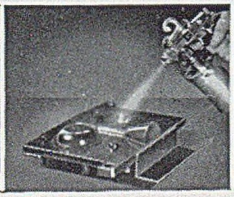
3 *The partially cured resin/sand mixture formed on the hot pattern before stoving.*

4 *The heat-hardened half-mould being stripped from the pattern.*

5 *Molten metal being run into the shell.*


1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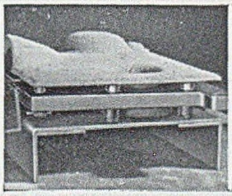
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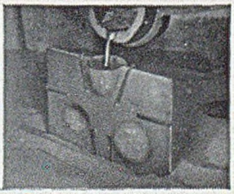
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