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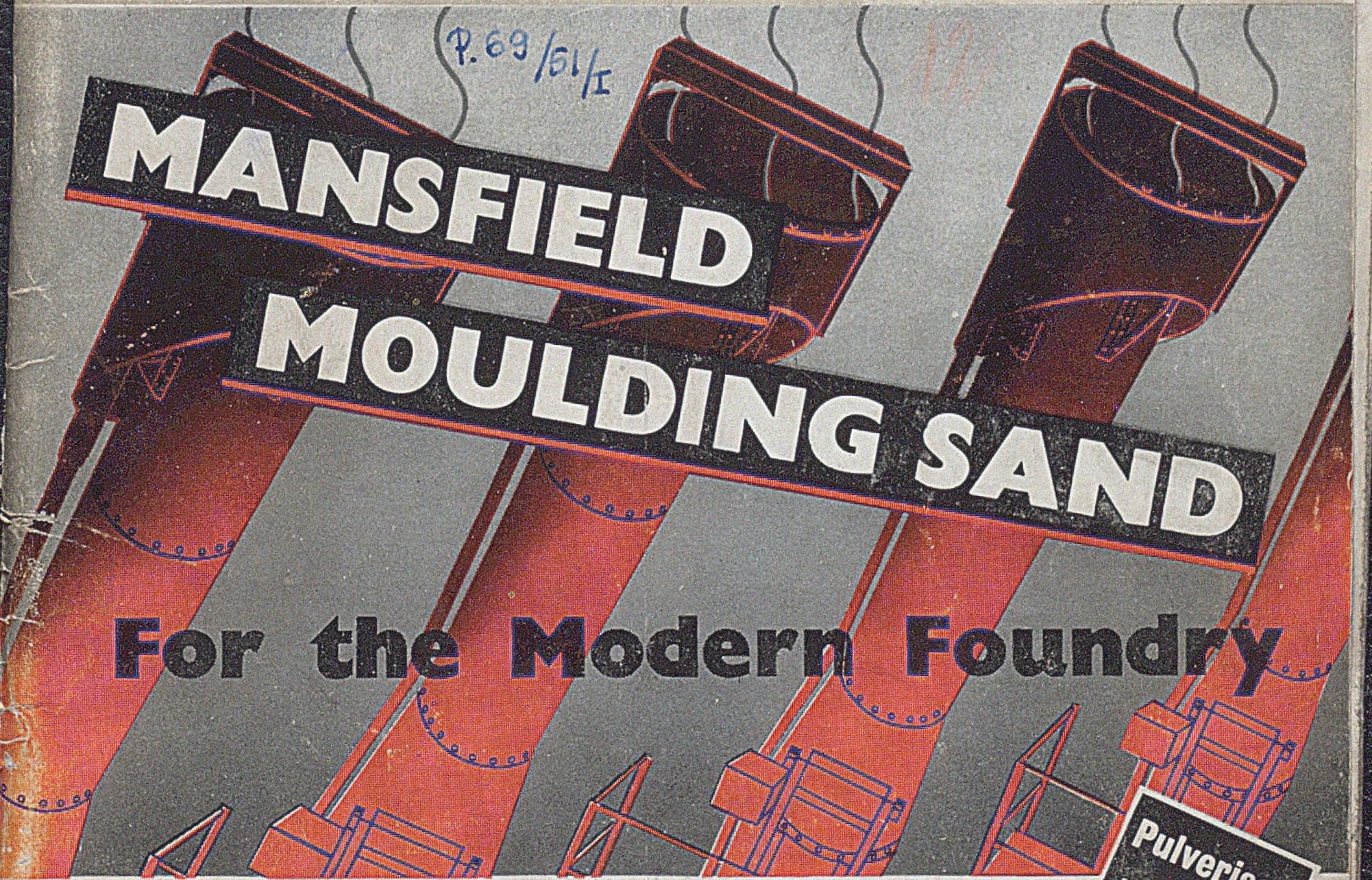

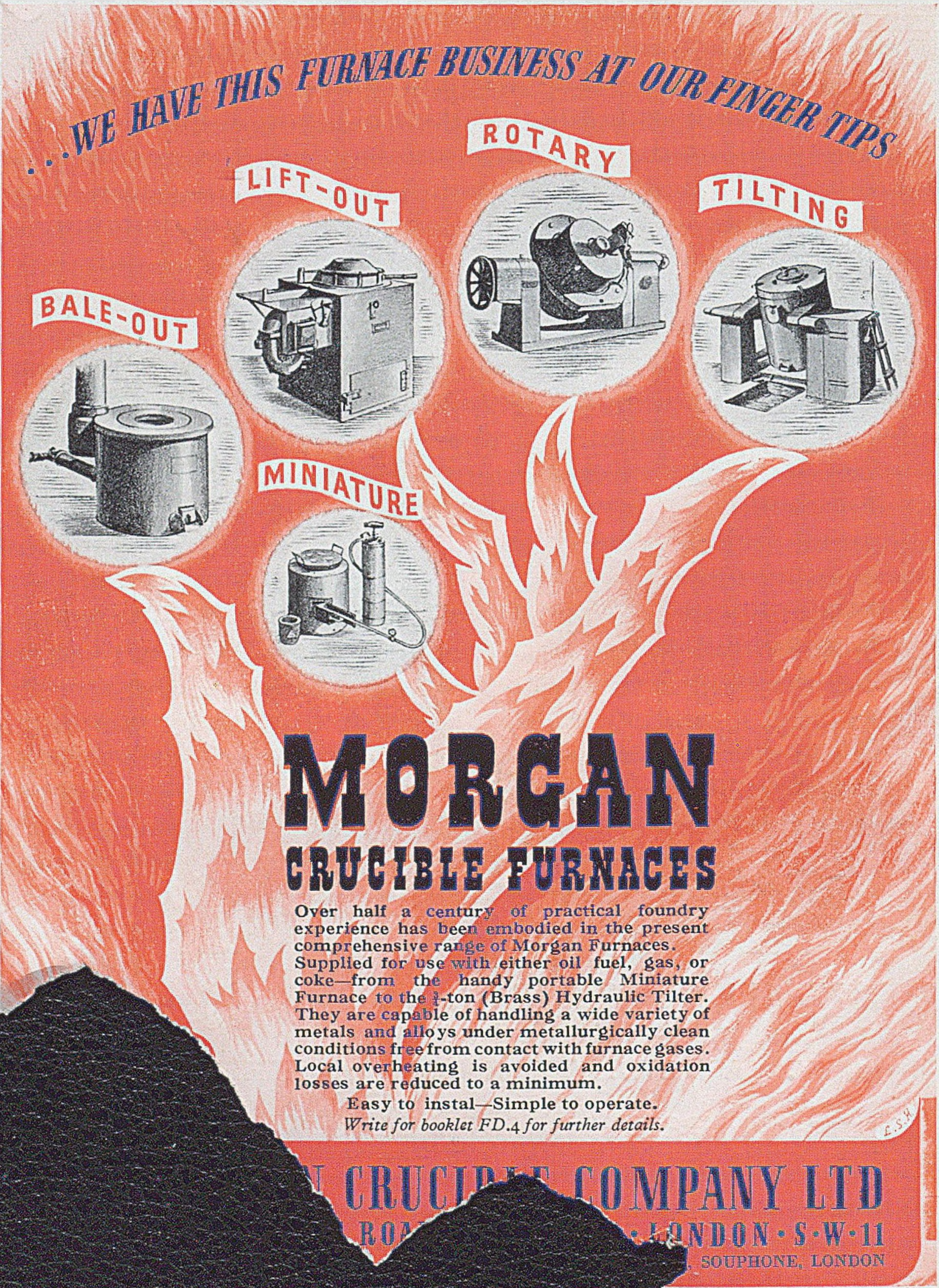

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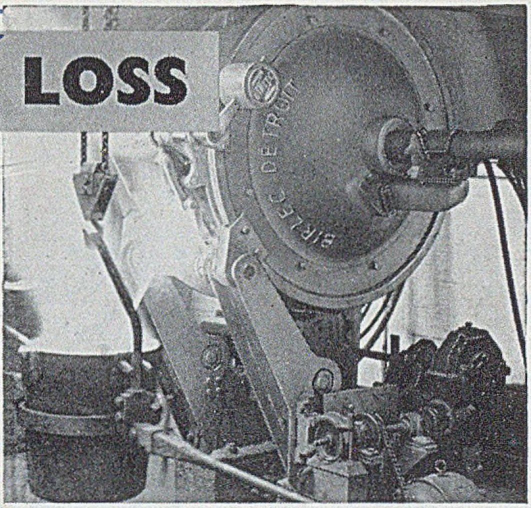
LOW MELTING LOSS



BIRLEC-DETROIT arc melting furnaces are remarkable for their low-melting loss figures as these recent test results show.

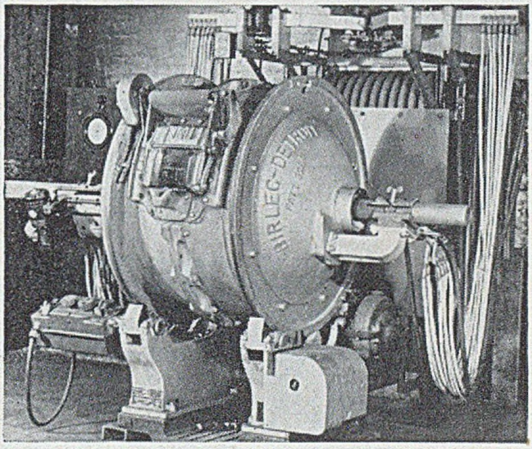
The test consisted of charging, remelting and re-ingotting six times a pre-alloyed metal of Cu 85 : Pb5 : Sn 5 and Zn 5 composition in a 500 lb. nominal capacity furnace. No additions were made during the test.

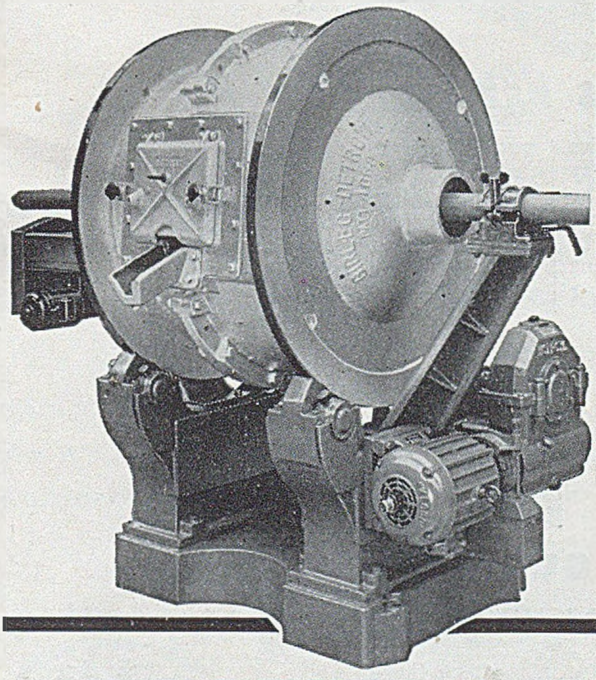
Summary of Melting Tests

Heat No.	Total Loss %	Temp. °C	Melting Time (Mins.)	Total power consumption (kWh).
1	1.40	1070	61	135
2	0.75	1220	31	95
3	0.47	1080	22	65
4	2.02	1160	41	80
5	0.49	1160	27	62
6	0.00	1160	27	62

Total loss over 6 heats = 24 lb.

LOSS PER HEAT ... = 0.77%

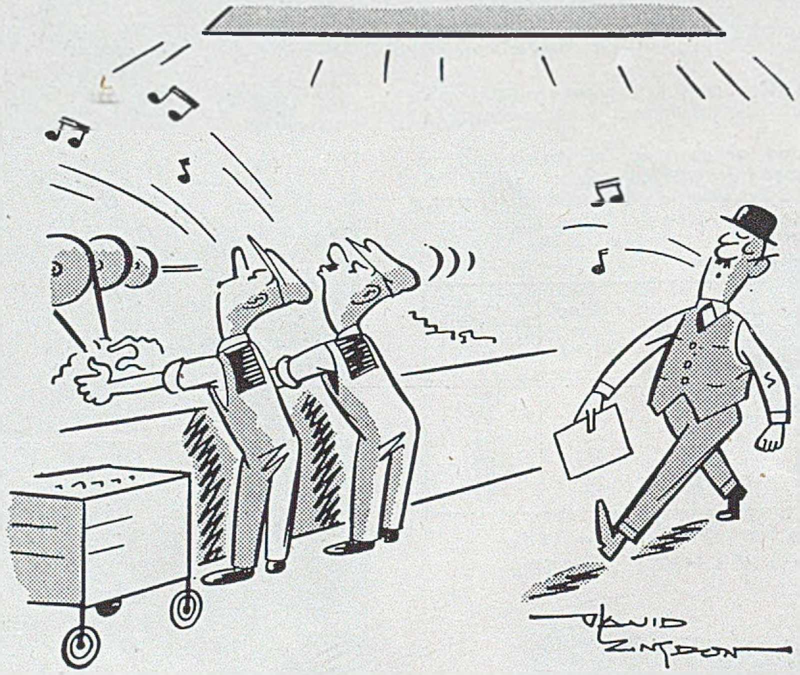




Analysis Results

	Copper	Lead	Tin	Zinc
Original	84.14	4.87	5.91	5.08
Heat 1	84.86	5.13	5.72	4.29
Heat 2	84.96	5.40	5.90	3.73
Heat 3	85.16	5.33	5.66	3.85
Heat 4	85.84	5.47	5.79	2.90
Heat 5	85.90	5.47	6.00	2.63
Heat 6	86.38	5.13	5.63	2.86

These tests were carried out in a model LFY Birlec-Detroit furnace installed at Messrs. Shipham & Co. Ltd., Hull: the figures are published by their kind permission.



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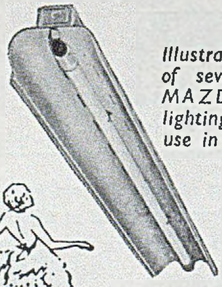

Illustrated here is one of several types of MAZDA fluorescent lighting fittings for use in factories

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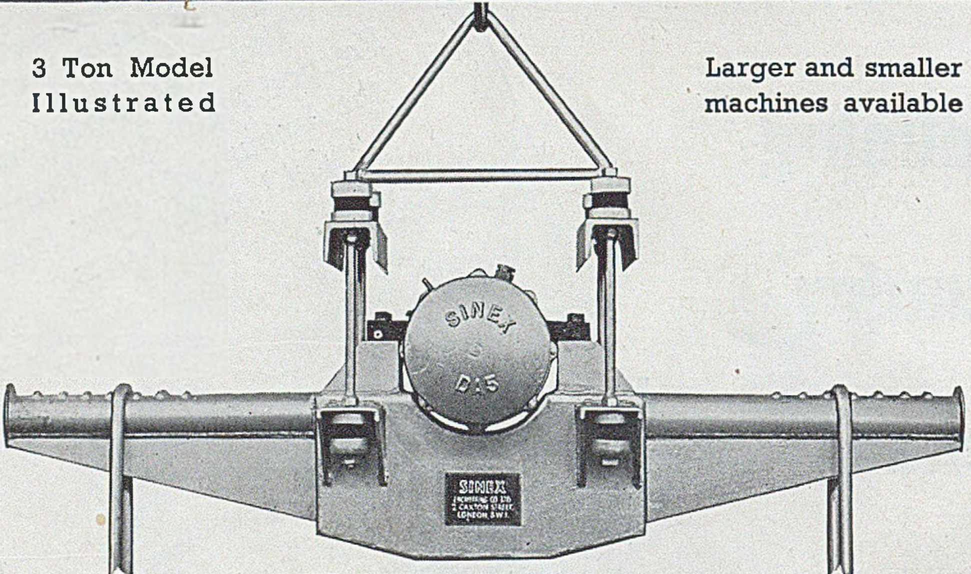


FIG. 7 SINEX VIBRATING BEAM

For the easy handling of Foundry Boxes, too heavy for a Knock Out Grid, this machine will remove the most stubborn sand from the casting, in a fraction of the time needed by present methods. (Links to suit requirements).

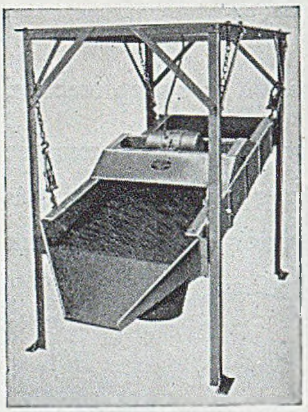


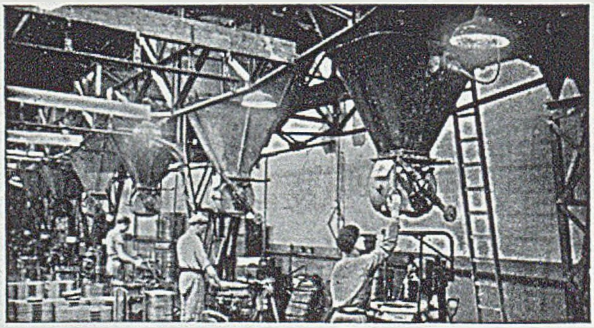
FIG. 10 (on left)

Sinex Vibrating Screen 6ft. × 3ft. Single Deck. Hourly output —15 tons of sand through ⅛ inch mesh.

This screen is also manufactured in sizes to suit requirements

FIG. 8. (illustrated below)

An important function of Sinex High Frequency Vibrators is the application to Sand and Storage Hoppers. To facilitate the rapid discharge of the material, long experience has shown that the fitting of a Sinex Vibrator to a Hopper containing the most stubborn material will avoid "arching" or "funnelling" of the material in the neck of the Hopper and assure a regular flow. Fig. 8 shows a batch of moulding Sand Hoppers fitted with Sinex Vibrators. These machines are manufactured in various sizes suitable to the capacity of the Hopper, and are wound suitable for any electric supply, single or 3 phase A.C.



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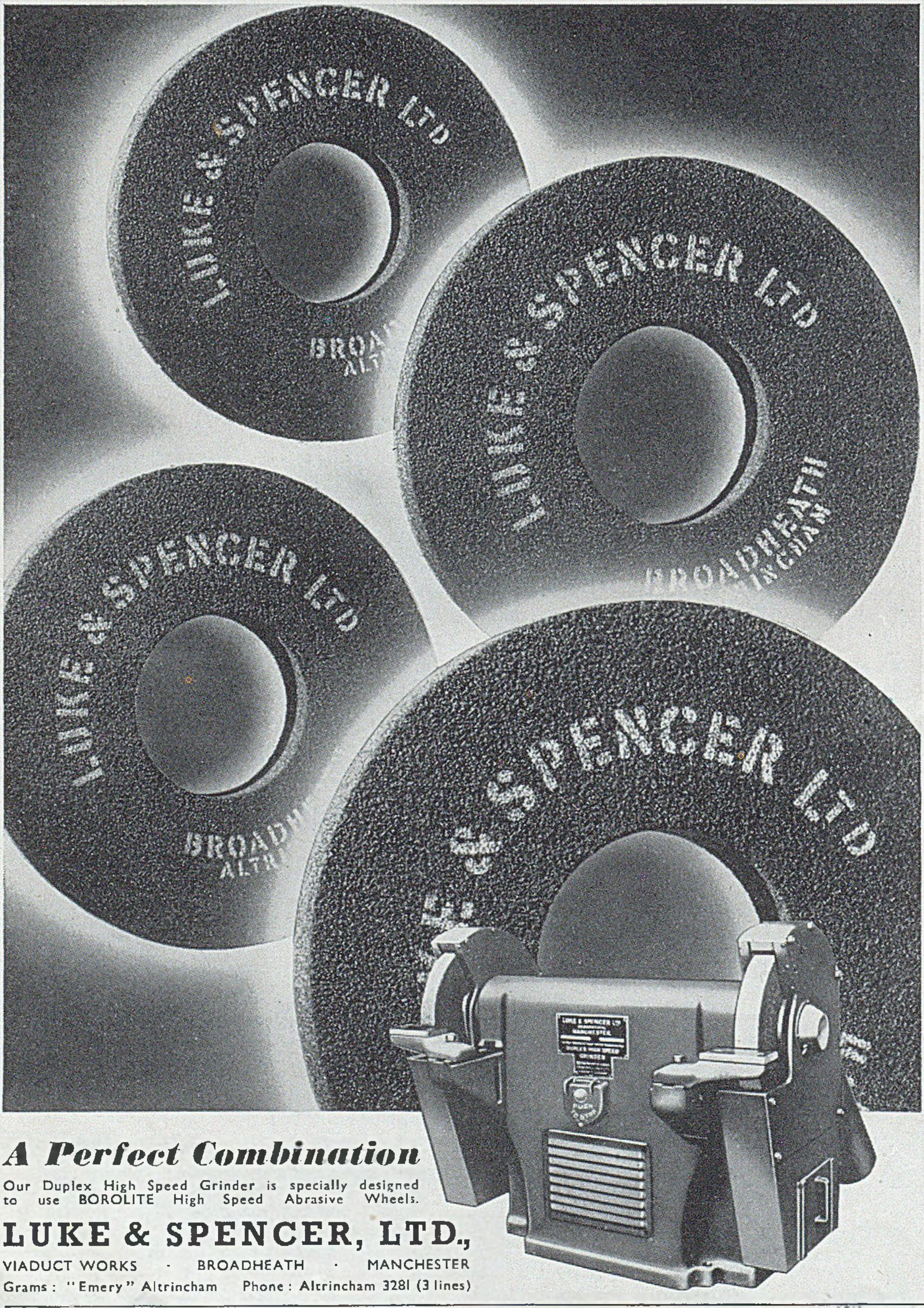
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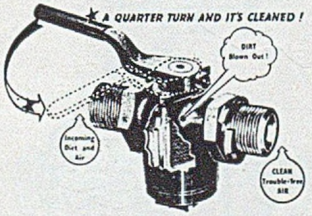

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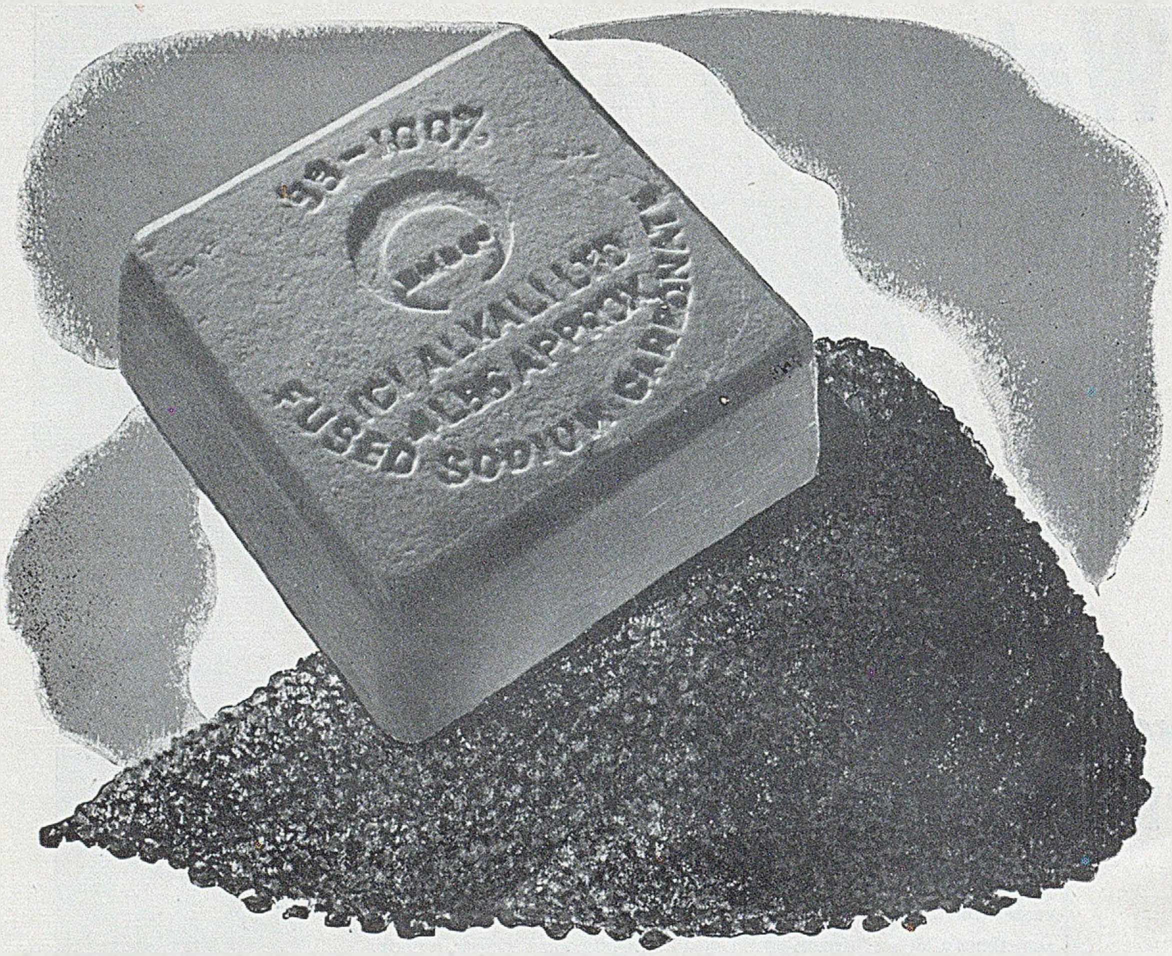

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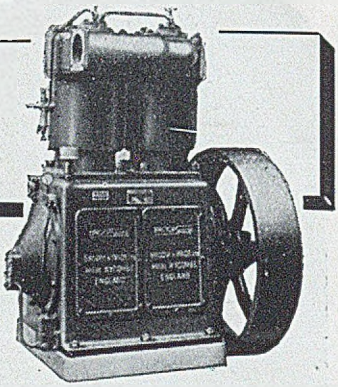

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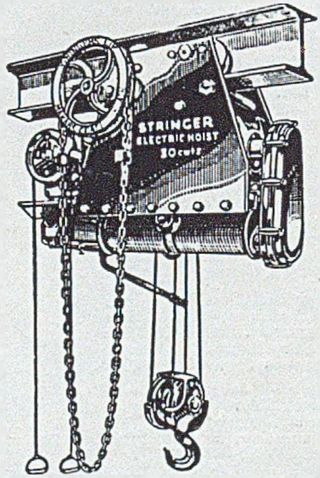

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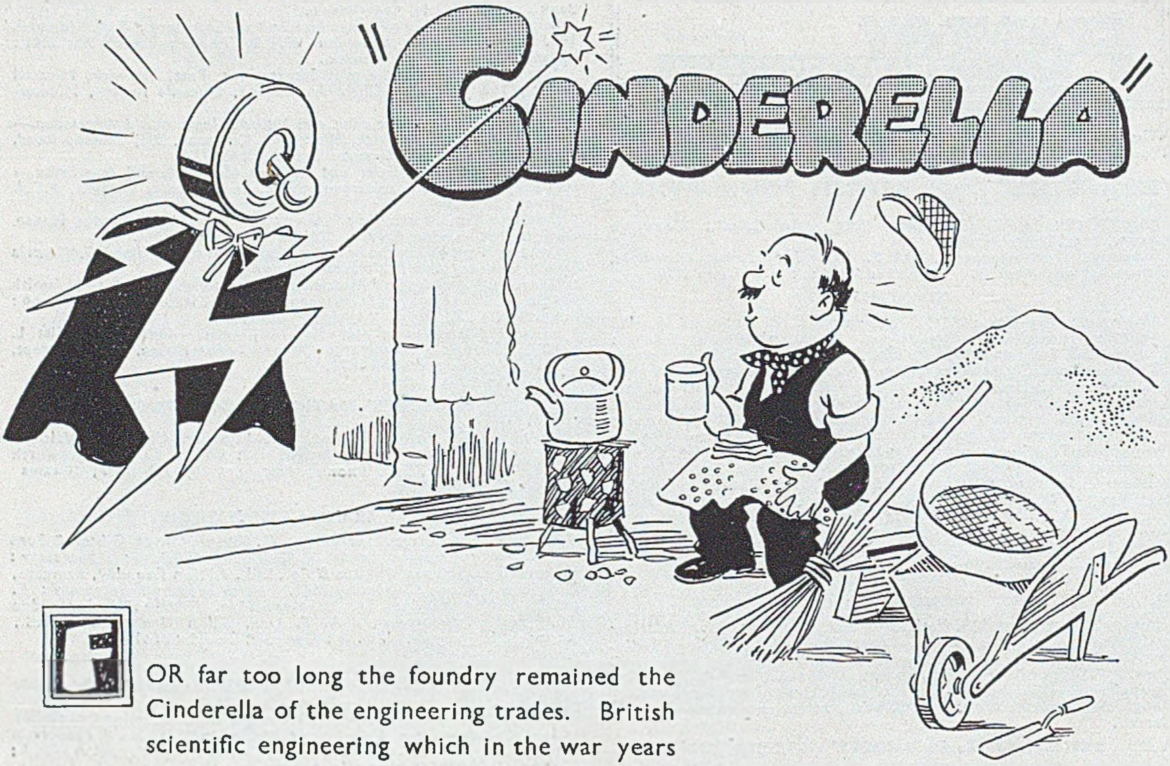

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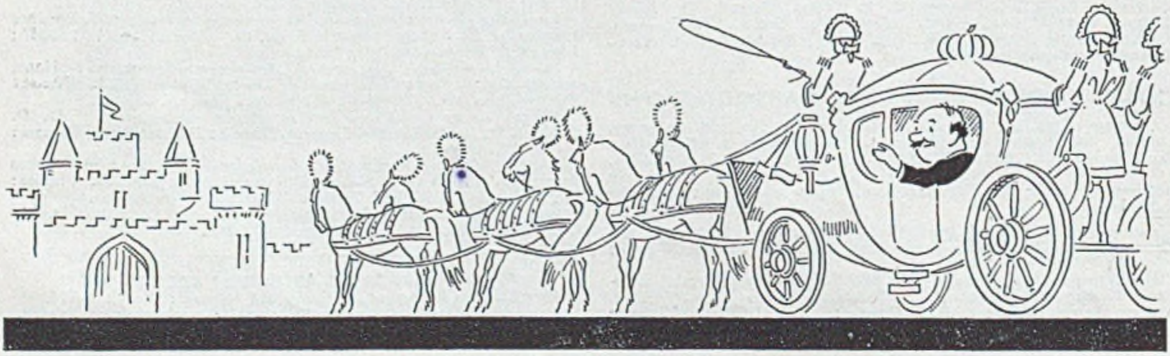

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1950 in Retrospect

There was no international foundry congress during 1950, but during the Buxton Conference of the Institute of British Foundrymen a committee meeting was held, which brought some 20 or more overseas delegates. The most important business transacted was the election of the Swedish and German foundry technical associations to membership. For the major part of the year, the supply of raw materials for the industry was adequate, but with continually enhanced prices for the non-ferrous metals. Towards the close of the year, however, material shortages became increasingly evident and, to make matters worse, there were constant interruptions in the manufacturing programme due to electricity cuts. Despite these drawbacks, it is reasonably certain that all previous production records for iron castings have been broken. We anticipate that this section of the industry will have produced 3½ million tons of castings in 1950.

The parliamentary elections were held in February and the result was virtually a stalemate, yet despite this, the Government with its attenuated majority decided to carry on with their wild-cat scheme of converting the iron and steel industry, plus a modicum of the foundries, into a state monopoly. An attaché case bearing the Royal cypher may be excellent for securing priority places on trains and planes, but it is not so well suited as equipment for commercial travellers, upon whose efforts industry must rely for its very existence.

During the year, the Beevor foundry—an outstanding example of mechanised production—was opened with due ceremony by Field Marshal Sir William J. Slim. A second one—for Smith & Wellstood—was completed and will be "opened" shortly. A third, at Doncaster—belonging to the International Harvester—also came into production.

Productivity

Early in the year, the jobbing ironfounders sent a team, led by Mr. S. H. Russell, to the United States to study conditions in that country. Immediately on the presentation of their Report, a London conference was held at which the chief speaker was Mr. H. P. Good, president, American Gray Iron Founders' Society. His contributions to the discussion materially enhanced the value of the meeting. Earlier in the year there was an unofficial visit from Mr. Max Kuniansky, a past-president of the American Foundrymen's Society; Mr. G. Vennerholm, the internationally-known metallurgist from Detroit, and Mr. Levy, who is associated with Mr. Kuniansky.

The malleable-iron section of the industry continues to make progress, with new annealing methods getting the most consideration. Steelfounders have been busy implementing their productivity report and the statistical position proves that real progress is being made. This section seems to be able to produce a series of brilliant men to conduct their co-operative affairs. During the year the British Steelfounders' Association has created its own research organisation under the direction of Mr. J. F. B. Jackson, who has a wealth of practical experience as a background.

The non-ferrous foundry industry also sent a team to America under the joint auspices of the Association of Bronze and Brass Founders and the National Brassfoundry Association. The team was headed by Mr. Frank Hudson, and whilst the Report has not yet been published, the members have already seen a film covering some of the features of American practice.

The light-alloy foundries have turned out about 60,000 tons of castings; more than half would be in the form of die castings. The industry has been much worried about the rising prices of raw materials and latterly the scarcity of aluminium. The magnesium foundries have done better than we expected and, with rearmament steadily increasing, they can look forward to really increased activity.

Developments

For once in a way, patternmaking has been in the news, and both the iron and non-ferrous teams have made reference to a new system, which is now being rapidly developed in this country. The standard for pattern colours is being revised and some of the proposed changes do not altogether meet with our approbation.

The cupola has also come in for reconsideration. The Doat system is but one of a series of new designs each embracing a hot-blast system. The cupola is undoubtedly an economic method of melting iron, but, with the ever-increasing cost of raw materials and the deterioration of quality, an impetus has been given to improvement in design.

A feature of foundry activities in recent times has been the attention given to washing and changing facilities for the operative staff. Every few weeks we recorded the installation of baths. That they are becoming more and more appreciated by the staff is unquestionable. Much research is being undertaken in the field of dust prevention. It is not easy, for quite often, as soon as one source is checked, experience shows adverse conditions elsewhere. When silicosis and similar diseases are being studied, we would like some reference to be made to mouth-breathers. Correlation in this direction might conceivably bring to light evidence which may be capable of making a reduction of lung diseases in the future.

Co-operative Organisations

The Institute of British Foundrymen continues, under the presidency this session of Mr. J. J. Sheehan, to make solid progress. So long as it continues to pursue a policy of marrying theory and practice its future is assured.

The British Cast Iron Research Association can take credit for focusing attention on nodular cast iron. This new alloy is making good progress and is being recognised in increasing measure as a useful addition to engineering structural materials.

The various employers' organisations, headed by the Council of Ironfoundry Associations, have supported in full measure all the progressive co-operative activities coming within their sphere. Research, technology, education, the training of apprentices and hygienic conditions of working have all benefited by their enlightened interest.

The foundry equipment industry is much more alive to-day than ever in its history. For the first time, British foundry plant was shown at the American Foundrymen's Society's exhibition, and this with good results. A team returning from America has indicated that in this country there is insufficient co-operation between the foundries and plant makers. This is capable of being remedied by putting any problem before the Foundry Equipment and Supplies Association, the members of which, without doubt, could in most cases supply a solution.

Vitreous enamelling continued to flourish as the wartime difficulties in obtaining raw materials gradually became overcome. The technical association of the industry—the Insitute of Vitreous Enamellers—gives not only a social meeting ground for its technicians but a live forum for the discussion of its pressing problems.

Conferences

Quite of feature of modern life is the "Conference." The frequency with which these occur is perhaps somewhat alarming. During the past year, there was the Second Foremen's Conference organised by the Institute of British Foundrymen—which was as successful as the original one. The ironfounders' productivity conference in London has already been referred to, another was held at Ashorne Hill. The British Cast Iron Research Association also had a gathering at Ashorne Hill, as did the British Steel Founders' Association. The largest of course was the conference at Buxton, which for many meant a full week away from business. An innovation last year, due mainly to the efforts made by Mr. R. B. Templeton, was the holding of a day for National Works Visits by members of the Institute. The Birmingham area was chosen and the occasion was an outstanding success. The local committee well merited the compliments they received on the model organisation achieved.

Training

The various educational activities connected with the industry continue to flourish. The "City and Guilds" examinations attracted a record number of entrants. The hostel for the craft school at West Bromwich was opened with due ceremony by an under secretary of state. This is a very well-conducted establishment and for continuity it warrants the enthusiastic support of every foundry throughout the land. The tuition given at the Centre is of the highest quality. Though there can be no guarantee that any firm sending an apprentice there will benefit (as the boy may well desire to get added experience elsewhere), yet there is no question but that the industry as a whole will gain thereby.

The foundry industry can take pride in its achievements in 1950 and, provided there are no major upheavals, it will continue to make a major contribution to the economic progress of the country.

Practical Experiences in Producing Nodular Cast Iron*

By M. M. Hallett, M.Sc., F.I.M.

The first announcement of the cerium process for the production of nodular cast iron was made by the British Cast Iron Research Association some three years ago. This was followed about six months later by an announcement from The Mond Nickel Company in England and the International Nickel Company in America, of the magnesium process. During the subsequent 2½ yrs. a great deal of information has been gained on the practical production of these irons as well as on the metallurgy of the process and the properties of the product. Several valuable Papers have been written on the latter two aspects, but comparatively little has been published on the foundry problems. The purpose of the present Paper is to deal with the practical aspects, as had been requested by the officers of the London branch.

TO REFER to these remarks as a Paper is perhaps to give a wrong impression. It is intended to be a progress report on the position reached at the moment and to deal with the subject purely from the foundry angle, considering theory only in so far as it facilitates a correct understanding of the variations experienced in practice.

It is necessary first to define the type of microstructure characteristic of spheroidal-graphite cast iron. In a normal grey cast iron, the graphite flakes are long and thin and tend to be pointed at the ends, as viewed in cross-section. Since the flakes possess a very low tensile strength, they act as serious discontinuities in the structure, the stresses necessarily being borne only by the small metallic bridges existing between the flakes. Furthermore, the sharp ends of the flakes act as points of serious stress concentration or " stress-raisers." If spheres of graphite be substituted for these irregular, sharp-edged flakes, it is clear that the metallic groundmass is much less broken up, leaving far larger metallic bridges, and, furthermore, that the sharp " stress-raisers " are entirely eliminated. Typical microstructures of iron containing this type of graphite are shown in Figs. 1 and 2.

Practical Limitations

A structure of this perfection is not necessarily always attained, and, in certain circumstances, what is referred to as quasi-flake graphite or compacted-flake graphite is obtained. Irons containing these types of graphite generally have better mechanical properties than those with normal flake graphite, but they do not approach the values obtained by the truly spheroidal-graphite irons, and they certainly do not show any appreciable ductility. It should also be added that the spheroidal graphite can be combined with any type of matrix structure, *i.e.*, pearlitic or completely ferritic, or a mixture of the two, usually with the ferrite forming envelopes around the graphite spheroids. It is easy by appropriate treatment to produce other types of base structure, as in martensitic or austenitic irons.

As already indicated, there are two major processes by which nodules of graphite can be produced. One involves the use of metallic cerium, and the other the use of metallic magnesium. These two elements have many characteristics in common. Both are highly reactive, combining readily with oxygen and with sulphur; both are carbide-forming elements, tending to suppress the formation of graphite and to promote the stability of carbides. Whichever element be used, an essential first step in the process is the removal of the sulphur. To ensure that the process will work effectively, the sulphur content must be reduced from its initial level down to some very low figure in the order of 0.01 per cent., or even a little lower. Also, there must be sufficient of the nodularising element left over after lowering the sulphur to effect the formation of the spheroidal graphite.

CERIUM PROCESS

When the details of the process were first published by Morrogh and Williams, severe limitations were placed on the composition of the iron to be treated. It had to be of high-carbon and high-silicon contents, *i.e.*, hyper-eutectic, preferably with about 3.8 per cent. carbon and 2.5 per cent. silicon. It was desirable for the phosphorus content to be as low as possible, preferably 0.1 per cent. or less, and the sulphur content as tapped had also to be low, 0.04 per cent. or less. The base iron was thus a special type of hematite pig-iron.

Following the release of the data on the process, many foundries made experiments with the addition of cerium to cast iron, but they usually failed to obtain the desired results, because they had not appreciated the very specific limitations laid down by the original authors. If those limitations are met, quite good nodular iron can be made by the cerium process. In practice, the process is difficult to apply because, in the first place, it is not possible to obtain, out of an ordinary acid-lined cupola, an iron with a sulphur content below 0.04 per cent. If desulphurisation be applied, this process has to be worked more efficiently than usual and normally results in such a loss of temperature that it is no longer possible to add the cerium and the inoculant and subsequently make good castings. The result is that the production of cerium-treated nodular

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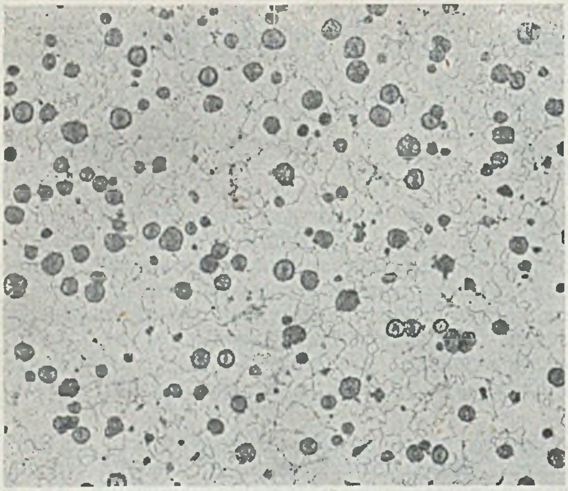


FIG. 1.—*Microstructure of Ductile Cast Iron* × 60 *dias. Etched.*

iron is not at the moment a practical proposition if the melting unit is a normal cupola. Perfectly satisfactory cerium-treated nodular iron can be made if the correct types of pig are melted in units which do not involve a pick-up of sulphur, such as a crucible furnace, or a high-frequency induction furnace. Under these conditions, the claims made for the process are completely fulfilled.

Sequence of Additions

In common with the magnesium process, two steps are involved. First, the addition of the reactive element, and secondly, the addition of the inoculant. Adding the cerium as Mischmetall, the element goes in very readily with no appreciable evolution of heat and with little apparent effect on the appearance and fluidity of the molten iron. The amount of cerium required varies to some extent with the pig-iron and with the size of the casting. The larger the casting the more the amount of cerium needed. In the case of a bar $\frac{7}{8}$ in. diam., foundry experience indicates that a Mischmetall addition of 100 gm. per 100 lb. of metal (0.22 per cent.) is sufficient, but with large castings of, say, 2 in. diam. and above, even 200 gm. per 100 lb. (0.44 per cent.) does not give a fully-nodular structure. In either case, the addition is followed by inoculation. The British Cast Iron Research Association favour the use of S.M.Z. material, which is an excellent inoculant, being both clean and powerful. It is normally added in an amount of 10 oz. per 100 lb. Using low-sulphur high-frequency-furnace metal, this treatment produced a tensile strength of about 35 tons per sq. in. on a $\frac{7}{8}$ in. diam. test-bar, but on the heavier bars of less satisfactory structure, a tensile strength of only about 28 tons per sq. in. was achieved.

A further disadvantage with cerium, as indeed with magnesium, is a marked tendency to the formation of carbide. It is for this reason that irons of a higher sulphur content than 0.04 per cent. cannot be treated by cerium. If sufficient cerium is added to eliminate the sulphur, the iron solidifies with a white structure This would lead to serious difficulties in making castings in permanent metal moulds.

Centrifuging

An interesting point has emerged from the study of cerium-treated irons, and some examples were shown in the Paper of Morrogh and Williams. If cerium-treated iron is cast centrifugally in sand moulds, there is marked centrifuging inwards of the graphite nodules to the bore of the tubular casting. This raises a point of some importance because it indicates that, in cerium-treated iron, the first nodules of graphite separate in the liquid; otherwise they could not be centrifuged inwards. Evidence with magnesium additions is not quite so clear on the initial separation of graphite as with cerium-treated iron, but a similar mechanism may apply. The point is that the expansion due to this initial formation of graphite is lost so far as its action in counteracting shrinkage is concerned. In normal grey irons, the separation of graphite at the eutectic point causes an expansion which counteracts the natural shrinkage and leads to the well-known soundness of grey-iron castings. If part of this graphite is formed at a higher temperature while the iron is still molten, it can no longer affect shrinkage, and its beneficial influence is lost.

MAGNESIUM PROCESS

Although magnesium has many of the characteristics of cerium, combining readily with sulphur and oxygen and promoting the formation of carbides, the balance of its effects is more favourable than that of cerium. The result is that it is possible to treat an iron of normal sulphur content by the magnesium process and obtain highly satisfactory spheroidal graphite. This may be illustrated by the Author's orginal experiences of some two years ago in starting production of magnesium-treated iron.

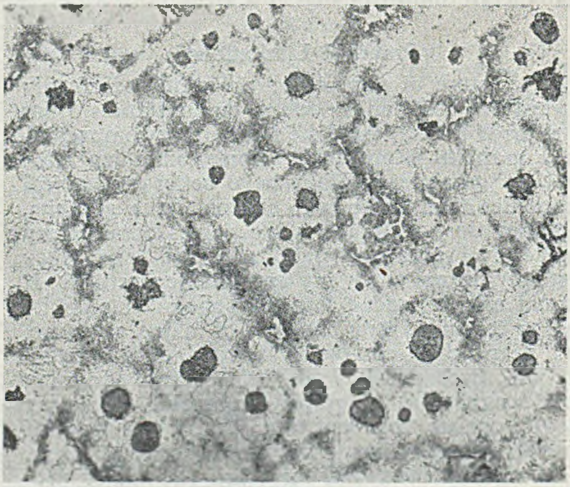


FIG. 2.—*Microstructure of Imperfectly-annealed Spheroidal-graphite Cast Iron* × 60 *dias. Etched.*

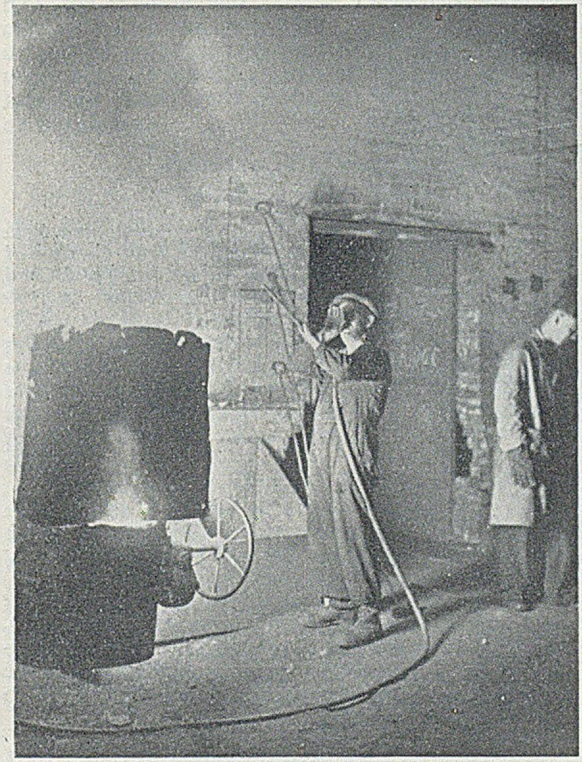


FIG. 3.—*Magnesium Process Alloying Operation in Progress.*

A normal engineering cupola-melted grey iron corresponding to British Standard 1452, grade 17, was made from a charge of hematite pig, steel and returned scrap. Almost at the first attempt, a tensile strength of 40 tons per sq. in. was attained, indicating the much wider applicability of the magnesium process.

Unlike cerium, magnesium cannot be added in the metallic form. It is almost insoluble in iron, possesses a low melting point and boiling point and a low specific gravity. If magnesium be added to molten iron there is an explosive evolution of magnesium vapour, which burns violently on the surface of the iron, generating much heat and light, and ejecting a large quantity of the metal from the ladle. Some intrepid investigators have added magnesium to molten cast iron, but, to put it mildly, the results have not been reliable. This difficulty is overcome by pre-alloying the magnesium with some carrier element, which enables it to be introduced safely. The most commonly used element is nickel, and the normal addition alloy contains between 10 and 20 per cent. of magnesium. The process for producing spheroidal-graphite cast iron with magnesium is divided into the same two steps as when using cerium. First, the reactive element, the magnesium, is added by the approved method. When the solution is complete, the iron is inoculated by a high-silicon alloy.

Method of Addition

The nickel/magnesium alloy is usually added in lumps of reasonable size, possibly with some finer material mixed, and is placed on the bottom of the normal acid-lined ladle. The iron is then tapped directly on to the addition from the cupola spout and the reaction progresses during the tapping of the iron. There is considerable emission of light and a fairly copious quantity of fumes is evolved, but there is no danger and no ejection of molten metal. The reaction normally ceases by about the time the ladle is filled, although in the case of a very large ladle, where the tapping time is prolonged, the reaction is usually over before the tapping is finished. A fair amount of non-metallic residues, rich in magnesium sulphide, rise to the surface. This light slag requires to be raked off rather carefully in order to leave the top of the metal as clean as possible. It is found helpful to add limestone chippings to thicken the slag at this stage.

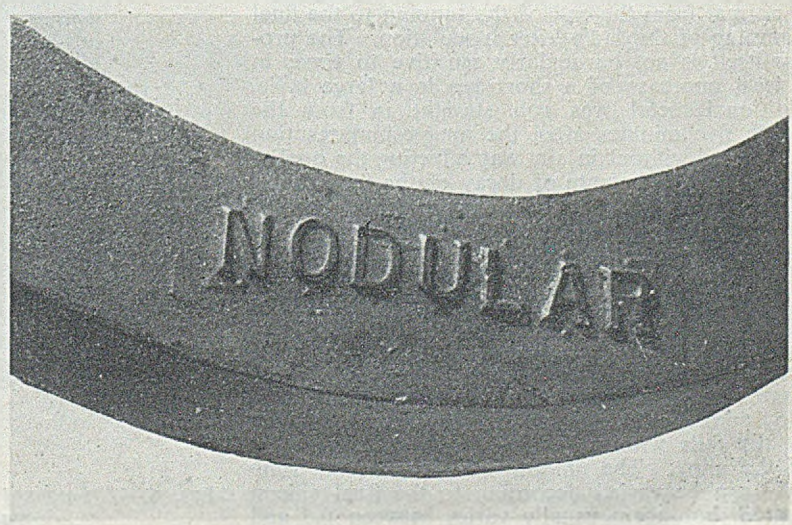


FIG. 4.—*Surface of a Casting in Nodular Iron showing the Degree of Mould-surface Reproduction Attainable.*

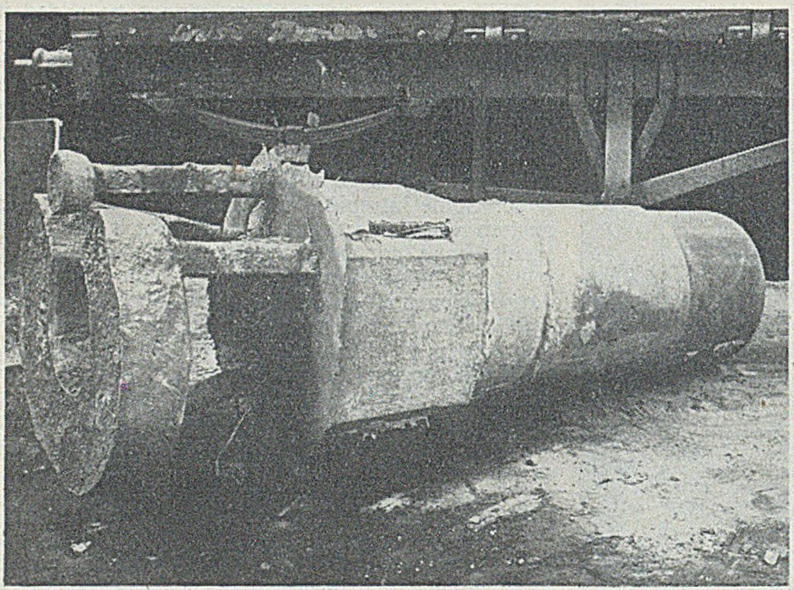


Fig. 5.—*Large Top-poured Spheroidal-graphite Iron Casting of a Holder for a Centrifugal Casting Machine, replacing a Steel Casting.*

The next stage is the inoculation with ferro-silicon. Normally, a 75 per cent. ferro-silicon alloy of about walnut size is thrown on to the top of the ladle and is plunged below the surface and vigorously stirred in using a graphite plunging rabble. The ladle is then skimmed quickly and taken to the casting point. These operations do not involve any danger to the workers. Fig. 3 is an illustration of the reaction in progress. The sheet of corrugated iron is placed over the ladle in order to mitigate the glare and also to deflect the smoke away from the weighing scale. The deflection is assisted by blowing compressed air against the scale, as shown in the illustration, so that definite weight can be tapped.

The whole operation does not take very long, and does not lead to such a drop in temperature as would make the iron difficult to handle in the foundry, a total time of about 90 sec. being regarded as normal from the end of the tapping to the final skimming of the ladle after inoculation. The process itself is not particularly sensitive to time; in at least one case of a short tap in a large ladle, additional metal was run straight in from the cupola five minutes after the magnesium reaction had ceased without in any way affecting the quality of the iron. The rate of decay of the inoculation effect is probably about the same as in the inoculation of engineering grey iron.

Cupola Charges

The charge consists of the same type as those used for the engineering grey iron noted earlier, but it is necessary to choose the pig irons with some care. The amount of the nickel/magnesium alloy addition depends on the sulphur content, but usually falls within the range of 1 to 2 per cent. of the alloy. The amount of the inoculant similarly can be varied according to the final silicon desired, but again usually varies between 0.5 and 1.0 per cent. silicon addition. The process is not subject to narrow limitations of composition, particularly as regards the normal elements. In personal experience, good castings have been made with carbon contents ranging at least from 2.9 to

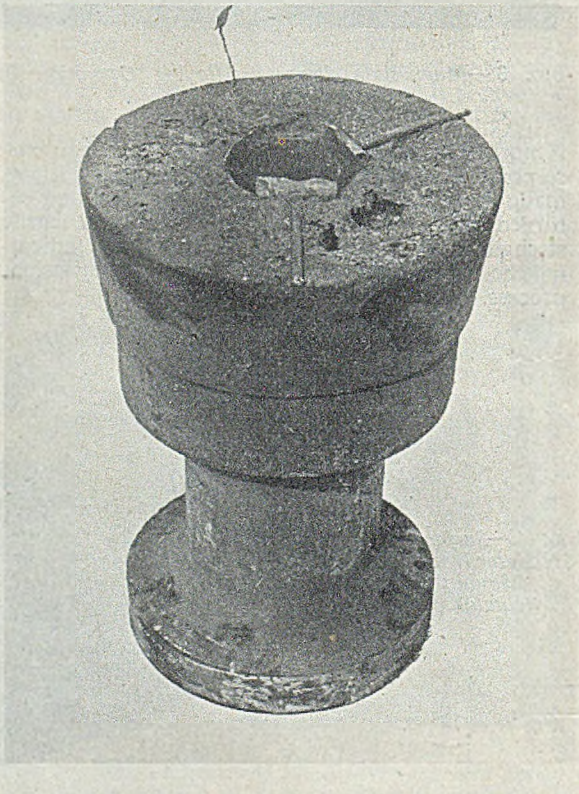


Fig. 6.—*Top-poured Cylinder Casting in Spheroidal-graphite Cast Iron.*

3.6 per cent., nor is there any reason to suppose that the range could not be wider still. If the carbon content be very high, there may be some danger of flotation of graphite in very heavy sections, but that is only an indication from American literature rather than from any home experience of this defect.

Influence of Elements

Similarly, the silicon content can vary over a very wide range to suit the section of the casting. Furthermore, a high silicon content does not lead to low tensile strength values in heavy sections as it does in flake-graphite grey-iron castings. Because of the tendency to chill in thin sections, due to the presence of the carbide-forming magnesium, there is a tendency in founding to keep the silicon content fairly high, of the order of 2.5 per cent., but perfectly satisfactory spheroidal-graphite iron has been produced over the range from 1.6 to 3.0 per cent. silicon.

Manganese, in itself, does not affect the formation of the graphite spheroids, but it has a profound effect on the form of the matrix, being very potent in controlling the spheroidisation of the pearlite. The lower the manganese content, the quicker the spheroidisation can be effected, while the higher the manganese content, the easier it is to produce fully pearlitic heavy castings. Thus two manganese contents tend to be selected. Large castings required to be pearlitic and wear-resisting are kept with a manganese content of about 1 per cent., whereas for castings which are to be annealed to give maximum ductility, the manganese should be kept as low as possible, below 0.5 per cent. and preferably below 0.4 per cent. Quite small amounts of pearlite left in the microstructure after annealing have a serious effect on ductility. Thus, Fig. 2 shows an iron annealed for the same time as the material in Fig. 1, but with a manganese content of about 0.78 per cent. instead of 0.35 per cent.

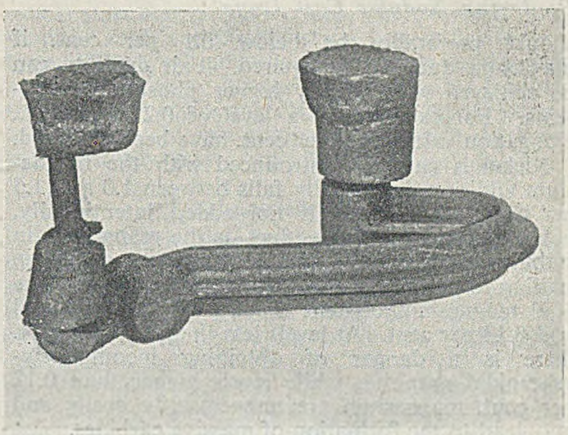


FIG. 7.—*Lift Arm Casting in Nodular Iron with a Whirlgate Side Feeder.*

There is a clear pearlite network left in Fig. 2, although the spheroids of graphite are equally well formed. The iron shown in Fig. 2 had an elongation of only 4 per cent. in the tensile test, as compared with the value of 20 per cent. given by the iron the structure of which is shown in Fig. 1.

The sulphur content, as tapped, can be that which is normal for grey cast iron. In the Author's practice, a level of about 0.09 per cent. is expected which, after treatment, drops to 0.01 per cent. The lower the sulphur content as tapped, the lower need be the addition of the magnesium alloy. A certain amount of magnesium is needed to combine with a certain amount of sulphur, so that if the sulphur content as tapped could be reduced to 0.04 per cent. there would be a distinct economic advantage by a corresponding reduction in the amount of magnesium addition. It is obviously desirable to keep the phosphorus content as low as possible, and it

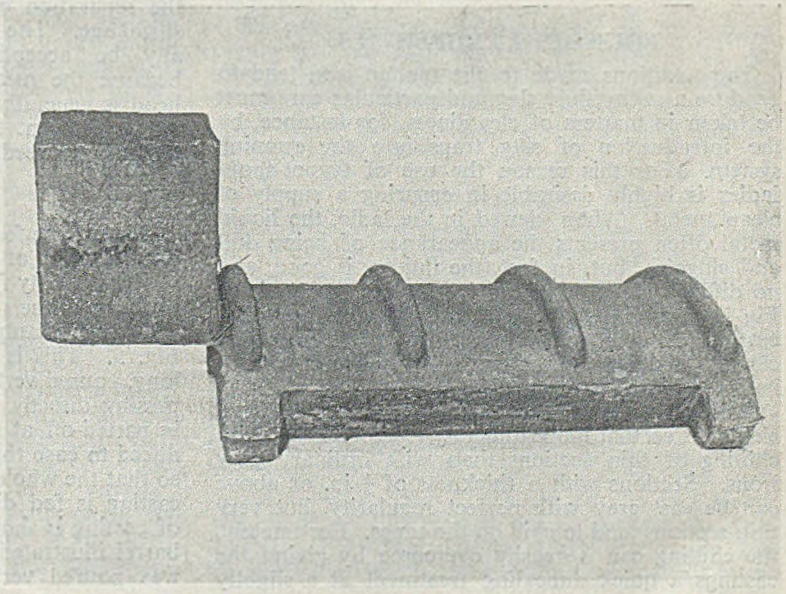


FIG. 8.—*Cheek Casting in Nodular Iron fed with a Connor Block.*

Producing Nodular Cast Iron

should preferably be below 0.1 per cent. if maximum ductility is required. Fair ductility can be achieved with slightly higher phosphorus contents. For example, at a level of 0.21 per cent., elongation values of 9 per cent. have been achieved.

Nickel is naturally introduced with the magnesium addition and usually falls between 1.0 and 1.5 per cent. Chromium is not added intentionally, because it has the same effect as the manganese in stabilising the pearlite and is even more potent in leading to chilling of the casting at thin edges. The final magnesium content usually lies between 0.06 and 0.12 per cent. At levels less than 0.05 per cent. there is a danger of obtaining incompletely-spheroidal graphite, while levels higher than 0.12 per cent. magnesium are unnecessarily costly and may lead to the formation of massive carbides.

In addition to these normal elements, it is necessary to consider a number of minor elements which receive little attention in ordinary grey cast iron practice. Apart from such regular contaminants of present-day pig-irons as tin and lead, there are elements of the arsenic, antimony and bismuth group, which are similar to phosphorus in their general characteristics. Selenium and tellurium act like sulphur, while vanadium and titanium are deoxidisers and carbide-formers and can be regarded as having effects something like those of manganese. Some of these elements have bad effects, some may not be so potent, but it is clear that the complications of working out the precise influence of each of these elements, when present in very small amounts, is a formidable job for research workers which will occupy a long time. It is likely that in the course of this work much light will be thrown on many puzzling features of the metallurgy of cast iron, but until the full results are available, it is better not to make guesses at the moment, but merely to bear in mind that these minor elements may profoundly influence the process.

FOUNDING PROPERTIES

The additions made to the molten iron tend to produce a rather fluid slag and particular care must be taken in matters of cleanliness, for instance, by the introduction of slag traps into the running system. For this reason the use of teapot-spout ladles is highly desirable in ensuring a supply of clean metal. When viewed in the ladle, the liquid metal often presents the appearance of being dull and sluggish, but, in fact, the fluidity is good, and no difficulty is experienced in running the castings. Fig. 4 is an illustration of a typical surface of a casting. It will be seen that the letters have run cleanly, and that minor marks on the sand surface have been well reproduced.

Both cerium and magnesium are carbide-forming elements, so that more difficulty is experienced with chilling of thin sections than with ordinary grey irons. Sections with a thickness of ½ in. or above can be cast grey with perfect regularity, but very thin sections tend to chill on the edges. Fortunately, the chilling can be easily overcome by giving the castings a quick annealing treatment at a slightly higher temperature than normal, and the times involved are so short that the cost is not very great.

Shrinkage Characteristics

The major difference between nodular iron and flake-graphite iron is in the shrinkage characteristics. The question of primary separation of the graphite has already been mentioned, with the consequent partial loss of expansion due to graphite separation. The result is that nodular iron tends to pipe deeply, behaving more like steel than grey cast iron. Consequently, much more care has to be taken in considering feeding practice than is normal for grey cast iron. The grey-iron foundryman is fortunate in that many castings can be made practically without feeding heads, and furthermore, a great tolerance for variations in feeding practice exists. On changing to the production of nodular iron, the feeding heads have to be applied with much more intelligence, and the examples quoted will give some idea of the principles to be followed.

In the production of castings in any metal, it is desirable to arrange the running and feeding system so that progressive solidification takes place across the casting and into the feeding head, the latter being the last to solidify. It is necessary to follow this procedure more rigorously in spheroidal-graphite iron than in flake-graphite iron. The feeding head must always be placed over the heaviest section of the casting, and every possible step should be taken to ensure that the hottest metal is retained in the feeding head. It is, therefore, good practice to run the castings through the feeding head.

In normal grey-iron practice, castings are frequently run into light sections at the lower levels, the metal gradually rising up through the mould into a gravity feeder placed at the top. This procedure generally gives good results, because it ensures freedom from dirt by sand washing, and gives a good surface. The expansion caused by the separation of graphite is sufficient to obviate shrinkage. The same procedure would not generally be acceptable in spheroidal-graphite iron, because the metal which passes into the feeding head is generally the coldest in the casting, and to obtain efficient feeding would necessitate prohibitively large feeding heads.

Feeding Heads

The precise feeding head to be employed depends on the type of casting. In many instances, the straight gravity feeding head is very successful, particularly if the metal be poured through the head. A typical example of such a casting is shown in Fig. 5. This is a fairly heavy casting some 7 ft. long, poured vertically from a ring runner, the metal passing directly into the feeding head. The head is parted-off at the bottom of the slit cores introduced to ease the breaking up of the massive head, so that the whole of the flange at the one end of the casting is fed directly. A somewhat similar type of casting is shown in the double-flanged hydraulic barrel illustrated in Fig. 6, and which, like Fig. 5, was poured vertically through the head. In this casting, the line for parting-off between the top flange and the head is clearly visible.

In many cases side feeding through a whirl-gate feeder gives the most economical results. In Fig. 7 is shown a lever arm of "X"-shaped cross section with a heavier boss at each end. This was run through a whirl-gate side riser at the left of the photograph, the other boss being fed by a fairly heavy top riser through a knock-off core. An alternative arrangement might have been to incorporate a side feeder on each boss, the feeders being supplied from a common runner.

Sometimes the Connor block runner can be applied with success, particularly if the design of the casting is such that a large amount of excess heat has not to be supplied to the feeder to produce the correct thermal gradients. Fig. 8 shows a curved cheek casting some 4 in. thick, about 2 ft. 6 in. long and 20 in. wide. The Connor block was found to be the most successful method of running this casting, avoiding both scabbing from the concave underface and producing complete freedom from shrinkage. These heads may be criticised as being unnecessarily heavy, but it should be explained that it has been preferable to err on the safe side and to ensure sound castings, at a time when foundry capacity is very heavily engaged. It should be added that in some castings of comparatively light and even cross-sectional thickness, no feeding heads at all are required.

Mechanical Properties

At the moment, the available material can be divided into two grades. In the "as-cast" condition, where the iron has a pearlitic structure, a desirable combination of very high tensile strength with good wear-resistance, but with no particular ductility, is produced. The tensile strength is regularly within the range of 38 to 42 tons per sq. in., but the elongation is only that of normal grey cast iron. The toughness is two or three times that of the latter material, and the Brinell hardness number about 280, depending on the section. Nevertheless, the material machines more easily than would be expected. If the iron be annealed, the tensile strength drops to 30 to 33 tons per sq. in., but the elongation reaches 15 to 20 per cent. The toughness is far greater than that of grey cast iron and machinability is excellent at the lower hardness figure of 180. These are average figures. Tensile strength values approaching 50 tons per sq. in. have been achieved, and elongation values of 25 per cent.

Applications

The applications of the material fall into many kinds of fields. The "as-cast" material may be regarded as a development of a super high-duty grey cast iron. The annealed material is more competitive with malleable iron and with carbon-steel castings. It undoubtedly fills the gap existing at present between high-duty grey cast irons and steel castings in all the properties, for it possesses at least as high a tensile strength, with nearly as good a ductility and shock resistance as the steel. The new material may well be complementary to malleable iron rather than competitive. Malleable iron is at its best in thin sections, whereas spheroidal-graphite iron is probably at its best in heavy sections. There will undoubtedly be some overlapping and competition between the two in medium sections, but where the dividing line finally comes will depend on cost comparisons, which, in turn, will obviously vary from job to job.

Acknowledgments

The work briefly described in this Paper has been carried out by many people. First, the Author must pay tribute to the investigations of Mr. H. Morrogh, of the B.C.I.R.A., who has carried out pioneering work of the highest order. The magnesium process is due to The Mond Nickel Company, Limited, and their American associates. All the information which has been gained has been based on their work, and particular reference should be made to Mr. W. W. Braidwood, who has been in charge of the development. Thanks are due both to The Mond Nickel Company, Limited, and to Sheepbridge Engineering, Limited, for permission to publish this account. Last but not least, the Author thanks all his own colleagues who have co-operated in reaching the present stage; in particular, the sand foundry manager, Mr. H. Morton, A.M.I.MECH.E., and Mr. P. D. Wing, A.MET., A.I.M., and Mr. J. Cumberland, A.I.M., of the laboratory staff, also have been in closest touch with the work throughout.

* * * *

At the October, 1950, meeting of the London Branch of the Institute of British Foundrymen, at which Mr. Hallett's Paper was presented, the branch-president, Mr. F. E. Tibbenham, took the chair. The first business of the evening concerned the presentation of a diploma of the Institute to Mr. E. S. Renshaw and Mr. S. J. Sargood for their Paper on "Some Modifications in Cupola Design," presented to the branch during the previous session.

The president next introduced Mr. M. M. Hallett, saying that he had recently been elected to the council of the Sheffield branch, and was chairman of the Institute's technical sub-committee 32, dealing with internal stresses in castings. Mr. Hallett then gave his Paper.

DISCUSSION

Mr. Cusworth asked if Mr. Hallett could give him a formula by which he could determine how much magnesium he would need to add to an iron for a given sulphur content.

Mr. Hallett said that obviously one must know first the sulphur content of the iron, and one could calculate from that, by ordinary chemical principles, the amount of magnesium which was needed to combine with that sulphur. One should then add sufficient magnesium to give the residual figure he had mentioned of from 0.06 to 0.12 per cent. (he would make it about 0.1, to be on the safe side). The yield of magnesium would depend on the foundry conditions. According to figures in the published literature, some people seemed to have

Discussion—Producing Nodular Cast Iron

achieved 110 (?) per cent. and others had been working nearer 10 per cent.! It was difficult to give exact figures, because the results obviously depended on conditions, the type of alloy used, and so on. He suggested that one might assume a 66 per cent. yield; then one should review the results obtained and try again.

MR. A. R. PARKES asked whether experiments had been made treating molten iron of suitable composition direct from a blast furnace. If so, would Mr. Hallett expect to be able to make castings direct, adjusting composition if necessary in a receiver, at a cost comparable with that of ordinary cupola re-melted iron, but, of course, with much enhanced physical properties.

MR. HALLETT said that all depended on the local circumstances. Certainly he would not like to make iron castings direct from blast-furnace iron produced by the group of companies with which he was associated, because they were making a high-phosphorus pig. As Mr. Parkes had suggested, one would need to have a pig-iron available of the right type and composition. If those apparently simple requirements were satisfied, if the foundry could make the right sort of castings right on the door-step of the blast furnaces, he believed it could make good castings. He understood that that had been done in at least one plant in the United States; but whether or not that was a sensible way of tackling the job—and he did not think one would achieve a great reduction of cost—must depend entirely on the plant concerned, on the exact composition and type of pig-iron produced, and the proximity of the foundry to the blast furnaces.

Choice of Nickel for Alloying

MR. B. LEVY, complimenting Mr. Hallett on the admirable way in which he had dealt with his subject, said it was put over with remarkable clarity of delivery, making interesting and comprehensible a subject which to him personally had always been a little mysterious. He asked how it was that magnesium had been alloyed with nickel, and yet there were obviously inherent difficulties in alloying magnesium directly with cast iron. Both nickel and cast iron had very high melting points, and it seemed remarkable that it was necessary to go to a metal such as nickel for the alloying agent.

MR. HALLETT said the problem of alloying was one of solubility. Although nickel had a high melting point, it had a very high affinity for magnesium, and for very many years magnesium had been used regularly for deoxidation of nickel. The metallic magnesium could be plunged straight into the molten nickel, and it dissolved quite quietly. Unless the nickel were excessively hot one could add 1-in. magnesium stick to a ladle of molten nickel and there would be virtually no flash on the surface. When added to iron it vaporised quickly, but it did not dissolve; it spread on the surface, blowing half the ladle of iron to the roof and, being reactive, burned violently at the same time. The reason for the choice of nickel was essentially because of its solubility in that metal.

Utilisation of Scrap

MR. D. MORRIS asked if there were complete loss of the magnesium when the iron scrap was re-melted.

MR. HALLETT considered it best to regard the magnesium as being completely lost. The nickel, of course, remained in the material, and one would achieve some build-up of that element in an ordinary geometrical progression, but it did not go up infinitely; with the normal addition, one might finish up with about 2 per cent.

The use of returned scrap, of course, was a factor in the economy of the process; one must use it if costs were to be kept down. The sulphur content of the iron, as tapped, might become a little lower (because of the use of very-low-sulphur iron then forming part of the charge) than if one had used an all-pig charge.

DR. R. V. RILEY wondered what would be the proportion of the nodular iron scrap produced under practical working conditions in the foundry. He recognised that one would have to provide for bigger feeder heads and there would be an increase of scrap on that account.

MR. HALLETT presumed that Dr. Riley was asking what percentage of heats were failures. The answer was that if one used the right pig-iron there would be no failures; his foundry nowadays made good nodular iron every time. If there were some major disaster in the foundry, such as an entirely wrong charge coming down the cupola, one did not produce good material; but, assuming one used the proved pig-irons, the process was absolutely reliable. If bad results were obtained, there was always some obvious explanation, such as contamination. Having established the technique, under normal conditions the process was 100 per cent. satisfactory.

MR. J. F. CHAMBERS asked if Mr. Hallett could enlarge on the effects of some of the minor constituents which influenced the formation of the nodular structures. Could he identify those which were the cause of trouble, or had it been to a certain extent a matter of trial and error in finding the types of pig-iron which were satisfactory and those which were not?

MR. HALLETT was afraid he could not answer the question, first because knowledge of the subject was not complete, and secondly because the nodular iron was being produced by a patented process and he would not be allowed to disclose complete details, which obviously were very important in the "know-how" of the process.

MR. E. J. WILLIAMS asked whether special steps were taken when moulding for nodular iron to give the gas freedom to escape from the mould. Were any special sands or other precautions necessary?

MR. HALLETT felt that the spheroidal-graphite iron should be compared with a high-duty cast iron, and not with the ordinary grey cast iron and high-phosphorus cast iron. He would class the spheroidal-graphite iron, in respect of its behaviour in the mould, exactly the same as high-duty cast iron.

Effect of Sectional Variation

MR. MOORE, dealing with castings incorporating considerable variations of section, asked whether there was considerable variation in the distribution of the graphite, and whether in spheroidal-graphite iron castings the mechanical properties of the heavy sections were comparable with those of the thinner sections. In particular, he asked whether the flotation of the graphite was serious in very large castings.

MR. HALLETT said the answer to Mr. Moore's questions was in the negative. He believed the flotation of graphite occurred only when the carbon contents of magnesium-treated irons were abnormally high, say, in the 3.7 per cent. region. The properties were extremely well maintained in the heavy sections. One might find slight differences in the sizes of the nodules, these being coarser in a section 6-in. thick than in one ½-in. thick; but the mechanical properties in both sections would be good. In other words, the iron made to the composition he had indicated was not particularly section-sensitive, apart only from the tendency to chill in very thin sections.

MR. G. C. PIERCE (past branch president) added his tribute to Mr. Hallett for a splendid lecture, one of the best he had heard for many years. On the assumption that one required castings of approximately ¼-in or 5/16-in. thick, and that they would require to be annealed, Mr. Pierce asked what the annealing process was likely to be. Would it be the same as for malleable iron, or would it be merely a heat treatment?

MR. HALLETT said the treatment needed to break down the carbides of nodular iron was very much less than that required for malleable iron. One would expect to break down most of the massive carbide in an iron with the sort of section mentioned—originally it would not be dead white, but mottled—by annealing for an hour at a temperature of not more than 950 deg C. and that was a very much shorter treatment than for malleable. A very interesting and practical point was that the graphite formed by the short annealing treatment was spheroidal.

Volume of Production and Applications

MR. PARKES asked for an idea of the scope of the production of nodular iron by Mr. Hallett's organisation. Could he also quote any customers' service reports, for instance to the effect that nodular iron was the "cat's whiskers" as compared with ordinary iron?

MR. HALLETT said he would be able to answer the question concerning production much better a year hence. For the reasons he had mentioned, the volume of production by his organisation was not very great, and they averaged only about one heat per week. That was due entirely to limitations of foundry capacity. But their order book was becoming longer and longer, and their customers were becoming more and more irate; the matter would be put right when their new foundry began operations next year.

An incredibly long time elapsed before customers could give reliable service reports. A period of two years, in which to find out whether or not an application was good, was perfectly normal, and reports from customers were not nearly so complete as he would like to see them. Very often castings were ordered for somebody who was building a prototype of some sort—maybe a new kind of engine or some other machine—and because the customer was thinking of designing something new, he wanted to try a new iron. The casting would be fitted into the machine, which might break down for no reason connected with the casting, and the customer would then spend a year working on the machine. Consequently the producers of the casting were not given any useful comments perhaps for a very long period.

With regard to proved applications, he said that very often machine parts such as lift levers could be said to have been proved. In some applications a lift lever might not be subjected to very severe shock, whereas in other cases the shock might be fairly extensive. One customer was supplied with a cast lever which was part of a foot-operated pedal, and a very heavy man was told to jump on to it. The casting, in nodular iron, had stood up to that test, and a repeat order had been given. Some of the hydraulic applications had definitely been proved and steady orders were being received for heavy castings which in service were subjected to shock. He felt certain that orders would be received for crankshafts; but again such castings were often prototypes, and in any engine component a great deal of time elapsed before modifications could be introduced.

It was only two years ago that his company had made their first magnesium-treated iron, and they had had a lot to learn, particularly in the first six months or so. At that time their percentage of metallurgical scrap was certainly not zero, as it was now. It would be appreciated, therefore, that it was difficult to give firm answers to Mr. Parkes' question. But he pointed out that in the Paper on some properties and applications of spheroidal-graphite cast iron, presented to the Buxton Conference of the Institute of British Foundrymen in June, 1950, by Dr. Everest, a large number of applications were detailed, with indications of their service status.

MR. A. TALBOT asked whether the nodular iron had been cast in green sand and, if so, what differences were there between green-sand and dry-sand moulded castings in respect of mechanical properties. He also asked whether a special facing sand was used.

MR. HALLETT replied that the material could be treated as one would treat ordinary engineering grey cast iron. He did not think the difference between green- and dry-sand made any appreciable difference to the mechanical properties of the castings. They were equally satisfactory in both cases, and one chose green- or dry-sand according to the job, just as one did for engineering grey cast irons.

Discussion—Producing Nodular Cast Iron

The practice in regard to facing sands was the same as with grey iron; the temperatures were the same, and the mould washes were the same.

Heat Resistance

MR. E. HARWOOD BROWN asked whether the nodular irons stood up to prolonged heating, and if they were better than irons having flake graphite, having regard to the smaller area exposed to oxidation with nodules instead of flakes.

MR. HALLETT said he could not answer the question from his own experience but, judging from the published literature, there seemed to be no question but that the spheroidal-graphite irons were better in respect of heat-resistance than were the flake-graphite irons. It was obvious that that would be so, because the oxidation of ordinary grey cast iron proceeded very largely by the penetration of gases along the graphite flakes, and it was clear from the microstructures that passages running deeply into the material did not exist in the case of spheroidal-graphite iron. He did not suggest that, because of that difference, a spheroidal-graphite iron was as heat-resisting as (say) a high-chromium or an austenitic flake-graphite iron, for it was not; but the published figures from both American and British sources—although the evidence was not complete—suggested that the heat-resistance of a spheroidal-graphite iron was approximately the same as that of an iron containing perhaps 1 per cent. of nickel and 1 per cent. of chromium.

There was no reason, of course, why the spheroidal-graphite process should not be combined with the production of heat-resisting irons; both "Ni-Resist" and "Nicro-silal" could be produced with spheroidal graphite, giving improved properties. "Ni-Resist," when magnesium-treated, would have its tensile strength raised from about 13 to about 25 tons per sq. in., and, as cast, it would have an elongation of about 5 per cent. Although to his knowledge the point had not been investigated, he was quite sure its heat resistance would be a little better than that of ordinary "Ni-Resist."

Low-sulphur Iron from the H.F. Furnace

MR J. C. HOWARD, who said he was not a foundryman, but was concerned mainly with electric furnaces, commented that as a spectator it seemed that one of the difficulties was to decide whether to make certain types of castings in steel or in cast iron; obviously, certain of the castings which Mr. Hallett had illustrated could not be made as steel castings. It was stated that one which had been proved was the lift lever, and it looked to be the sort of casting which would turn out to be a job suitable for making in steel. Mr. Howard asked what were the particular merits of nodular iron in such cases. He supposed that one of the many advantages of nodular iron was its improved machinability; but had it other advantages in castings which did not call for a lot of machining which would normally be considered suitable for steel?

Obviously economics were important, and probably nodular iron would be used to a greater extent than it was used so far if it could be made more cheaply than at present. One of the important items of cost was obviously that of the nickel magnesium alloy, and it would be of great advantage to be able to produce an iron which initially had very low sulphur content, so that much less magnesium alloy would be required. In that connection, he drew attention to the considerable use made in Scandinavia of the high-frequency furnace for the synthetic production of cast irons from steel scrap, thereby enabling founders to make an iron of low-sulphur content. The cupola had the advantage over the electric furnace of lower melting cost, but these days the synthetic process in the electric furnace had a particular significance, because very often the relative prices of pig-iron and scrap favoured the use of steel scrap as a basic raw material.

MR. HALLETT said there was a great deal of sense in what Mr. Howard had said. One foundry in this country was using a high-frequency furnace for making nodular iron. Whether or not that would be economical in the long run it was very difficult to say. Unfortunately, the capital cost of the high-frequency furnace was extremely high. Delightfully controlled and metallurgically satisfactory though high-frequency melting was, a great deal of leeway had to be made up in respect of cost as compared with the cupola. In Scandinavia, the conditions were much more favourable to the use of electric furnaces than here; power was cheaper, and coke and pig-iron were far more expensive.

It was difficult to make a decision generally on the problem; much depended on the particular plant concerned and the sort of work it was doing. If a plant was handling low-carbon steels and high-duty cast irons, and had a high-frequency furnace in the foundry, one would be very much tempted to use steel scrap and to offset the capital cost of the high-frequency furnace by reducing the alloy addition in producing nodular iron. However, he doubted very much if it would be worth anyone's while to put in a high-frequency furnace simply to reduce the amount of alloy needed in making nodular or spheroidal-graphite iron. An attractive feature of the magnesium process was that one could use the ordinary everyday melting plant and foundry sands and everything else, provided only that one had metallurgical control and sufficient technical "know-how" in the foundry to be able to handle intelligently the feeding problems.

His company had not used their high-frequency furnaces for making magnesium-treated iron, because they obtained perfectly good results out of the cupola. They had used the high-frequency furnaces for making cerium-treated iron where the customer had wanted cerium treatment, usually, of course, for some test purpose. However, the decision would depend entirely on the local conditions of the foundry. If there were high-frequency furnaces available he felt there might be a very good case for using them.

(*Continued on page* 16)

Modern Foundry in an Old-world Setting

By A. G. Thomson

PROGRESSIVE FOUNDRIES are often a legitimate source of pride to local residents, but it is seldom that they may justly be described as amenities as well as assets. An exception is Western Foundries, whose drive bordered with magnificent rock gardens is one of the scenic attractions of Southall, Middlesex, especially in spring and summer. So pleasing is the setting of this unusual establishment that it would be hard to find more congenial surroundings for the production of iron and non-ferrous castings. Fig. 1 shows the location of the Western Foundries buildings.

Western Foundries originated as a patternshop in 1910, an iron foundry being established some two years later (Figs. 2 & 3). From the windows of the existing foundry the moulders look on to a tennis court and to gardens abounding in flowers and vegetables. The adjoining building, which belongs to the present owners of the foundry, was once a hunting lodge for the Osterley estates. The patternshop is still housed in the former chapel and the old lodge itself was used before the war as an office. The vestry once accommodated the fettling shop and the stables are still used as overflow stores. The non-ferrous shop was originally established in a cowshed.

The transformation of this picturesque establishment into a modern foundry has been achieved without destroying the old-world character of the setting. The entire staff has the use of the gardens, which grow flowers for the offices and fine vegetables for the canteen, where 40 to 50 meals are served each day. There is also a tennis club for the works.

These ideal surroundings are unquestionably appreciated by the men, who seem to take a keener interest in nature than is possible in more highly industrialised areas. The company's blacksmith is secretary of the local chrysanthemum society, the foundry foreman is a singer, and among the moulders and patternmakers are breeders of canaries, tropical fish, rabbits and dogs.

Early History

The early history of the foundry is nebulous, though two of the original staff are still in the service of the present owners, Le Grand, Sutcliff & Gell, Limited, whose own history goes back to 1872. This company has specialised for many years in artesian well drilling, Abyssinian tube wells, deep-well pump manufacture and repair, the design and manufacture of turnstiles, and the servicing of installations. Being on the same site, the local foundry was given the orders for most of the castings required for these various purposes. When it came into the market in 1932, Le Grand, Sutcliff & Gell, Limited, therefore decided to purchase it. Previously the foundry had experienced many vicissitudes and, according to the old hands, a constant succession of foremen and managers had been unable to make it pay. Under the present ownership it has steadily forged ahead and to-day the turnover is vastly increased.

At the beginning of the recent war the company were engaged in rebuilding their machine shop and were embarking on a programme of building equipment for oil fields. This continued until the Government clamped down on exports. The foundry's production, which had forged ahead, then dropped back until contracts for gun mountings on tanks were received from the Government. The parent company were also accorded the wheel contract for Normandy, but the equipment was too heavy both for the machine shops and the foundry. When the war was over, Le Grand, Sutcliff & Gell resumed the manufacture of oilfield equipment. Due to the shortage of iron castings, increased demands were made on the foundry, which now furnishes about 75 per cent. of its output to the parent company as compared with 5 per cent. before the war. At the same time, the tonnage supplied to outside customers has been progressively increased and, due to the growing pressure on equipment and floor space, the iron section has overflowed into the non-ferrous foundry, which is now housed in part of the stores.

Present Range

The present establishment includes an iron foundry, small non-ferrous and light-alloy foundries, a patternshop and temporary pattern store—the former store was destroyed by fire in 1947—and large machine shops. Due to the expanding export business in oilfield equipment, a new extension factory some four times the size of the Southall works has been opened at Rochester, where the bulk of the castings are now machined. The main products of the foundry include castings for pumping units for oil wells and for the smaller types of equipment for oilfields. The well-drilling department of Le Grand, Sutcliff & Gell, Limited, still calls for many special castings in connection with water-well pumping machinery and well-boring equipment. Outside customers are supplied with castings for milk-bottle machinery, bottle-washing equipment, water-filtration pumps, machine tools and dies, components for stoves for heating churches, etc. Iron castings range in weight from an ounce up to 4½ tons. The non-ferrous side is mainly engaged in the production of castings for the electrical industry.

From 318 tons in 1938, the output of finished castings has risen to over 2,000 tons annually. Yet the floor area is no bigger than it was twelve years ago and the staff has only grown from some 38 men pre-war to 65 to 70 at the present time. This enormously increased tonnage has been achieved by rebuilding and reorganising practically the entire foundry, pulling down the old buildings, and recon-

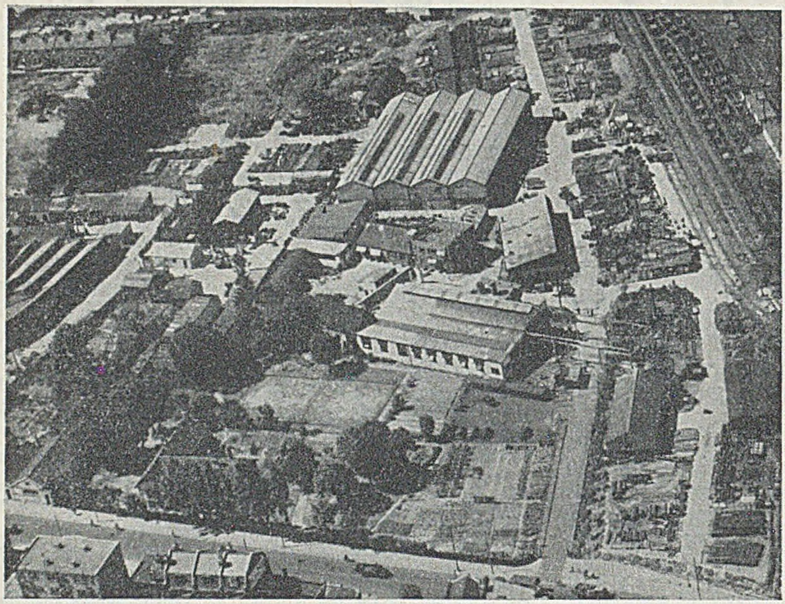


FIG. 1.—*Aerial View of Le Grand, Sutcliff & Gell Works at Southall. Western Foundries buildings are in the Centre.*

structing them to produce a straight-line layout. The rebuilding programme was largely undertaken with the company's own labour, and included raising the foundry roof by 4 ft. 6 in. in order to provide the necessary headroom for cranes. The entire programme was completed without any suspension of production. Roofs were put on while casting proceeded, and men were put on night shift so that columns, etc., could be erected during the day. These inconveniences were willingly accepted by the staff.

Repetition Work

To cope with repetition work, two moulding machines were installed in the iron foundry and other new equipment installed included a shot-blast, a duplicate furnace, and new and increased crane facilities. Moulding-box sizes were standardised and an increased number of boxes was made available. The parent company in its designs assisted the foundry by giving special attention to ease of moulding and adaptability of designs to the requirements of semi-skilled labour. Semi-skilled men were given the necessary training to enable them to take on the simpler types of skilled work. The labour force was augmented by men returning from active service, who were given all possible assistance to adapt themselves to their new trade.

Since the foundry is engaged essentially in jobbing work, wooden patterns are mainly used, but aluminium patterns are employed for the repetition work, some of which is of a heavy nature. Box sizes range from 6 ft. 6 in. square to 11 ft. by 5 in. One semi-repetition job for the oil-fields weighs 600 lb. The old chapel with its large windows and lofty roof makes an ideal patternshop and also accommodates a maintenance shop. Most of the patterns were destroyed in the fire of 1947, but the temporary store is already overcrowded. This temporary building also serves as the metal store.

Iron Foundry

The iron foundry is conspicuously clean and is painted in the recommended colour scheme of green and cream with aluminium for the roof. The floor is part concrete and part sand. The melting equipment consists of two 30-in. diam. cupolas, each of 3-ton per hr. capacity, run on alternate days. Casting every day, this plant melts up to 15 tons of metal. An Erith sand is used for moulding and a Ryarsh sand with proprietary core-binders for coremaking. The sands are loaded into bins through doors in the foundry walls. A pan-mill type mixer is used for the moulding sands and a Fordath mixer for the cores. The mould drying stove is coke fired, while the core stove is of the Newstad recirculation type. Some of the women employed in the core shop were introduced about 1941. The fettling shop is housed in a corner of the main building.

One of the two Macnab moulding machines in the foundry has been converted to take boxes up to 3 ft. long, this alteration being carried out by the company. It is of passing interest that the machine is operated by an ex fighter-pilot with five kills to his credit. He is now on the R.A.F. Reserve for flying jet aircraft.

The foundry is served by two cranes of 7½ and 5 tons respectively, while a third crane is now being converted from 1 to 3 tons. The crane gantry has been extended outside the building to cover the box yard.

Large Wheel Casting

In connection with the production of oilfield equipment, the foundry was called upon to produce a 5-ft. dia. cast-iron V-pulley. An order for a

6-ft.* wheel was subsequently received, and since the job was considered to be too heavy for cast iron, it was decided to cast it in aluminium. The pattern was turned in the patternshop, and owing to its unusual size it was necessary, in order to get it above floor level, to jack up the headstock of the lathe by about 4 in. The existing melting capacity for aluminium was only about 300 lb., so that a special furnace had to be built. The foundry had also to develop its own technique for melting, pouring, feeding and running. The job proved so successful that 25 of these wheels were cast and an order for yet another has recently been received. It is thought that at the time it was produced this was the largest aluminium casting made in the United Kingdom. Due to lack of space in the foundry, the furnace had to be built in the open under the extended crane gantry. It is a rectangular brick furnace with a cast-iron trough bath, the latter being tapped from one end into a large ladle suspended in a pit below the level of the furnace (Figs. 4 & 5).

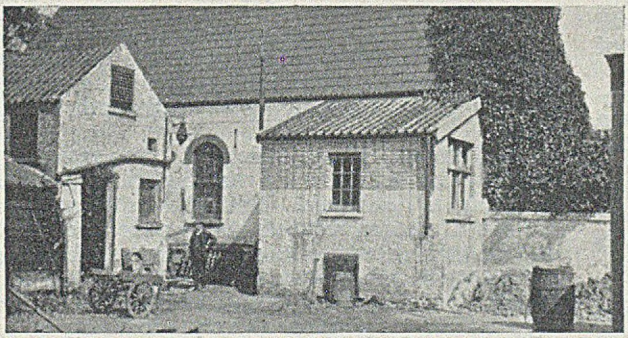
The non-ferrous foundry is served by three pot furnaces of 300 lb. capacity each. These furnaces were designed by the company and were described in a Paper entered for an Institute of British Foundrymen short-Paper competition. Due to the temporary removal of the non-ferrous department to the stores, it is at present necessary to carry metal from the foundry across the yard. Only ingot metal is used for non-ferrous products. Mansfield sand is employed. The foundry has recently developed a technique for the production of 20 per cent. leaded bronze bearings, which after pouring are plunged straight into cold water to eliminate sweating. The stage has now been reached when the foundry is able to scrap any defective castings on the spot for blowholes before they are sent to the machine shop.

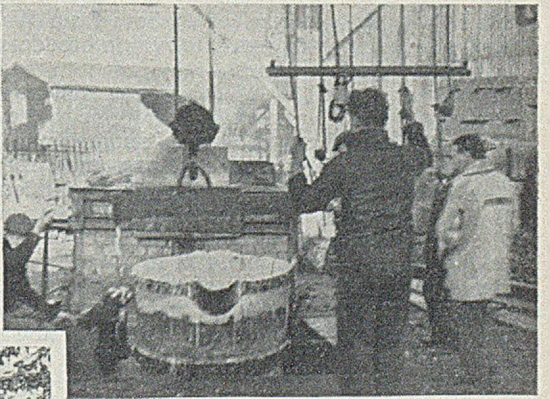
As components of oilfield equipment a high proportion of the castings produced by Western Foundries are exported throughout the world. Crates in the packing department of Le Grand, Sutcliff & Gell, Limited, are marked for such destinations as Trinidad, Labuan, Suez, Buenos Ayres, etc. Consignments are now being made to France.

* "Casting a Large Pulley in Aluminium Alloy." FOUNDRY TRADE JOURNAL, December 29, 1949.

Amenities

Showers for the men were installed in 1946 and the lavatory and washing accommodation has been rebuilt. During August of the present year a room was completed containing individual lockers for clothes. The company has a steady complement of about nine apprentices and is well known in the industry for its ability to secure as many lads as it requires. One reason is suggested by the fact that a chargehand, a furnaceman and a fettler all have sons serving their apprenticeship with the company. Another reason is that there is a standing arrangement with the local school to bring the boys round periodically to see the foundry. Lectures on foundrywork are given to local Rotary Clubs and Chambers of Commerce. In fact, a considerable amount of lecturing is undertaken not only for the benefit of the foundry itself but also to assist neighbouring foundries and the industry as a whole by interesting boys in the trade. Practical demonstrations are given to schools, youth clubs, boy-scout troops and model-making societies, so that the boys can see for themselves how castings are produced. and their enthusiasm is immediately aroused. The demonstration has been made use of





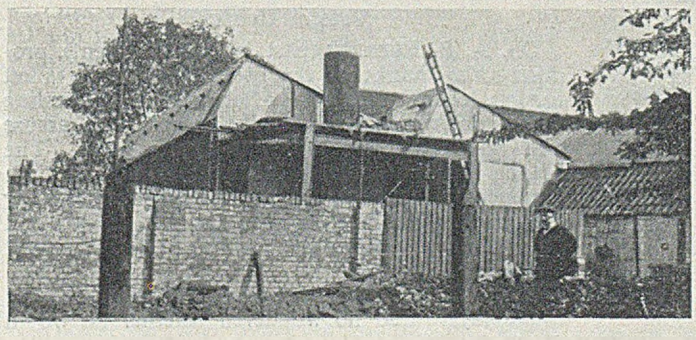


FIG. 2 (*top, left*).—*Western Foundries in* 1910 *showing the Chapel, still used as a Patternshop, and Vestry which formed the Fettling Shop.*

FIG. 3 (*bottom, left*).—*Iron Foundry in* 1910 *with the Non-ferrous Foundry in the Cowshed under the Tree.*

FIG. 4 (*above*).—*External Furnace for Melting Large Heats of Aluminium. The Ladle is located in a Pit under the Crane Gantry Extension.*

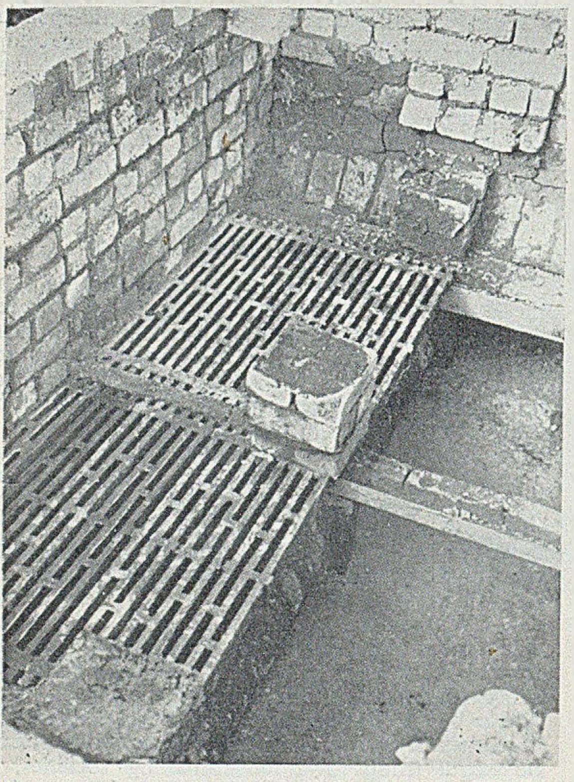


FIG. 5.—*Interior of the Large Aluminium Melting Furnace with the Bath removed showing the Blast Main across the Centre below the Fire-bars.*

officially in the lecture given to boys from Walsall schools and also in the B.B.C. television broadcast of November 23 of this year.

It is considered that these lectures and demonstrations are in all probability the principal reason for the very satisfactory intake of apprentices. This policy is one which brings long-term results, apprentices being taken on this year as a result of a lecture given two years ago. The foundry no longer needs to look for apprentices and, generally speaking, is assured of its requirements well in advance.

A very large proportion of the labour recruited remains permanently with the firm. The oldest employee, Mr. Spence, is in his 71st year and was presented a year or two ago with a watch for long service. Similar presentations were made at the same time to a non-ferrous moulder who has been with the foundry since 1912, and to a patternmaker who served his apprenticeship with the company. and has since completed 21 years' service.

Discussion—Producing Nodular Cast Iron

(*Continued from page* 12)

MR. FARREL asked what was the effect on mechanical properties of a quick knock-out.

MR. HALLETT replied that he did not think it made much difference. Certainly it would not affect appreciably the size of the graphite spheroids, assuming that the knock-out took place at a temperature below 1,000 deg. C., as would almost certainly be the case. Recalling the work of Institute sub-committee T.S.18, which dealt with knock-out temperature, he said the quick cooling of fairly light-section castings might give a slight increase of tensile strength and hardness—that was in ordinary irons having flake graphite. The same thing would occur to some extent with the nodular irons, if the pearlite were refined slightly there would be a small increase in hardness and tensile strength. Conceivably some effect might be gained by slowly cooling a large casting so as to form a proportion of ferrite. It might be important to be able to produce an iron with some ductility as cast, *i.e.*, to induce the formation of a fair amount of ferrite during cooling in the mould, as could be done more easily in heavy castings. In that case by hot knocking-out one would nip the ferrite formation in the bud, reduce the ductility and increase the tensile strength. If the casting were annealed afterwards, however, the effect of hot knock-out would be completely eliminated.

Basic Cupola for Nodular Iron

MR. F. C. EVANS asked for Mr. Hallett's comments on the use of a basic cupola for producing an iron for nodularising, for it seemed to him that the basic cupola, which offered the possibility of producing low-sulphur iron, would be much more economical than the use of the high-frequency electric furnace. Basic cupolas in this country were producing irons with sulphur contents as low as 0.03 per cent., and the use of such iron would seem to lead to economy in the magnesium/nickel alloy.

MR. HALLETT said the basic cupola was extremely attractive for such use and would certainly enable economies to be effected. Not only was the sulphur content of the iron reduced, but he understood also that the tapping temperatures were high, so that one had plenty of temperature margin to play with for adding the alloy and making adjustments. He regarded the proposition as very promising.

Vote of Thanks

DR. A. B. EVEREST (past branch president), proposing the thanks of the meeting to Mr. Hallett for his lecture, said that, after such an interesting discussion, words were hardly necessary to assure him how much his talk was appreciated. The branch was particularly indebted to him for his presence on that occasion, because arrangements for this meeting had been altered and Mr. Hallett had undertaken to address the branch at relatively short notice.

MR. BARNARD, who seconded, said he was a steel foundryman, and he wondered whether he would have to face much competition from nodular cast iron.

(The vote of thanks was accorded with enthusiasm, and Mr. Hallett responded, assuring the meeting that his visit to the branch had given him much pleasure.)

Centenaries of 1951

OUTSTANDING among the events of 1851 was the "Great Exhibition," and the admiration of Victorian Britain was divided between the Exhibition itself and the fantastic iron "pre-fab" in which it was housed, and which might have been as aptly nicknamed the "Iron Palace" as the "Crystal Palace." The Great Exhibition, however, is a separate story, and it is the purpose of this review to recall the other centenaries of 1951 of interest to foundrymen.

The mid-nineteenth century was regarded as the modern "iron age." It was in 1851 that John Vaughan discovered the seam of Cleveland ironstone; and Cleveland's iron trade began when Vaughan subsequently met that great ironmaster, Sir Bernhard Samuelson, and thereby laid the foundations of the fortunes of the Middlesbrough area. It was in that same year that the first iron ore was smelted at Glenravel, in Ulster. By 1851 the production of iron in the United Kingdom had risen to $2\frac{1}{2}$ million tons, of which it was estimated 600,000 tons were raised and smelted in the South Staffordshire iron district—the exact amount of Britain's total output a quarter of a century earlier.

John Percy was one of the most eminent of Victorian metallurgists, and his appointment in 1851 as lecturer in metallurgy at the newly-founded Metropolitan School of Science (which became later the Royal School of Mines and then the Royal College of Science) was a landmark in metallurgical history. It was in his inaugural address that Percy said that metallurgy was then regarded as "an empirical art," and his supervision that year of the analysis of a number of specimens of iron and steel was described as "the first serious attempt at a survey of our national resources as regards ores of iron."

Another eminent nineteenth-century metallurgist was Sir William Siemens, who had already invented the regenerative steam engine and condenser, but whose water-meter in 1851 was his first real success. Sir Alfred Hickman, famous president of the British Iron Trade Association, became an ironmaster and colliery proprietor that year; and there was published the third edition of Alfred Smee's "Elements of Electro-Metallurgy." Another publication of 1851 was Dr. Mayer's "Remarks on the Mechanical Equivalent of Heat"—a reminder of the long and unedifying controversy as to priority of discovery on this subject between Mayer and James Prescott Joule. Incidentally, Sir William Fairbairn (who had begun life in a colliery as an engine-wright's apprentice) was aiding Joule and Kelvin in their investigations of this theory in 1851; and it was in that year that the application of the doctrine that "heat and work are convertable" to the discovery of new relations among the properties of bodies, was established by Kelvin (who was then Professor Thomson). John Ericsson's caloric engine was brought to perfection in 1851.

There was a disastrous boiler explosion at Salford on February 20, 1851, and a more tragic one at Manchester in the following month, on which occasion there were nine deaths, and the coroner's jury returned a verdict of manslaughter against the owner and his engineer. By way of contrast there was a striking proof that on the Continent, at least, the highest honours were open to the ironmaster. Joseph Schneider, who had founded an iron works as far back as 1830, and had transformed the famous Creusot works into the largest in France, became in 1851 Minister of Commerce.

There occurs on October 5 the centenary of the death of William Brunton, who had been "mechanical manager" of the Eagle Foundry at Birmingham, and had subsequently erected copper smelting furnaces and rolling mills in South Wales. His calciner was used in Cornish tin mines, and he also invented a fan regulator, improved the system of ventilation in collieries, and produced the famous "Steam Horse," which was successfully introduced at the Newbottle Colliery, until it exploded, with loss of life.

Richard Cowling Taylor, who died in the same month as Brunton, surveyed coal and iron regions in America, and also the British Iron Company's property in South Wales, and was author of "Statistics of Coal," and "The Coalfields of Great Britain." Others who died in 1851 were John Farey, who constructed iron works in Russia, and wrote on the "Force of Steam"; and William West, who not only lectured on the atomic theory as far back as 1821, but also on boilers, explosions in coal mines, and on "data for a comparison between the heat yielded by coke and coal."

There will be many personal memories of that eminent metallurgist, Percy Carlyle Gilchrist, who was born on December 27, 1851, and shared with Sidney Thomas the distinction of being founder of the "Thomas Gilchrist" process for making steel from phosphoric pig-iron. Ernest Howard Griffiths, who was born on June 15 of that year, was a notable professor of experimental philosophy, and president of the South Wales Institute of Engineers. He was author of "The Thermal Measurement of Energy." Other notabilities born in 1851 were John Edward Stead, metallurgical chemist, president of the Iron and Steel Institute in 1920/1; Joseph John Tyler, who graduated from the Bowling Ironworks into the family brassfounding firm, and was a noted inventor; and Emile Berliner, inventor of an air-cooled engine.

In the year 1651, that famous ironmaster, Dud Dudley, who was the first man to smelt iron with coal, erected a furnace near Bristol in order to exploit the patent which had been granted him "for the sole making of iron into any sort of cast-works with sea or pit coals, peat, or turf, and with the same to make the said iron into plate-works or bars and likewise to refine all sorts of metals."

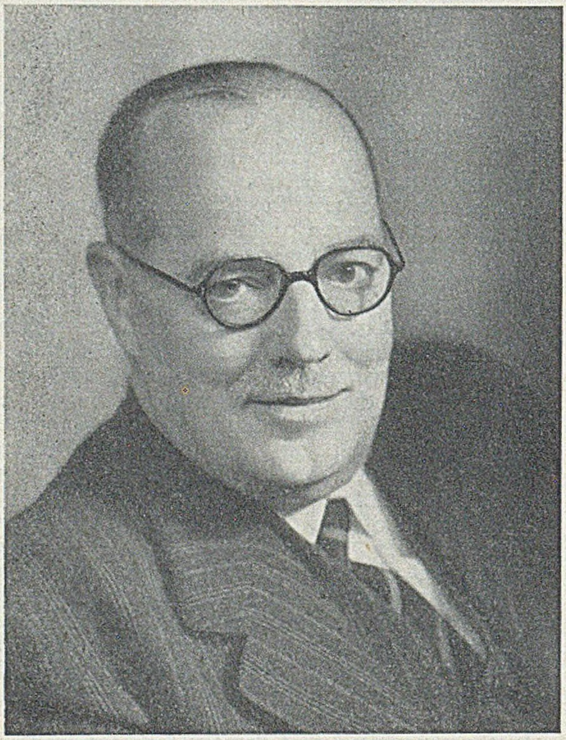
Methods of Producing Nodular Cast Iron

The authors of this interesting Paper, Mr. R. Collette and Professor Albert De Sy, point out that the irons shown in Figs. 1 to 4 contained a final sulphur content of 0.014, 0.010, 0.012, and 0.013 per cent. respectively, and not as printed, free from S, Mn and P. The article was printed on pages 495 *et seq* in our issue of December 14, 1950. The error, which we regret, was due to sub-editing.

Leaders of the Industry

Dr. J. E. Hurst, J.P.

Dr. J. E. Hurst was born in 1893 in Glossop, where he attended the local grammar school. He served an apprenticeship with Beyer Peacock where he became assistant metallurgical chemist. The period between 1913 and 1919 was spent as chief metallurgist to Richard Hornsby & Sons, Limited, and D. Napier & Sons, Limited. About this time he interested himself in centrifugal castings, and thereby founded an international reputation. In 1920, he was consulting editor of the FOUNDRY TRADE JOURNAL. Later he turned his attention to the nitrogen hardening of cast iron. At the present time, Dr. Hurst is deputy chairman and managing director of Bradley & Foster, Limited, of Darlaston; technical director of the Birmingham Chemical Company, Limited, of Lichfield; chairman of the British Grit Corporation, Limited; and director of research, the Staveley Iron & Chemical Company, Limited.



Dr. J. E. Hurst

Dr. Hurst's work in connection with technical associations has indeed been outstanding. Joining the Institute of British Foundrymen in 1914, he became president of the Sheffield branch in 1934 and of the Institute in 1935. He was awarded the Oliver Stubbs Medal in 1935 and the E. J. Fox Medal in 1938. In the Iron and Steel Institute he has also been active. He was a Carnegie Research Scholar in 1916 and member of council from 1944 to 1949. He presided over the Stafford Iron and Steel Institute during the period 1944 to 1947 and when the Institution of Metallurgists was formed he was a founder fellow. The International Committee for the Testing of Cast Iron has been guided by Dr. Hurst as president since 1938. He was the first national president of the National Trades Technical Societies and a life member of the Sheffield branch. He also holds membership in the Institution of the Chemical Engineers. After years of active participation in the affairs of the British Cast Iron Research Association he has recently been elected president—an honour he has well merited. He has also accepted the presidency of the Institute of Vitreous Enamellers. He has always interested himself in employer activities and has been associated in various capacities with the work of the Council of Ironfoundry Associations—especially on the more technical aspects. Also, he was deputy chairman of the Cylinder and Refined Iron Association. On the educational side he is a member of the board of the Faculty of Metallurgy of the University of Sheffield—it was Sheffield University which in 1939 recognised his outstanding merit as a metallurgist by the award of the degree of Doctor of Metallurgy (*honoris causa*).

The war involved Dr. Hurst in many additional activities. He was a member of the Metallurgy Subcommittee of the War Office and the Ministry of Supply Scientific Advisory Committee; member of the Advisory Committee to the Iron and Steel Control, the Technical Advisory Committee to the Controller of Iron Castings and the Silicon Iron Advisory Panel to the D.O.F.(X), Ministry of Supply.

Naturally, Dr. Hurst has won existence apart from his business and metallurgical activities and at Lichfield, where he lives, he is a Justice of the Peace; a Sheriff of the County of the City of Lichfield; chairman of the Lichfield Johnson Society; honorary freeman of the Worshipful Company of Smiths (Lichfield); a liveryman of the Worshipful Company of Founders (London) and a freeman of the City of London. He is the author of three textbooks: Metallurgy of Cast Iron; Melting Iron in the Cupola; and Centrifugal Casting.

I.V.E. Northern Section Notes

The first meeting of the Session of the Northern Section of the Institute of Vitreous Enamellers was held at the Queen's Hotel, Manchester on October 18, 1950, and the following officers were elected:—*As chairman*: Mr. H. Whitaker; *as deputy chairman*: Mr. A. M. Cleverley; *as secretary*: Mr. T. J. McArthur; Mr. P. Rogers, Mr. J. K. Whitaker, and Mr. W. Ball to make up the committee. It is arranged that the committee shall meet at 6.30 p.m. preceding each meeting.

Following the General meeting, a Paper entitled "Plant Control to Reduce Enamelling Rejects" * by Mr. J. H. Gray was read by Mr. D. H. Mill owing to Mr. Gray's unavoidable absence through illness. The Paper was well received and was followed by a lively and interesting discussion. A letter of thanks was sent to Mr. J. H. Gray expressing the hope that he will quickly recover from his illness. Members are invited to write the secretary putting forward any suggestions for further subjects or meetings.

* Printed on pages 19 to 23 of this issue.

Mineral Development Charges

A note on development charges in respect of minerals under the Town and Country Planning Act, 1947, has been issued by the Central Land Board.

Minerals listed in the appendix to the note cover barytes, cement, chalk, china clay, clay (including fireclay and silica), fluorspar, iron ore, igneous rock and sandstone, limestone, salt, sand and ballast, glassmaking sand, and slate.

Plant Control to Reduce Enamelling Rejects*

By J. H. Gray, A.I.Mech.E.

In preparing this Paper, it was intended to confine it as much as possible, to what may be termed the incidental tools and equipment, their use and effect from the point of view of reducing rejects; and, in some degree, to methods of control in the enamelling shop. Whilst the necessity and importance of this control has been stressed in previous Papers, the Author is still of the opinion that there is not sufficient thought given to this aspect of operating in some enamelling shops. This control has been subjected to examination based primarily upon functional considerations.

IT IS OBVIOUS that the job of the enamelling-shop foreman is to control the labour and produce the ware to the required standard on the most economical basis. The sprayer's job is to spray; the fuser's to carry out fusing, and so on throughout the plant. To control the production, it is not sufficient to know that the various operators are performing their duties. Something more is necessary if the enamelling plant is to produce ware of good quality at a minimum cost. It must not only be ascertained that each operation is performed on the prescribed lines, but that there is also some control over the materials and methods used, which will assist in the various operations being carried out efficiently and economically. Bearing in mind that the human element enters very largely into enamelling operations, and while it is not possible to eliminate this element, there are methods of control which can be introduced and operated for reducing the detrimental effects arising from a failure of this element.

It is not suggested that it is necessary, or even economical, to adopt complicated systems or methods, but it is certain that if a number of the well-known, and, in some cases, widely-practised methods were more generally adopted they would have a very definite bearing on the reduction of rejects, irrespective of the class of ware being produced. It is easy to introduce a method of control, but not so easy to control its constant use. No system is effective unless it is conscientiously adhered to. It has been said that the installing of a mechanised plant represented about 50 per cent. of the job—the other 50 per cent. was to make it work; and this is equally true with systems of control in enamelling shops.

Simple Tests

During this Paper it is proposed to explain, by means of diagrams, a few ideas which are simple in themselves, but can have a very definite bearing on the quality of the finished ware from the point of view of rejects. While some of these in their present form may not perhaps appeal to everybody, they may provide the germ of an idea for the development of a device to meet some special requirement. These come into the same category as the pickling pills for testing the acid bath, and a number of similar simple, but very effective means of control, such as the fineness-test outfit, the viscosity meter, or a simple method for checking density.

None of these methods has been developed purely as an idea, but they are the result of careful study and observation and the need for eliminating defects which cannot always be directly blamed onto the operator.

Rejects through Mishandling

A number of cases have been observed where a considerable proportion of the rejects was due entirely to mishandling, either by the sprayer, the fuser, or the employees handling the work between the operations. On first sight this appeared to be due simply to lack of interest in their work. On closer investigation, however, it was sometimes found that this marking of the ware or chipping of the enamel by the operators was not entirely their own fault, but the fault lay primarily with the people in charge of the department, through their not having given sufficient attention to the methods of handling the ware in its various stages.

In one works, steel racks were used on conveyors for conveying sheet-iron ware, and the space between the shelves was so confined that it was almost impossible to lift out sheets, say, 2 ft. by 2 ft. 6 in. without marking them, while smaller sheets, say, up to 18 in. square, could be handled quite comfortably. In other cases a slight alteration to the design of the sizes of sticks or trays has the effect of considerably reducing rejects through marking. Yet again, it sometimes is the practice for the fuser to "touch-up" any small marked places, and while this is frequently carried out very satisfactorily, it does not improve the appearance as compared with unmarked ware, and it very often results in rejection after firing, where as if the necessary care—and, it should be emphasised, forethought as well—were taken in providing the operators with the correct tools, and giving necessary attention to the arrangements for handling the ware, a considerable proportion of rejects from this cause would be eliminated.

Unskilled Labour

It is a common failing to underestimate the importance of what may be termed the non-pro-

* Paper read before several sections of the Institute of Vitreous Enamellers.

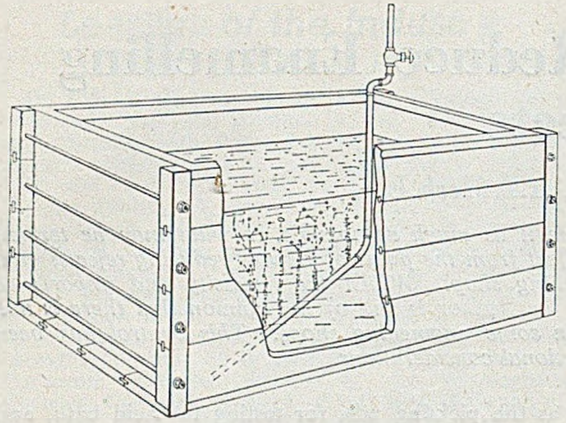


FIG. 1.—*Pickling Tank incorporating Aeration from a Perforated Monel-metal Tube.*

ductive labour in the enamelling shop; that is, the person whose job it is to push trucks of ware between the various operations, yet these employees are very important links in the chain of operations. There are instances where new labour of this class has been started without previous experience, and the foreman has just given them brief instructions as to their duties or detailed some other operator to show them what to do; it may be carrying work from the sprayers to the dryers, or from the dryers to the furnaces and so on. They consider that these brief instructions, probably taking but a few minutes, are sufficient. This often results, however, in the newcomers marking the ware for a number of days or even weeks; and having started in the wrong way it is more difficult to correct them than if they were properly trained initially. If the necessary time has been spent in properly training these new people—it could be done in a day or two—many rejects or spoilt work would be prevented, with a saving of time and money. The time taken in thoroughly training such work-people would prove much less than that necessary for continually correcting them over long periods.

Hard-and-fast rules cannot be laid down for general application throughout the trade; owing, of course, to the vast range of types and classes of ware which call for various systems of production. It can, however, be said that if close observation be maintained on the small items of control, it will assist materially in the smooth operation of the plant and in a reduction of rejects.

Defects from Shot-blasting

With the more general use of the "Airless" mechanical-type shotblast p'ant, defects due to poor quality blasting have been considerably reduced. A personal opinion is that any works having the need for new shotblast equipment should give very careful consideration to the type of plant to be installed. Whilst the mechanically impelled "blast" has many advantages, whether it be of the belt-conveyor or drum type, it may so happen that neither of these may be suitable depending on the type of castings to be processed, and consideration will perhaps have to be given to the room-type equipment.

In the case of the mechanical-type shotblast plants, a weekly inspection should be carried out by a competent engineer and a report issued to the plant manager on the general condition or need for renewal of parts. If this is carried out, expensive stoppages in production due to breakdowns will possibly be eliminated. At least once every four weeks, the steel shot should be completely emptied from the machines and re-sieved. This will ensure a visual inspection of the shot in use and any unwanted material can be rejected. Shotblast nozzles of the long-life type should be introduced wherever possible to save excess wear and loss of time in changing. Also, many plants find it advantageous to install an air-pressure recorder covering 24 hours. This will enable daily inspection to be made of the pressure supply during any of the 24 hours. A further point is that the inspection of shotblasted castings should be carried out before they are issued to the spray line. This inspection should cover cleanliness, warpage, cracks, and porous castings not suitable for enamelling. The inspector carrying out this work could also be the checker responsible for recording the work blasted, and this will avoid delay at the spray line.

Defects from Pickling

Difficulty has been experienced in sheet-iron enamelled ware production, including "copper-heading," blistering and similar troubles, the solution being traced to the pickling room, and the correction and prevention of this trouble recurring has been achieved by the introduction of a simple system of operation there. No set rule can be laid down to control all pickling operations, but in these cases the acid strength required should be determined, the time for immersion of each class of ware in the various solutions should be

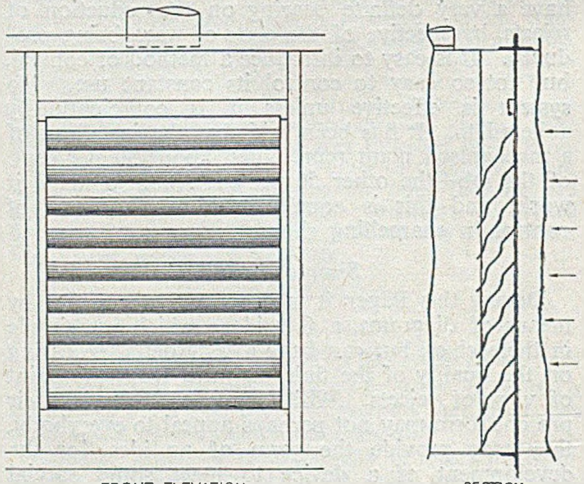


FIG. 2.—*Baffle Arrangements for Enamelling Spray Booths.*

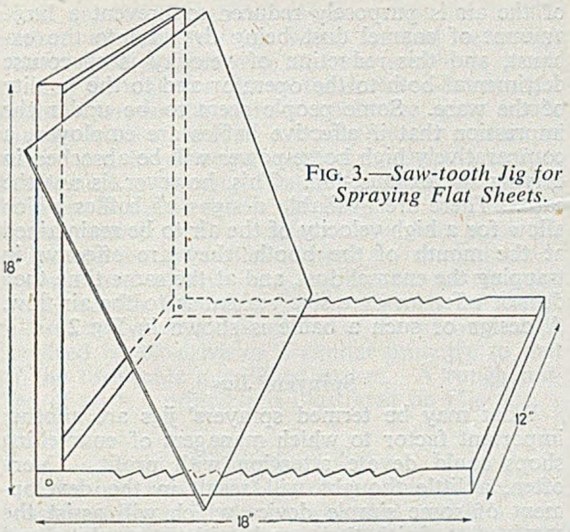


FIG. 3.—*Saw-tooth Jig for Spraying Flat Sheets.*

set and a standard acid test by "pickling pills" or titration introduced. Regular periodic cleaning-out and renewing of the various solutions can be agreed upon, with the result that there is no recurrence of these troubles from this source.

Attention is drawn, where cold hydrochloric acid is used, to a simple system of increasing the efficiency of the pickling tank by aerating the solution. This is done by running a small air supply to the pickling room, and allowing the air to escape into the bottom of the tank so that it bubbles up through the acid solution. A method of doing this is to run, say a $\frac{3}{8}$ or $\frac{1}{4}$ in. air pipe, and have a length of Monel metal tube running along the bottom of the tank with a number of drilled holes for the air to escape into the solution, as shown in Fig. 1.

Dipping Ground Coat

A large number of difficulties have been experienced through inconsistencies in the sheet-iron ground (grip) coat at the dipping tank. Most enamellers have encountered difficulties some time or another, at this stage in the production. Although it may sound a very elementary suggestion, a regular dip-weight test should be taken of the enamel. It is amazing the number of instances which occur where this is not carried out until rejects or poor quality work are seen coming from the grip-coat furnace. It is deemed essential that a dip-weight test should be carried out at least every two hours. The method of carrying out this test varies in different plants. In some cases, a sheet measuring 17 in. by 17 in. is used and the wet weight of enamel on both sides of this sheet is taken after it has been allowed to drain when placed vertically. In other cases, a sheet measuring 12 by 12 in. is used, and this is again dipped into the enamel and drained vertically and allowed to dry prior to weighing. The method adopted is one of personal choice; the essential point, however, is that whichever test be used it should be carried out repeatedly and at regular periods. The Author is purposely not specifying any definite weight of ground coat, because this must vary, depending on the type of enamel used and also the type of ware being processed.

Rejects, difficulties and loss of production are often caused by contaminating accumulations, during a shift, of the sheet-iron ground coat at the dipping tank. At a comparatively low cost this to a great extent can be eliminated by the introduction of a circulating system which can be carried out by taking a $1\frac{1}{2}$ in. (gas) pipe from the bottom of the grip-coat tank either in the centre or from one of the front corners, running it underneath the tank, up the back of the tank, and turning it over, so that with the incorporation of a special pump in this line, the grip coat can be circulated so that it discharges into one of the back corners of the tank above the level of the contents. A sieve, say 8 in. square, with a 20-mesh lawn, can be fitted in this corner of the tank below the discharge pipe, and by means of this continuous circulation and sieving the grip coat is kept free from any foreign matter and "settling" is prevented. It is not necessary to cause a rapid circulation, if the contents of the tank are completely circulated, say, once every two hours, it will be found sufficient. The pump incorporated in this circulating system should be capable of handling approximately 3 gall. of grip-coat per min. In this case, a pump is required having a speed of about 700 r.p.m. driven by a $\frac{3}{4}$-h.p. motor. Special pumps for handling slurries of this description are now obtainable.

Mill-room Operation

The method of operation in the mill room is outside the scope of this Paper, and has been dealt with in many previous communications read before

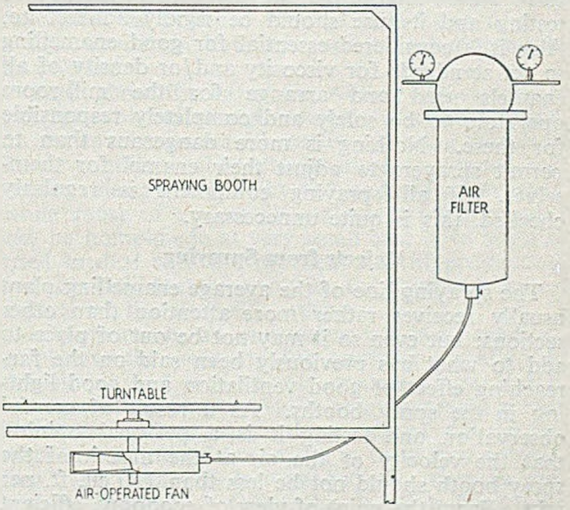


FIG. 4.—*Air-operated Rotary Turntable for a Spraying Booth, taking Compressed Air from the Spraying Supply.*

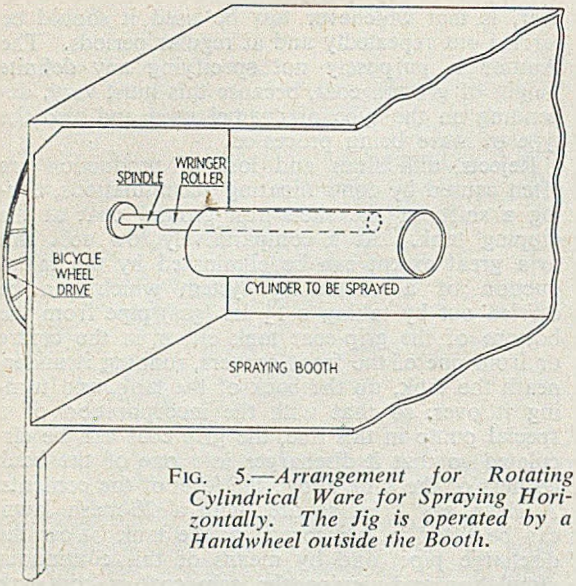


FIG. 5.—*Arrangement for Rotating Cylindrical Ware for Spraying Horizontally. The Jig is operated by a Handwheel outside the Booth.*

the Institute of Vitreous Enamellers, but in view of all that has been written in text-books, and said at previous meetings of the Institute on the subject of mill room control, the Author has been rather surprised from time to time at having been called in to investigate and correct troubles which have been due simply to lack of control in the mill room. For instance, the method of testing the fineness by using a 50 ml. beaker, 150-mesh sieve, and a graduated test tube, is so well known that it seems almost unnecessary to mention it, but it is surprising how frequently one finds those in charge of mill rooms allowing men to become slack and to ignore its use. There is no wet-process enamel ground for use in any branch of the enamelling industry which would not benefit by the constant use of this simple and inexpensive method of testing and its use should be rigidly adhered to. Also it is considered essential for good enamelling to set standards for viscosity and/or density of all enamels used and arrange for the mill-room operators to be solely and completely responsible for these. Nothing is more dangerous than to permit sprayers to adjust their enamel for themselves. If all spraying equipment is regularly checked, this is quite unnecessary.

Rejects from Spraying

The spraying line of the average enamelling plant usually receives rather more attention than other sections; but even so it may not be out of place to add to what has previously been said on the far-reaching effect of good ventilation and good lighting in the spray booths. As a result of careful observation and testing it is a personal opinion that the velocity of the air at the mouth of the spray booth should not be less than 110 cu. ft. per min. From the point of view of economy, efficient enamel baffles should be used to prevent an excessive amount of enamel being drawn into the exhaust system. On some spray booths the velocity of the air is purposely reduced to prevent a large amount of enamel dust being drawn into the exhaust, and this reduction of velocity is of course detrimental both to the operator and to the quality of the ware. Some people seem to be under the impression that if effective baffles are employed, a comparatively high horse-power will be absorbed in driving the exhaust-fan. This, however, is not the case. There are available designs of baffles which allow for a high velocity of the air to be maintained at the mouth of the booth, they are effective in trapping the enamel dust, and at the same time they do not offer an excessive resistance to the air-flow. A design of such a baffle is shown in Fig 2.

Sprayers' Jigs

What may be termed sprayers' jigs are another important factor to which managers of enamelling shops could devote attention with profit. Very often, a little thought will result in the development of some simple device which will assist the sprayers to finish their work without marking and often, at the same time, speed up the sprayers' operation. In this connection, attention is drawn to Fig. 3 showing a very simple form of spraying jig which can be used for sheets, and, in some cases, for cast iron, and which to some extent simplifies the spraying operation. A simple method of having an automatically rotating turn-table in the spray booth can be adopted by the use of a small air-operated fan fixed to the spindle of the turn-table, which projects through the base of the spray booth. The method of propelling such a fan is by taking an air supply from the base of the air filter to the spray booth and depending on the adjustment of the valve, so the speed of the turn-table can be regulated. This method, incidentally, ensures a continual throw-off of any oil or moisture from the air line, leaving the air supply to the spray gun absolutely clean. The principle of this is illustrated in Fig 4.

Another very simple fixture can usually be adopted for the spraying of large or small cylinders similar in construction to the standard type of water-heating casing. The spraying of such ware is often delayed, or rejects are caused, by the building-up of enamel on the turn-table or angle

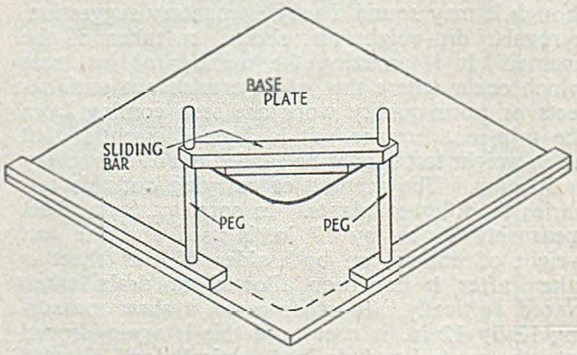


FIG. 6.—*Jig for Accurate Brushing off of Enamel from the Corners of the Ware after Spraying.*

irons on the turn-table, causing difficulty at the bottom of such casings when sprayed vertically. The method suggested is to have a spindle fixed, passing through the side of the spray booth at right angles. On to the spindle inside the spray booth can be fixed a wooden or rubber roller similar to those used in wringing machines. On the end of the spindle projecting outside the spray booth can be fitted a wheel similar in design to an ordinary bicycle wheel. The operator can then place his cylinder over the roller referred to, spray it horizontally and revolve the casing by turning the wheel outside the spray booth with his left hand. Alternatively, this spindle can be automatically revolved by air-drive on a similar principle to that of the turn-table mentioned earlier. A rough outline of such a principle is illustrated on Fig. 5.

Brushing-off Jigs

Referring now to Fig. 6 showing a type of brushing-off jig, it will be seen that this is a very simple but effective device for brushing-off plates with a radius at the corners. The edges of the plates are brushed off in the usual way by means of stencil brushes, a piece of stencil metal or sheet zinc is cut to the required radius and secured to the underside of the sliding strip, the plates are put into the jig, the sliding strip lowered onto the plate, and the corner brushed off with an ordinary stencil brush. This is very simple in construction and operation, every corner of the plate being brushed off to the same radius. The method eliminates the necessity for measuring and marking. This gadget may not be of service to a number of enamellers in its present form, but it may very well form the germ of an idea for the development of some other types of tools or jigs to suit a particular class of work.

Drying Problem

In plants where the oven or box-type dryer is used, numerous cases have been encountered where a considerable number of rejects have been caused through marking of the ware in the dryer. This can be avoided to a very considerable extent if more forethought is applied to deciding the design and size of the dryers, and the position of the doors. When continuous dryers, either of the horizontal or vertical type, are under consideration, the method of handling the ware in and out of the dryer and the design of the carriers receive a good deal of attention, and this naturally has its effect on the reduction of rejects. With the simple type of box-dryer, however, this aspect of the matter is liable to be overlooked. The method of handling the ware at the furnace should have constant attention, particularly so as it is the last phase in the enamelling operation, and rejects here are more costly than in earlier stages of production. This subject on its own could well be made the subject of a future Paper.

A system could be devised for delivering and stacking the ware around the furnace so that the fusers can select their loads without undue shifting of unfused work, or lifting pieces of work from various trays, as this is always liable to cause marking. The perrits or fusing jigs, whichever are used, should be carefully selected or designed to suit the class of ware being fired. Also, all perrits should be cleaned periodically by shot-blasting. The method of loading the ware according to its design is worth attention and emphasising during instructions to the fusers the necessity for correct loading is time well spent. For instance, where possible heavy castings or castings with heavy lugs should be fired separately in one load. The mixing of light and heavy castings should be avoided. Where the firing of double-decked loads is practised, the top-deck or layer of casting should always be loaded first, as if the bottom layer is loaded first there is the possibility of scale, dust, or differently-coloured enamels falling on to the lower castings while the upper layer is being loaded.

In cases where the work is suspended during fusing and mixed loads cannot be avoided, the heavy castings, or those with heavy lugs, should be loaded on the outer edges of the perrits. The fabricating of heat-resisting perrits and jigs from 14 to 16 s.w.g. metal is also helping enamellers to overcome a number of their fusing problems. These are simple well-tried ideas, but unquestionably their importance is not always sufficiently emphasised to the fusers.

Temperature Control

Whilst there are probably no enamelling furnaces in operation without pyrometers being connected, it is considered that a *recording* pyrometer should always be installed in preference to an *indicating* pyrometer, as a complete record could then be maintained from week to week of furnace loads and temperature conditions. Such a record is also very valuable to enable the plant superintendent to get some guide as to the production of any furnace during his absence, and to carry this a stage further, if such a recording pyrometer could be coupled with a temperature-control unit, conditions would be as favourable as possible. By the installation of such a unit, saving in both fuel and man-hours would be effected.

Throughout the Paper the Author has essentially put forward only simple systems of control which do not involve increased cost in operating the plant. He is confident that the methods suggested will reduce rejects and thereby reduce production costs, while most of the small appliances recommended can be home-made at very small cost. He has also tried to deal with the practical side of production, and has deliberately avoided the highly-technical aspects of the enamelling process.

In conclusion, an endeavour has been made to emphasise the necessity for constant attention to the simple and well-known maxims of control in the enamelling shop. Whilst many enamellers may feel certain that many, if not all of the control methods mentioned are in use in their own enamelling departments, it is suggested that they be personally checked. Often this is all a frit-supply service man has to do to locate the course of some so-called serious trouble in an otherwise well-run plant.

Zinc Allocation Scheme

Measures to Meet Shortage

ON DECEMBER 7 the Minister of Supply announced that the shortage of supplies of all grades of zinc likely to be available to industry over 1951 would, so far as could be seen, involve further cuts in consumption, and that out of the amount available the increasing requirements of defence would have to be met. He explained that during the first quarter of the year the position was likely to be particularly serious, and that the supply of the ordinary grade of zinc might have to be restricted during that quarter to about 50 per cent. of the rate of consumption during the first nine months of 1950.

The Minister announced last Thursday that although every effort continues to be made to increase supplies to this country, such further supplies as have been or may be secured are likely to be wholly absorbed by increasing demands for defence purposes and that, accordingly, the Government must plan on the basis that the serious shortage in the first quarter of the year will continue for some time.

The Government therefore intends to introduce this month a statutory Order prohibiting from February 1 certain specified uses of zinc and brass which are regarded as unjustifiable in present circumstances. There will be provision in this for licensed exemptions for special purposes. To prevent substitution of copper in these uses, and to conserve the supplies of this metal, the Order will include prohibition of certain uses of copper.

The allocation of zinc will for the time being be made on a monthly basis. The February allocation will be determined in the latter part of January in the light of experience of the working of the January allocations and of any further developments in the supply position. Purchasers of zinc from the Ministry are being individually notified by the Directorate of Non-ferrous Metals of their allocations for January. The quantities of the three grades of zinc available for distribution in this way are the following percentages of the average monthly rate of consumption over the first nine months of 1950:—ORDINARY (G.O.B.)—used predominantly for galvanising and also for brass and zinc oxide—50 per cent.; ELECTROLYTIC—used mainly in brass, rolled zinc products, and zinc oxide—for brass 85 per cent., for other uses 70 per cent.; HIGH PURITY—used mainly in die casting—85 per cent.

Prohibited Uses

The provisional list of prohibited uses of zinc, copper and copper alloys is as follows:—

ARCHITECTURAL AND DECORATIVE METAL WORK OF ALL KINDS (INTERNAL AND EXTERNAL).—Barrel bolts; brackets; catches; chains (including sink and bath waste chains); cills; clips; cornice coverings; damp courses; draught excluders; drawer pulls; expansion joints; fire irons; flashings; floor plates and floor strip (*e.g.*, durazzo strip); glazing bars; grills; gutters and rainwater goods; handles; hangers, hasps; hinges, hooks; knobs other than for external use; linings; plaques; plates (*e.g.*, name, number, and letter plates, kicking plates); rails and railings; rings; roofing sheets, except for essential repairs; sash lifts; sheathing generally; staples; stays; step treads; strips (*e.g.*, for counter edges); door knockers.

HOUSEHOLD APPLIANCES AND DOMESTIC UTENSILS.—Ash trays and other ash receptacles; bins; bowls; buckets; coal scuttles; containers of oil lamps and stoves; electroplate ware; fruit dishes; fern pots; fireguards and sparkguards; fire screens; fire irons; fire dogs; fire-iron boxes; coal and log boxes; funnels; furniture fittings (including handles) other than screws and hinges; gongs; hardware and hollow-ware generally; picture wire; pot scourers; soap dispensers; soap, sponge, and drinking-glass holders; serviette rings; smokers' stands; stair rods and fittings; table hollow-ware; tea strainers; towel rails; toothbrush holders; toilet-paper holders; vases; washstands; bedsteads; window fittings; curtain rails.

ORNAMENTAL.—Jewellery boxes and caskets, cases and containers of all kinds; badges; jewellery and ornamental jewellery; ornamental brassware generally; beads, bead trimmings, and articles made from beads; tinsel thread and braid; bag frames and fittings.

DRESS ACCESSORIES.—Buttons, except linen; key rings and chains; collar studs; sleeve links; watch chains; shoe trees and shoe racks.

STATIONERS' SUNDRIES, ETC.—Paper fasteners; drawing pins; file eyelets and other fittings; screw binders; office furniture and stationers' sundries; desks; tables; waste-paper bins; shelving; bookcases; bookstands; transfer cases; deed boxes; stationery cabinets; metal furniture; penholders and nibs; ink pots; propelling pencils; pencil sharpeners; book-ends; blotters, inkstands, paperweights; letter racks and trays.

MEDICAL AND SCIENTIFIC APPARATUS.—Bedpan sterilisers and racks.

ELECTRICAL AND GAS ACCESSORIES AND APPLIANCES.—Bodies and lids of electric kettles, saucepans, coffee percolators, waffle plates, and similar cooking and portable water-heating appliances; conduit tubing; fan blades and guards; lamp caps of certain types and sizes; lighting reflectors, shades, galleries and shade carriers, and suspension chains; conduit bushes and fittings for civil use; ornamental lighting fittings of all types, including table and standard lamps; reflectors, guards, and ornamental parts of electric radiators and bowl fires; switch, socket, and bell-push plates; tumbler switch covers; wiring clips and non-current-carrying parts of wiring fittings and accessories; junction-box covers.

MISCELLANEOUS.—Antique metal-ware generally; bird cages; blow-lamp bodies; card, mirror, and photo frames; powder bowls and boxes; indoor games and accessories; fancy goods generally; funfair machinery; coin- or disc-operated machines for games; childrens' toy apparel; sports and outdoor games goods; cigar and cigarette boxes and cases; toys; handle ferrules; lipstick cases; luggage fittings; rubber stamp mounts and ferrules; safety-razor parts (handle, guard, or case); school drawing instruments; garden and agricultural requisites, except for spraying equipment or other proved essential use.

GALVANISED TUBES AND FITTINGS, except for water services; naval services; and refrigeration plant.

GALVANISED SHEETS, except for food tanks and containers; drinking-water tanks and other naval services; building for oversea; and fire-fighting equipment.

FULLY GALVANISED IRON AND STEEL WIRE, except for wire ropes and wire strand; wire netting for Summerfield track; sheep netting; electric cables for submarine and subfluvial cables; mining cables and certain Admiralty patterns; cables for coal mines; aerial cables; and cables where the armouring is left bare and bright.

WIPED GALVANISED WIRE, except for telephone, telegraph line, and earth wires; electric cable; chain-link fencing; patent-steel fencing; agricultural barb wire; and fencing wire.

GALVANISED HOLLOW-WARE.—Tar buckets; hods; boiler fillers; hand bowls; manure or socket bowls; turnip and lynn skips; rubbish burners; garbage or refuse pails; dustbins; waterloos; cans (contractors', greenhouse, toilet, or paint); deep jets; slop pails; seed hoppers; fire buckets (if they are labelled sand).

GENERAL GALVANISING.—Cinder sieves; coal bunkers; foot scrapers; gutters and gutter brackets; lamp shades; scoops, hods, and scuttles; ventilators and cowls, except for use on ships and in connection with fume extraction; scaffolding; tubes and fittings other than water tubes; conduit and conduit fittings; air bricks; door plates and frames; gratings; hat and coat hooks; manhole covers, except for houses; wire guards for machinery, etc., except for use on ships or exposed to moisture and chemical action; wall ties and nails; roofing sheets; tertiary lighting for engine rooms.

ROLLED ZINC.—Roofing sheets, except for repairs.

Institute of Metals

In order to continue to accord to its membership the same high standard of services as has been given in the past the Institute of Metals requires additional funds. Rightly it has been decided not to raise the subscription levels (as this money very largely comes from young technicians) but instead to ask the various firms operating non-ferrous works to make donations, preferably on a 7 years basis for the obvious reason of minimising income-tax claims. The president, Mr. H. S. Tasker, has sent us a copy of a reasoned appeal for increased financial support for the work of the Institute and we suggest that firms should write to Lieut.-Col. S. C. Guillan, T.D., the secretary, at 4, Grosvenor Gardens, London, S.W.1, for this document which stresses the urgency of the problem to be overcome.

Ironfounders' National Confederation

East and West Ridings Section

The ninth annual general meeting of the East and West Ridings Section of the Ironfounders' National Confederation was held at the Great Northern Station Hotel, Leeds, on December 19, and as a fitting climax to a very lively year was well supported by the members. Mr. R. Chisholm was re-elected as president and Mr. F. D. Drake elected as vice-president for the ensuing year, the remainder of the executive being re-elected *en bloc* with the addition of Mr. C. L. Carver. At the luncheon which followed were many distinguished guests, including:—The Lord Mayor of Leeds; the president and director of the I.N.C.; the president and secretary of the Engineering and Allied Employers' Leeds and District Association; the president and secretary of the Leeds and District Ironfounders' Association; the manager of the government training centre, Leeds; and four members of the Ironfounders' Anglo-American productivity team.

Replying to the toast to the guests, the Lord Mayor paid tribute to the work of the Association in Leeds and district, and referred to a most interesting visit which he had made to the foundries of two of the members. Mr. D. Graham Bisset complimented the Association on the progress made during the year, and particularly on the lead given in applying the productivity formula. He congratulated the Association in having such an enthusiastic and hard-working president, expressed his gratification at his re-election, and looked forward to another year of enterprise and success in handling the many problems which lie ahead. The afternoon was devoted to a discussion on the Ironfounders' Anglo-American productivity team's Report, and the four members of the team who were present spoke on the various aspects of foundry practice in America.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

FRENCH CHALK IN THE FOUNDRY

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—In answer to a query raised by one of your correspondents regarding the dusting of moulds with white powder, *i.e.* french chalk, or the like, this surely has arisen through the bad lighting in many foundries, because after a mould has been dusted with powder any loose sand can be easily seen, and thus removed, especially in deep pockets. Also, by trial and error over the years, it has been found that if a mould has had to be drastically patched up and a lot of water used, a liberal dose of this powder will absorb the moisture and thus prevent blown or scabbed castings.

Yours, etc.,

W. L. HARDY,
Foundry Manager,
Lake & Elliot, Limited

January 2, 1951

MR. H. W. KEEBLE points out that in the discussion on "Modernising an Iron Foundry" printed in our December 21, 1950, issue the figure he quoted for material moved to make one ton of castings should lie between 200 and 300 tons, not 2 and 3 tons as reported.

Acknowledgements

Christmas and New Year greetings, Diaries, and Calendars have been received from the following. In acknowledging them we heartily reciprocate the good wishes they contained.

Aluminium Development Association; Mr. A. Augstein; Mr. J. Augstein; British Bath Company, Limited; British Moulding Machine Company, Limited; British Industrial Plastics, Limited; British Tabulating Machine Company, Limited; Mr. L. G. Beresford; British Iron and Steel Research Association (Mr. Max Davies); British Iron and Steel Federation (Mr. Q. Lumsden); Mr. J. Bolton; Mr. R. Forbes Baird; Mr. J. N. Burns; Geo. Cohen Sons & Company, Limited; Mr. John Cameron, J.P.; Davidson & Company, Limited, Belfast; Mr. John Davies (Australia); Mr. Frank C. Evans; Frodair Iron & Steel Company; The Gas Council; Mr. W. A. Gibson (Australia); G. & W. Industrial & Chemical Supplies, Limited, Johannesburg; Dr. R. Genders; Holman Brothers, Limited, Camborne; J. Hobkirk & Son, Limited; John Harper & Company, Limited; Mr. F. Hoult (Newton Chambers, Limited); Mr. E. Hunter (Incandescent Heat Company, Limited); Mr. T. A. Hammersley (Marco Conveyor & Engineering Company, Limited); Mr. H. G. Hall; Mr. R. L. Handley (Ferranti, Limited); Mr. R. G. Hanson; Institution of Production Engineers; Institute of Industrial Supervisors; International Alloys, Limited; Mr. Brindley Jones (Climax Molybdenum); Mr. H. W. Keeble (A.P.V. Company, Limited); Baron Krayenhoff (Amsterdam); F. H. Lloyd & Company, Limited; Mr. G. R. Lewington; Dr. J. T. Mackenzie (Birmingham, Alabama); Mr. and Mrs. Maloney (Chicago); Mr. G. F. Mundell (president, Association of Bronze and Brass Founders); Mavor & Coulson, Limited; Morris Industries, Limited (Mr. E. C. Dickinson); National Foundry Craft Training Centre; Mr. Mario Olivo (Milan); Pont à Mousson; Professor Pisek (Brno); Professor Piwowarsky (Aachen); Mr. J. Preston (Sheffield); Dr. J. G. Pearce; Mr. A. Phillips (Grimsby); Mr. Frank Rowe (president, British Steel Founders' Association); Mr. S. H. Russell and Mr. P. A. Russell; Stein & Atkinson, Limited; Stewarts and Lloyds, Limited; Stone Wallwork, Limited; Mr. O. Smalley (New Rochelle, USA); Mr. John Sissener (Norway); Mr. J. J. Sheehan (president of the Institute of British Foundrymen); Mr. R. C. Shepherd; Tyseley Metal Works, Limited; Mr. F. Tibbenham (president, Institute of British Foundrymen, London branch); Mr. Gösta Vennerholm (Detroit); Mr. D. H. Wood (Constructional Engineering Company); Women's Advisory Council on Solid Fuel; Western Foundries, Limited; T. W. Ward, Limited; Stork Engineering Works, Hengelo, Holland; North-Eastern Refining Company, Limited; Educational Productions, Limited, and the Fulmer Research Institute.

Obituary

MAJOR S. GUY NEWTON, joint managing director of Brown, Bayley's Steel Works, Limited, Sheffield, since May, 1948, died on December 22. He was 61.

MR. F. W. HALL, former secretary of the brass foundry of William Doxford & Sons, Limited, Sunderland, died recently. He spent 56 years in the company's service before retiring in 1946.

THE DEATH occurred on Sunday last of Sir John Greenly, director of Babcock and Wilcox Limited since 1929 (chairman since 1937), and a past-president of the Institute of Metals. In 1937, also, he was made chairman of the British Non-ferrous Metals Research Association and a member of the advisory council to the Committee of the Privy Council for Scientific and Industrial Research and held office until 1943. As chairman of the Industrial Advisory Panel to the Air Ministry he was much concerned with the allocation of non-ferrous metals to factories making aircraft parts.

"Birlecarols"

This is the title of a brochure of poems written in a light vein and issued by Birlec, Limited, at the festive season. The reviewer confesses that his reading of poetry has been confined to Barrack Room Ballads and a few "collected works," so that he is not well placed to assess the merits of this particular publication. The poems are at least amusing.

New Year Honours

Among the names included in the New Year Honours List are several of direct or indirect foundry interest. The Knights Bachelor include Mr. G. W. Barr, managing director, Fairfield Shipbuilding and Engineering Company, Limited; Mr. E. D. A. Herbert, chairman, Short Bros. and Harland, Limited; Mr. C. Hinton, deputy controller, Atomic Energy (Production) Ministry of Supply; Mr. R. Lloyd-Roberts, personnel management branch, Ministry of Labour; Mr. W. Wallace, vice-president, Engineering and Allied Employers' National Federation. Mr. E. Barnard, deputy secretary Department of Industry and Scientific Research, is named in the civil list of departmental awards and receives a C.B. In the main civil list are included Mr. P. H. Muirhead, director and general manager of Vickers-Armstrongs, Limited; Mr. E. Sanders, managing director of Helliwells, Limited; Mr. J. E. Serby, deputy director R.A.E., Farnborough; and Mr. W. Watson, secretary, Shipbuilding Employers' Federation who have been awarded the C.B.E. The citations for O.B.E. contain the names of Mr. A. W. Angus, director of instrument production, Ministry of Supply; Mr. A. J. Charnock, general works manager, Leyland Motors, Limited; Mr. B. Gardner, general secretary, Amalgamated Engineering Union; Mr. S. L. Hopkinson, manager, (German Office) British Iron & Steel Corporation; Mr. E. G. Neate, deputy director of Navy Contracts; Dr. W. Hume-Rothery, lecturer in metallurgical chemistry, Oxford University; Mr. J. E. Stanier, divisional manager West Midlands Gas Board and Mr. T. P. Threkeld, superintendent inspector of factories. Mr. W. H. Chinn (aged 84) who has been engaged in foundrywork for 70 yrs. and is at present with J. Lassam and Company, Limited, Cardiff, is named amongst those receiving the B.E.M.

Power Cuts

"Electricity authorities are using the wrong psychological approach to this matter in lecturing the housewives and industrialists and blaming them for getting electricity supplies into a mess" said Mr. J. F. Jones, of Jones & Campbell, ironfounders, Larbert, at Falkirk on December 27. "Instead of doing this they should say to the housewife and the industrialist: 'We, the Electricity Board, are in a mess: help us to get out of it.'" He was one of the 200 industrialists, union leaders and delegates who attended an urgent meeting called by the Forth Valley Industrial Development Council about power cuts, following an appeal by the Scottish Board for Industry. Mr. F. Moffat presided over the gathering, which represented all the manufacturing and industrial establishments in Stirlingshire—particularly Falkirk, Grangemouth, Larbert and Denny, the centre of light castings industry in Scotland.

He was accompanied by Mr. A. W. Andrew and Mr. H. A. Carson, both of the South-East Scotland Electricity Board. It was stated that a reduction of power of 30 per cent. (17,000 kw) in Stirlingshire was needed. The meeting was held with a view to securing the industrialists' collaboration in saving this amount of power and thus averting power-cuts. Mr. J. Preston, a Bonnybridge industrialist, said that limited closing would help. Mr. Andrew, of the Electricity Board, pointed out that the Board could not guarantee that if this cut was effected the power would not be "exported" elsewhere. He said that domestic consumers could still make a considerable reduction by economising in the use of their electrical appliances in the home.

Sir William Griffiths, chairman since 1945 of the Mond Nickel Company has resigned with effect from December 31, 1950.

Forthcoming Events

JANUARY 6

Institute of British Foundrymen

West Riding of Yorkshire Branch:—"Brains Trust" session, at the Technical College, Bradford, at 6.30 p.m.

JANUARY 8

Sheffield Branch:—"Economics of Foundry Mechanisation," by J. Blakiston, at the Royal Victoria Station Hotel, Sheffield, at 7.30 p.m.

JANUARY 9

Institution of Chemical Engineers

"The Sampling of Dust-laden Gases," by C. J. Stairmand, at the Geological Society, Burlington House, Piccadilly, London, W.1, at 5.30 p.m.

JANUARY 11

Institute of British Foundrymen

Lincolnshire Branch:—"Loam Moulding, including Large Pump Cases and Impellors," by E. Clipson, at the Technical College, Lincoln, at 7.15 p.m.

Burnley Section:—"Loam Moulding of Cast-iron Cylinders," by D. Monkhouse, at the Municipal Technical College, Ormerod Road, Burnley, at 7.30 p.m.

Liverpool Metallurgical Society

"The New Nodular Cast Irons," by H. Morrogh, at the Electricity Service Centre, Whitechapel, Liverpool, at 7 p.m.

JANUARY 13

Institute of British Foundrymen

East Midlands Branch:—"Grey Ironfoundry Productivity Team's Report," at the Derby School of Arts and Crafts, Green Lane, Derby, at 6 p.m.

Scottish Branch:—"The Production of Intricate Castings from a Durable Loam Mould," by J. Currie, at the Technical College, George Street, Glasgow, at 3 p.m.

Lancashire Branch:—"Foundry Management To-day," by J. Stott, at the Engineers' Club, Albert Square, Manchester, at 3 p.m.

Newcastle-upon-Tyne Branch:—Branch president's night. Visit of Mr. J. J. Sheehan, B.SC., A.R.C.SC.I., president of the Institute, and Mr. T. Makemson, M.B.E., general secretary, at the Neville Hall, Westgate Road, Newcastle-upon-Tyne, at 6 p.m.

Birmingham Students' Section:—Visit to Stewarts and Lloyds, Limited, Bilston, at 9.30 a.m.

Another Productivity Team

Another team sponsored by the Anglo-American Council on Productivity, the first of three to study education and training for industry, sailed for the United States in the Queen Mary on December 28. The members are representative of industrial management, trade unions, the Ministry of Labour, the Ministry of Education and the Scottish Education Department jointly, and of technical colleges. They will be led by Group-Captain P. G. Thompson, of J. Stone & Company, Limited; their terms of reference include consideration of American methods for the training of operatives within industry and for industry in technical institutes and their further training with a view to promotion to more responsible work.

Glasgow Technical College Extension

A public appeal for almost half the cost of a £750,000 extension to the Royal Technical College, Glasgow, was launched on December 22. The Governors say that State assistance has fallen far short of the total cost of completing and equipping the building. The increased demand for trained scientists and technologists is given as the chief reason for the decision to extend the college.

A new block of laboratories, lecture rooms and administrative offices will be erected in Montrose Street, on a site adjoining the present building. Approval has been received from the Scottish Education Department and the plans have been passed by the Dean of Guild Court. Building is about to begin.


Photo micrograph of SOUTHPORT SEA SAND
Photo micrograph of SOMERFORD SAND
Photo micrograph of K.L. SILICA SAND
GENERAL REFRACT
SHEFFIELD
REFRACTORY
SANDS
for every purpose
Photo micrograph of YORK YELLOW SAND
Photo micrograph of CHELFORD SILICA SAND
GENERAL REFRACTORIES LIMITED SHEFFIELD
Photo micrograph of MINIMUM SAND
SILICA SAND
GENERAL REFRACTORIES LIMITED SHEFFIELD
Photo micrograph of HENSALL SAND
GENERAL REFRACTORIES LIMITED SHEFFIELD
Photo micrograph of MAXIMUM SAND
GENERAL REFRACTORIES LIMITED SHEFFIELD

Raw Material Markets

Iron and Steel

Most foundries were at work again last Thursday following the Christmas holidays. The break was desirable to enable vital repairs to plant and cupola relining to be carried out, although some sections of the industry —notably the engineering foundries—can ill-afford the loss in output necessitated by holidays. The year 1951 has opened with the position of foundries in reverse to the conditions which ruled at the opening of last year. Then very few foundries could show satisfactory order-books, and supplies of raw materials were in the main adequate to demands. The engineering and textile foundries, and some of the jobbing and light foundries, are now engaged to capacity, but, unfortunately, the engineering foundries are beset with many difficulties in obtaining raw materials. The low- and medium-phosphorus grades of pig-iron cannot be secured anywhere near the desired tonnage, and the alternative grades in both hematite and refined are daily becoming more stringent.

A further problem has now developed. In the last few weeks difficulty has been experienced in obtaining adequate supplies of foundry coke. At this period of the year, when the possibility of delivery delays is ever present because of bad weather, stocks should be available to meet such contingencies, but many foundries to-day are denuded of reserves. Deliveries are not being received regularly from the ovens, due, apparently, to inadequate supplies and also to shortage of wagons.

The Derbyshire furnaces are sending forward regular deliveries of high-phosphorus irons to the textile and other foundries, but outputs have to be carefully distributed. The Northamptonshire grade is being taken up more heavily, and these furnaces have not the tonnages available for distribution that they had a short time ago.

Ganister, limestone, and ferro-alloys can usually be obtained as required, and firebricks are coming forward to specification. All arisings of suitable parcels of cupola scrap are eagerly accepted, particularly in heavy cast iron. Foundries have been able to secure sufficient quantities for current usage, but they are anxious to augment stocks.

The supply of steel semis is the chief concern of the re-rollers at present. Stocks of semis are low, and they are not now being enlarged very much with supplies of Continental material. Demands are heavy and shortages exist for many sizes—principally small square and flat billets—resulting in restrictions in production. Work on hand ensures very substantial outputs of all sizes of sections, bars, and strip, while sheet re-rollers in both black and galvanised are exceptionally active. Regular deliveries of sheet bars are forthcoming. The steelworks are able to dispose readily of all tonnages of defective steel semis which become available.

Non-ferrous Metals

Last week saw the long-awaited announcement from the Minister of Supply about events this year. A long list of articles, in the manufacture of which copper and zinc must not be employed, is printed elsewhere in this issue. The ban will be effective from February 1, so that within a matter of days many manufacturers will find themselves in difficulties unless it is possible to employ substitute materials. Directions have also been given as to the amount of zinc available during the present month. Apparently the authorities find it impossible to budget for more than one month at a time and the February allocation will be made known towards the end of January.

To start the year G.O.B. or ordinary zinc will be available only as to 50 per cent. of the average monthly consumption during the first nine months of 1950. This is indeed a serious cut and it will affect, among others, the galvanisers, brassmakers, and zinc oxide manufacturers. In electrolytic zinc the ration is 85 per cent. for use in brassmaking and 70 per cent. in other uses. The third quality, high purity assaying 99.99 per cent. zinc, which is employed mainly in die casting, will be available at 85 per cent. of the basic period usage. Compared with the reduced consumption rate in force since October 1, the ration of electrolytic zinc for brassmaking is not too bad, and it is not impossible that some manufacturers running solely on this grade may find themselves slightly better off. But if the reduced flow is set against activity in, say, the third quarter of last year, then there is a disastrous drop for everyone.

The Minister of Supply confirmed that it is the intention of the Ministry to introduce as soon as possible a set of ceiling prices for scrap brass, copper, lead, and zinc. At the same time we shall return to a system of licensing as during the war and for some time afterwards. Consumers will not be sorry about this, for they have been paying through the nose for supplies for long enough to be heartily tired of it. Whether we shall see more scrap coming out in consequence of this new arrangement will be seen in due course. The Minister referred to the shortage of scrap last week when he made his statement, and if there is any suspicion of hoarding it could happen that steps would be taken to compel release of accumulated tonnage.

London Metal Exchange official tin quotations were as follow (the market was closed on New Year's Day):—

Cash—Thursday, £1,165 to £1,170; Friday, £1,150 to £1,155; Tuesday, £1,125 to £1,130; Wednesday, £1,140 to £1,145.

Three Months—Thursday, £1,095 to £1,100; Friday, £1,095 to £1,100; Tuesday, £1,095 to £1,100; Wednesday, £1,115 to £1,125.

Aluminium Price Higher

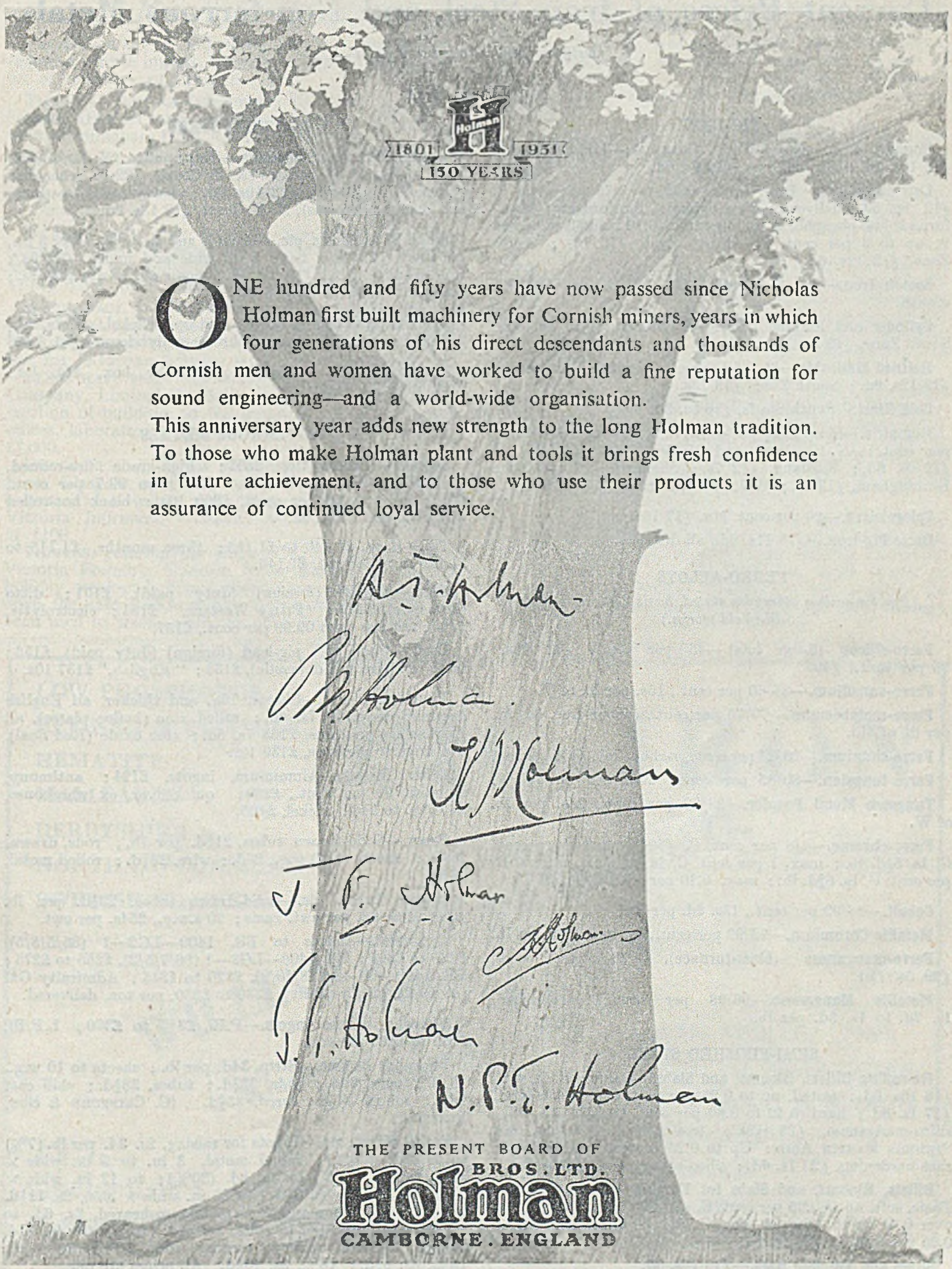
An increase of £4 per ton in the price of virgin aluminium came into effect on New Year's Day, the new price being £124 for metal of a purity of 99 to 99.5 per cent. The previous price of £120 per ton had ruled since last October. Since the pound was devalued in September, 1949, the price of the metal has risen £31 a ton.

Existing premiums for purities above 99 to 99.5 per cent. are unchanged, and the existing addition of £2 10s. a ton for metal in notch bar form remains unaltered.

Publication Received

Post Office Year Book. Published by H.M. Stationery Office, York House, Kingsway, London, W.C.2. Price 2s. 6d. net.

Quite a number of aspects of the organisation of the Post Office with which the public are not familiar are dealt with in this quite attractive brochure. An organisation which employs about a third of a million people has problems of training and promotion of a unique character. The commenting on these and other activities is quite well done. Together with the illustrations, it makes a really attractive publication.



Holman Bros. Ltd., Camborne, England. Phone: Camborne 2275 (7 lines). Grams: Airdrill, Camborne. Subsidiary Companies, Branches & Agencies throughout the World.

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

(Delivered, unless otherwise stated)

January 3, 1951

PIG-IRON

Foundry Iron.—No. 3 Iron, Class 2 :—Middlesbrough, £10 10s. 3d. ; Birmingham, £10 5s. 6d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent P, £12 1s. 6d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si)—North Zone, £12 10s. ; South Zone, £12 12s. 6d.

Scotch Iron.—No. 3 foundry, £12 0s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £13 2s. 6d. ; South Zone, £13 5s.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £13 12s. 6d. ; South Zone, £13 15s.

Cold Blast.—South Staffs, £16 3s. 3d.

Hematite.—Si up to 2½ per cent., S. & P. over 0.03 to 0.05 per cent. :—N.-E. Coast and N.-W. Coast of England, £12 0s. 6d. ; Scotland, £12 7s. ; Sheffield, £12 15s. 6d. ; Birmingham, £13 2s. ; Wales (Welsh iron), £12 0s. 6d.

Spiegeleisen.—20 per cent. Mn, £17 16s.

Basic Pig-iron.—£10 11s. 6d., all districts.

FERRO-ALLOYS

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

Ferro-silicon (6-ton lots).—45 per cent., £33 15s. ; 75 per cent., £49.

Ferro-vanadium.—35/60 per cent., 15s. per lb. of V.

Ferro-molybdenum.—70/75 per cent., carbon-free, 8s. 7d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £100 per ton.

Ferro-tungsten.—80/85 per cent., 23s. per lb. of W.

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

Ferro-chrome.—4/8 per cent. C, £60 ; max. 2 per cent. C, 1s. 5½d. lb. ; max. 1 per cent. C, 1s. 6d. lb. ; max. 0.15 per cent. C, 1s. 6¾d. lb. ; max. 0.10 per cent. C, 1s. 7d. lb.

Cobalt.—98/99 per cent., 15s. 6d. per lb.

Metallic Chromium.—98/99 per cent., 5s. to 5s. 3d. per lb.

Ferro-manganese (blast-furnace). — 78 per cent., £30 5s. 11d.

Metallic Manganese.—96/98 per cent., carbon-free, 1s. 7d. to 1s. 8d. per lb.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—Basic : Soft, u.t., £16 16s. 6d. ; tested, up to 0.25 per cent. C (100-ton lots), £17 1s. 6d. ; hard (0.42 to 0.60 per cent. C), £18 16s. 6d. ; silico-manganese, £23 19s. ; free-cutting, £20 1s. 6d. Siemens Martin Acid : Up to 0.25 per cent. C, £22 4s. ; case-hardening, £23 1s. 6d. ; silico-manganese, £26 6s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £19 16s. 6d. ; basic, hard, over 0.41 up to 0.60 per cent. C, £21 1s. 6d. ; acid, up to 0.25 per cent. C, £23 1s. 6d.

Sheet and Tinplate Bars.—£16 16s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £20 14s. 6d. ; boiler plates (N.-E. Coast), £22 2s. ; chequer plates (N.-E. Coast), £22 19s. 6d. ; heavy joists, sections, and bars (angle basis), N.-E. Coast, £19 13s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £22 6s. ; flats, 5 in. wide and under, £22 6s. ; rails, heavy, f.o.t., £19 2s. 6d. ; hoop and strip, £23 1s. ; black sheets, 17/20 g., £28 16s.

Alloy Steel Bars.—1-in. dia. and up : Nickel, £37 7s. 3d. ; nickel-chrome, £55 ; nickel-chrome-molybdenum, £61 13s.

Tinplates.—I.C. cokes, 20 × 14, per box, 41s. 9d., f.o.t. makers' works.

NON-FERROUS METALS

Copper.—Electrolytic, £202 ; high-grade fire-refined, £201 10s. ; fire-refined of not less than 99.7 per cent., £201 ; ditto, 99.2 per cent., £200 10s. ; black hot-rolled wire rods, £211 12s. 6d.

Tin.—Cash, £1,140 to £1,145 ; three months, £1,115 to £1,125 ; settlement, £1,145.

Zinc.—G.O.B. (foreign) (duty paid), £151 ; ditto (domestic), £151 ; "Prime Western," £151 ; electrolytic, £155 ; not less than 99.99 per cent., £157.

Lead.—Good soft pig-lead (foreign) (duty paid), £136 ; ditto (Empire and domestic), £136 ; "English," £137 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, all English destinations, £170 7s. 6d. ; rolled zinc (boiler plates), all English destinations, £168 7s. 6d. ; zinc oxide (Red Seal), d/d buyers' premises, £139 10s.

Other Metals.—Aluminium, ingots, £124 ; antimony, English, 99 per cent., £250 ; quicksilver, ex warehouse, £47 10s. to £48 ; nickel, £406.

Brass.—Solid-drawn tubes, 21⅛d. per lb. ; rods, drawn, 28¼d. ; sheets to 10 w.g., 26d. ; wire, 26⅝d. ; rolled metal, 24¾d.

Copper Tubes, etc.—Solid-drawn tubes, 23¼d. per lb. wire, 226s. 6d. per cwt. basis ; 20 s.w.g., 254s. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £225 to £265 ; BS. 1400—LG3—1 (86/7/5/2), £265 to £275 ; BS. 1400—G1—1 (88/10/2), £320 to £345 ; Admiralty GM (88/10/2), virgin quality, £330 to £350, per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £345 to £360 ; L.P.Bl, £270 to £285 per ton.

Phosphor Bronze.—Strip, 34d. per lb. ; sheets to 10 w.g., 35⅞d. ; wire, 36d. ; rods, 33½d. ; tubes, 38¾d. ; chill cast bars : solids, 34½d., cored, 35½d. (C. Clifford & Son, Limited.)

Nickel Silver, etc.—Ingots for raising, 2s. 3d. per lb. (7%) to 3s. 2d. (30%) ; rolled metal, 3 in. to 9 in. wide × .056, 2s. 9d. (7%) to 3s. 8d. (30%) ; to 12 in. wide × .056, 2s. 9¼d. to 3s. 8¼d. ; to 25 in. wide × .056, 2s. 11¼d. to 3s. 10¼d. Spoon and fork metal, unsheared, 2s. 6d. to 3s. 5d. Wire, 10g., in coils, 3s. 2½d. (10%) to 4s. 1½d. (30%). Special quality turning rod, 10%, 3s. 1½d. ; 15%, 3s. 6¼d. ; 18%, 3s. 10½d. All prices are net.

News in Brief

FROM JANUARY 1, individual licences are no longer required for the import, from the usual " liberalisation " list of countries, of chromium ore.

THE 1951 BRITISH INDUSTRIES FAIR will be held in London (Earls Court and Olympia) and Castle Bromwich, Birmingham from April 30 to May 11.

NORTH BRITISH LOCOMOTIVE COMPANY, LIMITED, Glasgow, are to provide 150 out of 217 locomotives ordered for India. The remainder will be manufactured in Germany.

DURING LAST YEAR John G. Kincaid & Company, Limited, Greenock, produced machinery for 17 vessels, totalling 70,660 indicated horse-power, an increase of 12,515 i.h.p. over 1949.

A CONTRACT, which involves about a year's work and is valued at approximately £350,000, has been received by Robert Stephenson & Hawthorns, Limited, Darlington, for 30 locomotives for the Indian Government.

PLANS HAVE BEEN PREPARED by Glasgow Iron & Steel Company, Limited, Motherwell, for the alteration and erection of buildings in Netherton Street, to be used as offices, laboratories, and test house, at a cost of about £7,000.

EMPLOYEES of Argus Foundry, Limited, Thornliebank, Glasgow, have allocated the sum of £243 to city infirmaries, hospitals and West of Scotland homes. Victoria Infirmary, Glasgow, benefited to the extent of £100.

THIEVES, entering the office of C. A. Hoare & Co., Victoria Foundry, Victoria Mills, Bingley, during the holiday week-end, found themselves unable to break open the safe with a heavy iron hammer, which had been used to smash open the office door.

SEVENTEEN EMPLOYEES of Guest, Keen & Nettlefolds (South Wales), Limited, received long-service awards from Mr. N. R. R. Brooke, a director and general manager, on December 20. They have between 30 and 60 years' continuous service with the firm. Additional awards were made to two employees with 60 years' service.

THE DIRECTORS of Joshua Bigwood & Son, Limited, engineers and ironfounders, of Wolverhampton, announced the issue of £100,000 5 per cent. redeemable loan stock 1955-60 at par, and 34,000 6 per cent. 10s. cumulative preference shares at par. Both will be privately placed and the proceeds will augment working capital.

THE THIRD RESIDENTIAL national conference of the Institution of Works Managers will be held at Southports from April 13 to 15, 1951. Previous conferences have been organised entirely by the headquarters of the Institution, but this one is being arranged largely by a local committee drawn from the Manchester and Merseyside branches.

ELECTRONIC APPARATUS, for use in vibration research and on ships' trials, will be developed at the laboratory and workshop established by the British Shipbuilding Research Association at the Palmer's Hill works of William Doxford & Sons, Limited. Tests will also be carried out during launching operations. Mr. A. V. Ridler is in charge of the laboratory.

AN ORDER for about 1,200 tons of manganese-steel castings for lining ball and rod mills at a copper mine in Chile has been placed with Edgar Allen & Company, Limited, Sheffield. Part of the order, which is one of the biggest single orders handled by the company for some years, will be manufactured in the steel foundry of the company's subsidiary in France.

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.

SITUATION WANTED

FOUNDRY MANAGER, recently returned from abroad, offers his services. Iron, steel, non-ferrous. Mass production. General engineering. Thorough, practical and technically experienced man. Suitable to progressive firm.—Box 458, FOUNDRY TRADE JOURNAL.

ASSISTANT CHIEF DRAUGHTSMAN (30) requires Technical Representative or Administrative post. Experienced pattern shop, foundry, factory production and maintenance, machine design. Box 438, FOUNDRY TRADE JOURNAL.

WORKS AND FOUNDRY MANAGER, experienced in fully mechanised or floor moulding up to 3 tons. Standard mass machine shop practice. Conversant with cupola and sand control.—Box 456, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER (39), sound practical and technical experience, metallurgy, moulding (mechanised, jobbing up to 20 tons), sand control, pattern-making, keen, reliable, excellent organiser, commercial knowledge, desires change and permanent progressive position, preferably South, South Midlands. Excellent references. A.M.I.B.F.—Box 464, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER (age 44 years). Practical and technical experience of 30 years' standing. Iron and non-ferrous, loose pattern, strickle, and mechanised. Full control all branches. Prepared to build up run-down foundry. London district preferred, but any area considered. —Box 462, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

CASTINGS INSPECTOR (ferrous and non-ferrous) required for responsible post in Wolverhampton. Good salary and prospects for qualified foundryman with knowledge of machine shop requirements. —Write full particulars, age, experience, etc., to Box 7662, c/o WHITE'S, LTD., 72, Fleet Street, London, E.C.4.

FYLDE WATER BOARD

THE Board invite Tenders for the supply and delivery of Cast Iron and Semi-Steel FIRE HYDRANT FRAMES AND COVERS.

Specification, General Conditions and Drawing, may be obtained upon application to Mr. H. Will Apted, M.Inst.C.E., M.Inst.W.E., Engineer to the Board, Sefton Street, Blackpool.

Tenders in plain sealed envelopes endorsed "Fire Hydrant Frames and Covers," but not bearing any name or mark indicating the sender, shall be delivered to the undersignd, on or before 15th January, 1951.

The Board do not bind themselves to accept the lowest or any Tender.

W. LESLIE HALL,
Clerk and Solicitor.

Sefton Street, Blackpool.
21st December, 1950.

SITUATIONS VACANT—*Contd.*

YOUNG ASSISTANT FOREMAN required for Textile Machinery Foundry, 12 miles north of Manchester. Man with knowledge of plates and machine moulding preferred.—Apply Box 448, FOUNDRY TRADE JOURNAL.

EXPERIMENTAL PRODUCTION or MECHANICAL ENGINEER required for experimental and development work. Higher National Certificate minimum qualification. Preference given to man having some experience in foundry work. Salary according to age and experience. The job is permanent and offers good prospects to right man.—Box No. 5470, SCOTTS, 9, Arundel Street, London, W.C.2.

FOUNDRY MANAGER required for large Iron Foundry in South-West Lancashire, producing a wide range of castings, varying from a few ounces up to 5 cwts. The total production averages 50/70 tons per week. Should be fully conversant in Modern Methods of quantity production of high grade castings. Must have knowledge of Cupola Sand Control and Metallurgy, and capable of utilising and training "green labour." Excellent prospects for energetic man.—Write, giving full particulars, salary required, Box 444, FOUNDRY TRADE JOURNAL.

WANTED, by well-known Firm of Ironfounders, ASSISTANT FOREMAN PATTERNMAKER. Must be thoroughly conversant with modern repetition methods or willing to receive instruction. Applicants can be either wood or metal patternmakers. First-class knowledge of drawings essential. Able to control small shop.—Apply, giving age, experience, and salary required, to Box 460, FOUNDRY TRADE JOURNAL.

REPRESENTATIVE required by Nonferrous Foundry. Light alloy, sand and gravity die casters, engineers and pattern makers. Liberal commission to the right man.—Box 450, FOUNDRY TRADE JOURNAL.

SENIOR RESEARCH METALLURGIST required by West Riding Foundry and Engineering Works to assist in planning research, effectively to direct investigation of quality complaints and to prepare reports. A practical economic outlook towards research is essential and applicants should be capable of preparing estimates of costs. Graduates with metallurgy as primary subject, or A.R.S.M., Assoc.Met., with some administrative experience in Metallography, Chemical Analysis, Mechanical and Creep Testing, and good practical knowledge of hot working of metals, steel and non-ferrous metal melting and foundry practice will be considered. A good salary will be paid to man possessing required qualities of initiative, experience, outlook and ability. Applications in confidence, giving full particulars of qualifications, experience, and salary requirements, to Box 466, FOUNDRY TRADE JOURNAL.

PLANT FOR DISPOSAL

ONE Steel Stack, Furnace or similar. Approx. 45 ft. by 15 in. dia. In good condition.—Apply MEYNELL & SONS, LTD., Montrose Street, Wolverhampton.

AGENTS

CUPOLA Limestone 2 in. down and Silica Clay ex our Ketton Quarry. Any quantities. AGENTS wanted, or supply direct. Limestone, calcium carbonate 97.04 per cent.; Clay, silica 83.68 per cent.—Full particulars, KETTON FOUNDRY CO., LTD., Ketton, near Stamford. Tel.: Ketton 206.

FINANCIAL

EXPANDING and progressive Ironfounders in Yorkshire, private limited company, require additional capital up to £10,000 as shares, loans or debentures.—Box 446, FOUNDRY TRADE JOURNAL.

ENGINEERING OR ALLIED INDUSTRY.—Industrial Syndicate, with substantial financial resources, desire to acquire part or whole interest in an established concern with a good profit-earning record. An investment involving from £20/100,000 is envisaged.—Address "Consultant," Box 454, FOUNDRY TRADE JOURNAL.

PATENTS

THE Proprietors of Patent No. 498,076, for "Improvements in or relating to Apparatus for Drawing Seamless Metal Tubing," desire to secure commercial exploitation by licence or otherwise in the United Kingdom.—Replies to HASELTINE, LAKE & CO., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

THE Proprietors of Patent No. 540,611, for "Improvements in or relating to Tackers," desire to secure commercial exploitation by licence or otherwise in the United Kingdom.—Replies to HASELTINE, LAKE & CO., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

MACHINERY WANTED

IRON CASTINGS wanted by London Firm of Pattern Makers with good connections. Prompt and regular delivery to London essential.—Box 442, FOUNDRY TRADE JOURNAL.

MACHINERY FOR SALE

FOR SALE.

LANCASHIRE BOILER FLUES, suitable for Cupolas; can be inspected at our works; cheap.

MARKLAND SCOWCROFT, LTD.,
Cox Green Works, Bromley Cross, near Bolton.
Tel. No. Eagley 600/1/2

"SKLENAR" FURNACE.—500 lbs. capacity, oil fired; complete with blower. Spare set of bricks for re-lining. Price £250.—Box 286, FOUNDRY TRADE JOURNAL.

MACHINERY FOR SALE—*Contd.*

FOUNDRY PLANT FOR SALE

SAND PLANT

No. 1 Pneulec Royer Machine.

No. 2 Pneulec Royer Machine.

"BM2 SAND MILL," 6 ft. 10 in. dia. 4 tons per hr. Motorised. 400/3/50. By Foundry Equipment.

"AUGUST" Sand Mill Hoist. Motorised, 400/3/50.

MOULDING MACHINES

2 Type ATO Pneumatic Jolt Squeeze Turnover British Moulding Machines.

CUPOLAS

One 15-cwt. brand new Cupolette, complete with Motor Blower, Staging. Ready bricked. By Constructional Eng. Co.

One Ditto, secondhand, reconditioned.

One 2 ft. 9 in. Roper Cupola, reconditioned.

Two 6 ft. Cupolas, with Charging Hoist and Staging.

CONVEYORS

One Pallet Mould Conveyor, 30 Pallets, 3 ft. Pitch, 18 in. wide. New condition.

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

IN STOCK AT SLOUGH FOR IMMEDIATE DELIVERY.

STEEL MOULDING BOXES. 3,000 pairs, at £1 per pair; send for list.

Brand new SAND DRYER; 1 ton per hr. £48.

Two complete small CUPOLAS, 30 in. diam., £150 each, including Keith Blackman Fans, etc.

25 practically new BALE-OUT FURNACES, cheap.

31 in. CUPOLA complete, by "Constructional," with spark arrester, Keith Blackman Blower and new lining—all at £250.

48 in. ditto complete, for £375.

ADAPTABLE MOULDING MACHINES. £45 each.

SAND MILLS, by Jas Evans. 4 ft. diam., £48; 5 ft. diam., £120.

TITAN CORE BLOWER, as new, 150 lbs. £285.

Several WEIGHING MACHINES, by Avery. Type 282, as new, cheap.

Large stock new Broomwade Compressors, new. A.C. Motors and Keith Blackman Fans.

Immediate attention all enquiries.

ELECTROGENERATORS LTD.
Australia Road, Slough
Telephone: Slough 22877.

FOR DISPOSAL

2 40 B.H.P., 400 V., 3-phase, Crompton-Parkinson Screen Protected Motors.
1 Ellison Starter, Rotor type.
1 10-cwt. Lip-poured Geared Ladle.
1 5-cwt. Hand Ladle.
Box 440, FOUNDRY TRADE JOURNAL.

SECONDHAND Cleveland Osborn Jolt Rollover Moulding Machine, 4 ft. 9 in. by 2 ft. 6 in. table. Seen in operation by appointment.—DORMAN'S, Stafford.

MACHINERY FOR SALE—*Contd.*

STAFF Time Checking and Job Costing Time Recorders. All makes for quick cash sale. Exceptional condition.—Write Box 313, SMITHS', 100, Fleet Street, E.C.4.

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

ALBION TWW WORKS

"POLFORD" FOUNDRY PLANT AND EQUIPMENT—IMMEDIATE DELIVERY

"POLFORD" CORE SAND MIXER. 1-cwt. capacity, 7½ h.p. Motor; 3-cwt. capacity, 12½ h.p. Motor. Either with or exclusive of Motors, arranged for Vee Rope Drive.

"POLFORD" LABORATORY MIXER. 50-lbs. capacity, 2 h.p. Motor.

"POLFORD" ROTARY MIXER MILLER, with Aerator. 3-cwt. capacity, 15 h.p. Motor.

ALL THE ABOVE WOUND FOR 400/440 volts, 3-phase, 50 cycles.

"POLFORD" FURNACES, CENTRAL AXIS—COKE FIRED. 100-lbs., 150-lbs., 250-lbs. and 400-lbs. capacity.

OIL FIRED—ditto—400-lbs. capacity.

"POLFORD" CRUCIBLE FURNACE—OIL FIRED. 200-lbs. capacity.

"POLFORD" COKE FIRED MOULD DRIER.

"POLFORD" VIBRATORY KNOCK-OUTS of 1-ton capacity, arranged for motor driven through vee belts. Ideal for knocking out moulding boxes.

"FORWARD" FOUNDRY SAND RIDDLE—TRIPOD TYPE. 5-tons per hour capacity. Motor Driven, only weighs 200-lbs., fully portable.

WE ARE SOLE SELLING AGENTS FOR THE "POLFORD" RANGE OF FOUNDRY PLANT AND EQUIPMENT. AND IF YOU DO NOT SEE LISTED THE ITEM REQUIRED, PLEASE LET US HAVE DETAILS AS IN ANY CASE WE CAN USUALLY GIVE VERY GOOD DELIVERY.

THOS W. WARD LTD.
ALBION WORKS : SHEFFIELD
Phone 26311 'Grams: "Forward."

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DELIVERY EX STOCK

New shot blast cabinets complete with Dust Extractors, etc., size 5ft. × 3ft. Also new 8ft. cube room Plants Low prices.

Please send for our NEW Illustrated catalogue on request

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BUY FROM US AND SAVE MONEY

MACHINERY FOR SALE—*Contd.*

CRANES

2-Ton Electric Overhead Crane, 36 ft. Span (can be adjusted).

Electric Hoist and Hand Long and Cross Travel. Roller and Ball Bearings throughout.

2-Ton Hand Overhead Travelling Crane, 40 ft. Span (can be adjusted).

3-Ton Ditto.

½-Ton Swing Jib Crane, 8 ft. radius.

1½-Ton Ditto, 15 ft. radius.

2-Ton Ditto, 12 ft. radius.

All Hand Cranes are brand new and fitted with Ball and Roller Bearings throughout.

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

600

AIR COMPRESSORS

530-C.F.M., HOLMAN, model 60S, vert., 2 stage, 2 cyl., water cooled, 100 lb. w.p., 730 r.p.m., with intercooler, direct coupled 120-h.p. S/R motor by E.C.C. 400/3/50.

490-c.f.m., BROOM & WADE, maker's No. 23022, vert., 3 cyl., single stage, water cooled, 30 lb w.p., 323 r.p.m., direct coupled 55-h.p. auto. synch. Crompton motor 400/3/50.

400-c.f.m., ALLEY & McLELLAN, series 34B, size 7, vert., enclosed, 2 stage, 2 crank, double acting, water cooled, 100 lb. w.p., 975 r.p.m., with vert. F.M. intercooler and aftercooler, vee rope driven by 95-h.p. S.C. motor by L.D.M. 400/3/50.

330-c.f.m., BROOM & WADE, type EH241, vert., twin cyl., single stage, water cooled, speed 310 r.p.m., 100 lb. w.p., with automatic unloader, "V" belt driven from new 75-h.p. Brook S/R motor 400/3/50.

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300-c.f.m., BROWETT LINDLEY, maker's No. 279299, vert., 2 crank, 2 stage, water cooled, 100 lb. w.p., "V" belt driven from 75-h.p. E.E.C. S/R motor 400-440/3/50, 1,460 r.p.m.

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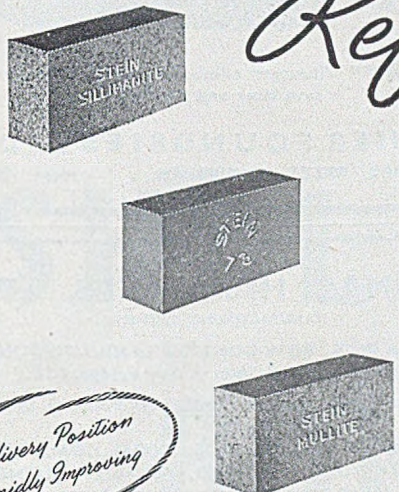

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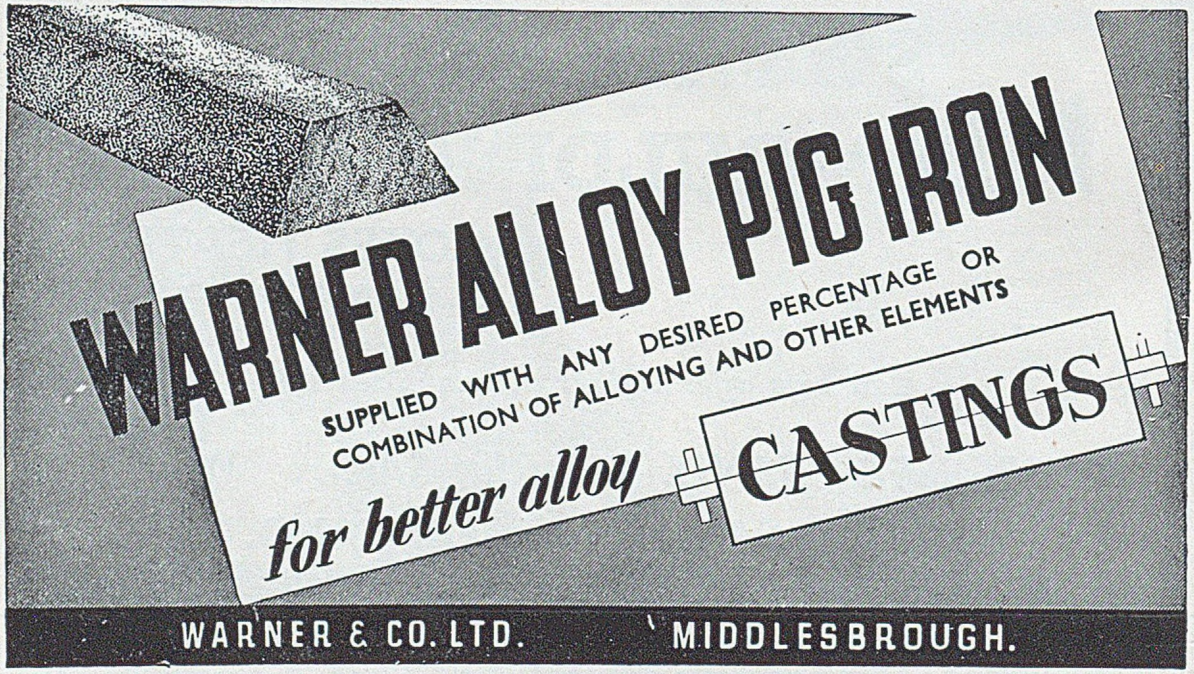
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