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PRINCIPAL CONTENTS

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1951 in Retrospect

Whilst production in 1951 in the foundries has continued to be of high order, there is much evidence that productivity has also made a considerable contribution to the overall results. Especially is this true of the steelfoundry section, where a number of good examples have been published. During the early months of the year, the industry was severely handicapped through power cuts. Then through the following months, material shortages developed to an alarming extent, though the early winter, being mild, was happily free from power failures. The nonferrous foundries experienced increasing pressure throughout the year consequent upon the rearmament programme; especially is this true of the production of magnesium castings. In aluminium castings, production each year sees the die-casting process gaining at the expense of the traditional methods.

The year has been a busy one for communal activities. There was held in Newcastle, the annual conference of the Institute of British Foundrymen, when Mr. Colin Gresty was elected president and delivered an inaugural address of outstanding merit. In the Spring there was held the third foreman's conference at Ashorne Hill. Next came the foundry exhibition at Olympia. The stand organised by the Council of Ironfoundry Associations in conjunction with the British Cast Iron Research Association was a noteworthy example of industrial and scientific co-operation for the benefit of the whole industry. Much interest was aroused at the exhibition by a new process for the production of castings and by the new types of core-bonds. The event was followed by the International Foundry Congress in Brussels. It was an outstanding success, both socially and technically. We thought the discussions of the various Papers reached a much higher standard than is usual at such gatherings—some of which are little more than a glorified Cook's tour.

No sooner was this over than the founders were called together again to participate in a day of works visits in the London area. There was a choice of about a dozen foundries for inspection ranging from the highly mechanised to well-conducted modest jobbing foundries. An informal dinner concluded really interesting excursions. Sandwiched in between sessions was a visit by London foundrymen to the French Ardennes. Whilst this was thoroughly enjoyable, the maximum value was obtained from it by the publication in the JOURNAL of detailed, illustrated accounts of each works visited. The information presented is such that it deserves to rank with the productivity reports emanating from the teams returning from visits to the States. There appeared in the Autumn the third productivity report dealing with American foundry practice; this covered the making of brass and bronze castings. Its publication completed the survey of the major sections of the industry except for light-alloy and malleable. The whole series—steel, grey iron and brass, constitute a veritable textbook in progressive foundry practice. A field in which astounding progress has been made during the year is that of investment casting and, at the close of a public lecture, the manager of one enterprising concern stated both with truth and pride that his was "the largest and finest shop for making

precision castings in the world." Summing up, 1951 has been a year of solid achievement in the industry. A good start has been made on dust and fume elimination, following upon the immense strides registered in the provision of washing and bathing facilities. Moreover, here and there, developments have been spiced with intriguing innovations, the success of which only time will show.

Correspondence

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—In your issue of December 6, reference is made to the religious ceremony at the opening of the Spanish Iron and Steel Institute meeting in Madrid. You suggest that this is probably unique in the opening of a metallurgical congress.

This is not so. The meeting of the Institute of Metals in Cambridge was inaugurated on September 14, 1948, by a service held in the fifteenth-century church of St. Edward at which an appropriate lesson from Job, chapter 28, was read by the president and a stimulating sermon was preached by the vice-chancellor of the University, Professor C. E. Raven, D.D.—Yours, etc.,

D. F. CAMPBELL.

Electric Furnace Company, Limited,
Weybridge, Surrey.

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—A new library for students (full-time, part-time and evening) in all branches of engineering is to be opened shortly in a separate building away from the main buildings of the Leicester College of Technology and Commerce. The librarian wishes to provide a comprehensive collection of trade catalogues, instruction handbooks and house journals for use in this library.

Such material will be greatly appreciated and should be addressed to the chief librarian of the College at Lero Buildings, Painter Street, Leicester.

Yours etc.,

H. L. HASLEGRAVE

College of Technology and Commerce,
The Newarke, Leicester.

Luncheon

SOUTH OF ENGLAND IRONFOUNDERS' ASSOCIATION

An informal Christmas luncheon was held at the Abercorn Rooms in the City on December 19. Commander Adamson presided; the guests included Mr. Kenneth Marshall, Mr. J. Butler, Mr. A. T. Fitter and Mr. V. C. Faulkner. Following the luncheon, there was an exhibition of films dealing specifically with the foundry industry. The function was organised by Mr. G. B. Judd, secretary of the Association.

Presentation to Mr. Frank Rowe.—When Mr. Frank Rowe relinquished the chairmanship of the British Steel Founders' Association at the annual general meeting recently, he was presented with an illuminated address and a 17-century bracket clock, made by Henry Massey of London, in recognition of the services he has rendered to the Association and its members during his period of office. The presentation was made by the new chairman, Mr. T. H. Summerson, J.P.

Leaders of the Industry

MR. T. H. SUMMERSON

At the annual general meeting of members of the British Steel Founders' Association held recently, Mr. T. H. Summerson, was elected chairman. Mr. Summerson is chairman and joint managing director of Summerson's Foundries Limited, of Darlington, a family business which was started in 1840 and which he—a grandson of the founder—joined in 1922. The steel foundry was then carried on by what is now the parent company, Thomas Summerson & Sons Limited. In his early days with the company, he was employed in the shops where he gained practical experience of steelfounding processes, and later worked in the company's machine shops. Mr. Summerson first became known to members of the steelfounding industry when he represented his company at meetings of the old General Steel Castings Association.

In 1940, he was appointed director for steel castings in the Ministry of Supply, Iron and Steel Control. He was later a member of the Townsend Committee, whose report provided the framework for the British Steel Founders' Association when it was formed in 1944, and from the beginning, he was a member of the executive council and chairman of the publicity committee. From 1948 to 1950, he was also chairman of the development committee and became vice-chairman of the Association in 1949. For some time, he has held the office of vice-chairman of the North East Coast Association of Steel Founders and in November last was elected chairman.

Outside the steelfounding industry, Mr. Summerson holds directorship in some eight companies and is chairman of five of them. He is also a member of the Development Areas Treasury Advisory Committee to which he was appointed earlier this year. Other industrial interests include membership of the executive council of the Association of British Chambers of Commerce and he is the immediate past-president of the Tees-Side and South West Durham Chamber of Commerce. His public appointments include membership of the Development Corporation of Aycliff New Town, and he is chairman of the Darlington Rural District Council, the Darlington County Bench and vice-chairman of the North East Development Association. Mr. Summerson is 48 years of age and was educated at Harrow.

Pressure-tight Gunmetal Castings*

Application of Research Results to Production Technique

By L. Buckley and E. C. Mantle

This is an account of some large-scale foundry trials which have been carried out to exploit the results of the research of the British Non-Ferrous Metals Research Association has done on the control of porosity in gunmetal castings. The work is thought to be of interest to foundrymen as an example of the methodical investigation of problems associated with the leakage of castings. A point worth noting is the considerable use which has been made of test-bars for following changes in the gas content of the metal. The use of test-bars in this way, as a tool for investigating foundry difficulties, is an important departure from the usual practice of casting test-bars mainly for inspection purposes. As a preliminary to the account of the foundry trials it is as well to recall the main difficulties the foundryman is up against in making castings with these alloys.

Gunmetals and phosphor-bronzes are good casting alloys in the sense that serviceable castings can be made with simple running and gating techniques, and the yield of fettled casting to metal melted is high. Unfortunately, some castings made in these alloys are prone to leakage at points where there are changes in section thickness—around flanges at the ends of pipes, for example. This leakage is mainly the result of a concentration of shrinkage unsoundness at points in the casting where freezing is delayed either as a consequence of the thickness of the section or because the mould becomes overheated locally in pouring the casting.

It is well-known to foundrymen that gas dissolved in the metal during melting can have a considerable effect on the occurrence of shrinkage unsoundness. A large amount of gas in the metal is recognised as being harmful, contributing to the unsoundness of the casting and producing other manifestations of gassy metal such as " tin sweat " or " lead sweat." On the other hand, the presence of a small amount of gas can sometimes be a help in the production of pressure-tight castings. However, the amount of gas absorbed by the metal during melting is difficult to control, depending as it does on the nature of the charge and the atmosphere in the furnace, and while this phenomenon is sometimes utilised in making light-alloy die-castings, it is rarely used in bronze foundries.

Research Work

Work carried out at the laboratories of the B.N.F.M.R.A. has shown that not only can gunmetals and phosphor-bronzes absorb gas during melting, but gas is also absorbed after the metal has been poured into the mould. This is because of a reaction which goes on between the molten metal and the steam generated from the sand. Even with dry-sand moulds or core-sands there is ample steam evolved for the reaction to take place. Through this reaction, gas can be picked up by the metal all the time it is freezing in the mould.

Laboratory tests have indicated that gas absorbed in this way helps to bring about a more even distribution of the shrinkage unsoundness in castings and is much more effective in preventing leaky castings than is gas absorbed during melting. In the test casting used in the laboratory, for instance, the localised unsoundness which led to leakage under pressure could be avoided by making use of this reaction and it seemed that this should provide a useful tool for helping the practical foundryman to make pressure-tight castings in cases of difficulty.

The extent of this reaction, which might be termed " metal/mould reaction," depends mainly on two factors:—(*a*) The pouring temperature and (*b*) the phosphorus content of the alloy.

With leaded or lead-free gunmetals, the reaction is slight when the phosphorus content is 0.02 per cent. or less, except when the pouring temperature is very high, so that with the amount of phosphorus usually added for deoxidation of these alloys the amount of gas absorbed by the metal in the mould is negligible. Generally, an increase in either the phosphorus content or the pouring temperature causes the absorption of larger amounts of gas, and *control of the amount of gas absorbed by the metal*

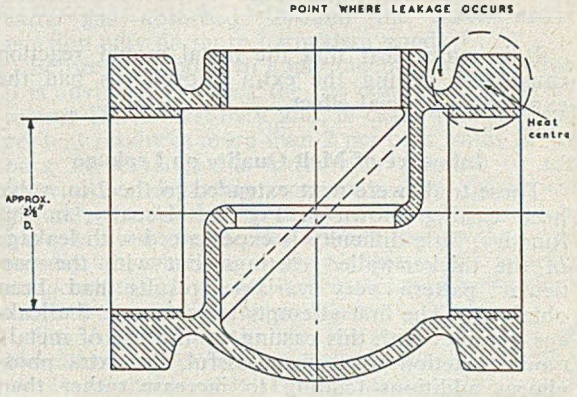


FIG. 1.—*Small Valve Body in which Metal/Mould Reaction has been Successfully Employed to overcome Leakage.*

*This article is based on the B.N.F.M.R.A. Report No. D.52. The Authors are, respectively, foundry manager, Newman Hender and Company Limited and liaison officer, British Non-ferrous Metals Research Association.

is thus possible by adjustments to either the pouring temperature or the phosphorus content of the alloy.

Metal/Mould Reaction in Small Valve Manufacture

Following the laboratory work, practical foundry trials described below were carried out and, as reference to Table I will show, have confirmed that the metal/mould reaction can be a useful means of combating lack of pressure-tightness. These trials have been made in a foundry casting a variety of valve parts mainly in 85/5/5/5 gunmetal. Although with most valve patterns porosity troubles have not been prevalent, some designs have proved troublesome, giving a number of leaky castings. The first casting chosen for the practical trials of the metal/mould reduction was the light type of globe valve body illustrated in Fig. 1. With this casting, the number of "leakers" produced varied considerably from melt to melt, probably following variations in the gas content of the metal.

The melting procedure used in the foundry was unchanged for the first tests. Two trials were made with 400-lb. charges of 85/5/5/5 gunmetal melted in tilting crucible furnaces. In each case, half the melt was transferred to a preheated 200-lb. crucible and cast in the usual way, adding only sufficient phosphor-copper to deoxidise the metal, while extra phosphor-copper was added to the other half of the melt to promote metal/mould reaction. No changes were made in the moulding procedure or in the sand used.

The results of these first trials were as follow:—

TABLE I.—*Results of First Trials on Gunmetal Castings of the Type Shown in Fig. 1.*

Heat 1 ..	Normal procedure	44 sound castings, 13 "leakers"
Heat 1 ..	Extra 1¼ lb. 15 per cent. phosphor-copper added to 200 lb. metal (0.08 per cent. P added)	50 sound castings, 0 "leakers"
Heat 2 ..	Normal procedure	76 sound castings, 8 "leakers"
Heat 2 ..	Extra phosphorus added as above	52 sound castings 0 "leakers"

It is quite clear that the metal/mould reaction caused by adding the extra phosphorus had the expected beneficial effect.

Influence of Melt Quality on Leakage

These trials were next extended to the 2-in. valve head casting shown in Fig. 2. Usually, in this foundry, little difficulty is experienced with leakage of the thicker-walled castings, but with the particular pattern very variable results had been obtained. The first attempts to overcome the leakage troubles with this casting by the use of metal/mould reaction were unsuccessful, the extra phosphorus additions tending to increase rather than decrease the number of leaky castings produced, unless inconveniently-low pouring temperatures were used. It soon became apparent that trouble was associated with the pick-up of gas by the metal during melting.

In all these practical trials, D.T.D.-type test-bars were poured at the same time as each batch of castings. Density measurements were made on these test-bars to determine the extent of the unsoundness in them (per cent. voids), which is a gauge of the gassiness of the metal. Table II shows the number of leaky castings obtained from a number of heats during experiments on this 2-in. valve head and the gassiness of the corresponding test-bars. All these melts contained less than 0.02 per cent. phosphorus and hence gas absorption through metal/mould reaction was negligible except possibly in Heat 1. where the pouring temperature was unusually high for castings of this section thickness. It can be seen that there is a close connection between the number of leaky castings and the gas content of the melts, as reflected by the voids in the test-bars.

TABLE II.—*Leaky Castings Using a 2-in. Valve as the Experimental Basis.*

Heat.	Pouring temp., deg. C.	Gassiness of Metal, as shown by voids in D.T.D. bar expressed in percentage.	Pressure-test Results.	
			Sound.	"Leakers"
1	1,200	3.0	7	7
2	1,130	2.2	12	2
3	1,120	3.0	4	10
4	1,120	1.2	14	0
5	1,080	1.6	14	0

The value of casting a suitable test-bar at the same time as the production castings, in trials of this sort, is well illustrated by these results. Without the indication of the gas content of the metal which the test-bars have provided it would be impossible to draw conclusions from the results of these pressure tests. It is clear, however, from consideration of the densities of the D.T.D. bars, that to make these castings satisfactorily the metal must absorb no more gas during melting than will produce 2 per cent. voids in the test-bars.

In the subsequent experiments described below, the melts were given a de-gassing treatment, and the results obtained confirm the conclusion that sound castings can be produced without difficulty if the melts are moderately free from gas.

Other Effects of Metal/Mould Reaction

The trials described in the first part of this article indicated clearly that with the lighter types of castings, there were considerable benefits to be gained from the application of metal/mould reaction. On the other hand, castings where the sections are thicker, similar to that illustrated in Fig. 2, could be made sound without making use of the metal/mould reaction, and with these castings it seemed to be more important to make sure that the melts were free from gas. However, the use of metal/mould reaction for certain classes of work, entailing as it does the addition of unusually large amounts of phosphorus to the alloy, might possibly lead to a general increase in the level of the phosphorus con-

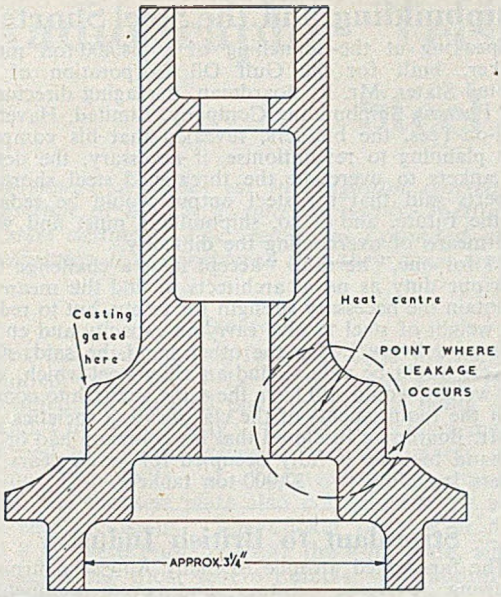


FIG. 2.—*Valve Head where the Section Thickness was so great that Metal/Mould Reaction was only Successful in preventing Leakage when Low Pouring Temperatures were used.*

tent of the metal being melted in the foundry, arising from the return of gates and runners for remelting. Because of this possibility, it was felt advisable to investigate more fully the effect of large phosphorus additions on these castings with thicker sections. A further series of trials was therefore carried out in which the melts were first degassed, and then divided into two, one half being treated in the usual way, extra phosphor-copper being added to the other half. The method used for degassing was to blow a vigorous stream of nitrogen through the melts for 5 min. at the end of the melting period. A large proportion of oily swarf was intentionally included in these charges with the object of making the metal gassy in order to test the efficacy of the degassing treatment. The results of pressure tests on the same 2-in. valve head made from two 400-lb. heats of 85/5/5/5 gunmetal are given in Table III.

TABLE III.—*Trials on 2-in. Valve Head: Melts Degassed with Nitrogen.*

Heat 1 ..	Normal phosphorus content	14 sound castings, 0 "leakers"
	Extra phosphorus added (0.09 per cent. residual)	12 sound castings, 2 "leakers" (one caused by dirt)
Heat 2 ..	Normal phosphorus content	14 sound castings, 0 "leakers"
	Extra phosphorus added (0.08 per cent. residual)	13 sound castings, 1 "leaker" (dirt hole)

With the degassed metal and a normal phosphorus content, all the castings were sound on pressure testing. There were three "leakers" out of the 28 castings made from the two half-melts to which the extra phosphorus was added. In at least two of these castings, the leakage was obviously the result of dirt trapped in the casting. This may be an indirect result of the extra phosphorus addition, since this does result in a rather fluid slag and some additional care is needed to prevent this entering the mould. With both of these trial melts, the phosphorus addition was large enough to promote very marked metal/mould reaction, but this does not seem to have had a seriously harmful influence on the pressure-tightness of the castings.

Conclusions

It seems safe to conclude that *provided the metal is initially reasonably free from gas,* phosphorus additions sufficient to produce marked metal/mould reaction may be made without detriment to the pressure-tightness of these castings, at least over the range of pouring temperatures used. (These castings were poured at about 1,120 deg. C. and it is not normally necessary to exceed this for castings with thick sections.) As may be judged from the results in Table I, there is considerable benefit to be derived from the use of large phosphorus additions to promote metal/mould reaction in making thin-walled castings in leaded gunmetals, and the results recorded suggest that any slight build-up of phosphorus in the metal arising from the melting of gates and risers high in phosphorus is unlikely to have a harmful effect on the heavier types of castings. Subsequent production experience has confirmed these conclusions.

The trials carried out on the 2-in. valve head are interesting in that they show the marked difference between the effect of gas absorbed in the mould through the metal/mould reaction and gas absorbed by the metal during melting. The latter was shown to be definitely detrimental to the pressure-tightness of this particular casting, whereas the absorption of an equal amount of gas through metal/mould reaction did little or no harm. In the case of some castings, even with thick sections, it is quite possible that metal/mould reaction could help to make a pressure-tight casting, although with these valve heads pressure-tightness could be obtained without its aid. It must be emphasised, however, that the metal must be reasonably gas-free initially, or the extra gas absorbed through the metal/mould reaction may do more harm than good.

Before attempting to apply metal/mould reaction it is advisable to check the gas content of melts by casting D.T.D. test-bars, and, in cases where the gas content produces more than 2 per cent. voids in the bars, to scavenge the melts with nitrogen or use some other degassing treatment. On theoretical grounds one would expect metal/mould reaction to have its most useful effects when the casting cools rapidly, *i.e.*, when the section is thin or the pouring temperature is low, and these practical observations are in line with this expectation.

The Authors' thanks are due to the directors of Newman Hender & Company, Limited, in whose works all the practical trials described above were carried out; and both to the firm and to the director and Council of the British Non-Ferrous Metals Research Association for permission to publish this article.

"Safety" Colour-code

During recent years, industry has given increasing attention to colour-coding of danger points in factories to indicate high-voltage lines, toxic gases, and obstructions such as low doorways and steps and other varying degrees of hazard, and a committee of the British Standards Institution, representative of a wide variety of industrial experience, has been considering the possibility of preparing a "safety" colour-code in order to secure unification of the present divergent practices. The Royal Society for the Prevention of Accidents made an extensive enquiry on behalf of the committee, as a result of which and of other investigations, it has now been decided to abandon the attempt to prepare a code. As the reasons for this decision will be of interest to all sections of industry, they are set out below.

Examination of the problem showed that a distinction must be made between a *safety* colour-code and an *identification* colour-code—the purpose of the former being, broadly, to classify types of hazard and to give warning of them by colour, whilst the object of the identification code, as in the British Standards 1710 for pipe-lines and 349 for gas-cylinders, is primarily to identify the contents by colour, and any application to safety is incidental. It was the former type of code that the committee had to consider, and it was found that many colours had traditional connotations, which whilst not always consistent, were so well-known that they could not be rationalised.

The second difficulty was that the only truly satisfactory method of ensuring safety is to eliminate the hazard, and the committee felt that a code might encourage identification of hazards by colour instead of their removal. Thirdly, the increase in the scientific use of colours for decoration to secure better lighting and to improve working conditions detracted from the effectiveness of a safety colour-code, and these schemes of decoration were considered to be more effective in the reduction of accidents. A fourth and important point arose from positive evidence submitted showing that the significance of colour-codes put into effect had been quickly forgotten; whilst this is relatively unimportant in the case of an identification colour-code where time is not vital, it was felt to militate seriously against the use of a safety-code where recognition and significance of colour must be immediate and instinctive.

Steel Teeming Temperature

Factors determining the teeming temperatures of open-hearth steel were discussed by Mr. D. Hadfield and Mr. A. Donald, of Colvilles, Limited, in a Paper delivered to members of the West of Scotland Iron and Steel Institute in Glasgow on December 14. From theoretical calculations of the probable effect of each factor, their relative importance was assessed. Theories advanced were tested by measuring the temperature in the ladle of a large number of heats, using a specially-designed pyrometer. Results of the temperature measurements were analysed statistically to account for wide variations found. The Authors showed that any control of temperature must be applied to the metal while it remained in the open-hearth furnace, but by knowing how far it fell in temperature during tapping and while in the ladle, it should be possible to adjust the bath temperature to give the correct degree of superheat in the teeming.

A NEW SUB-COMMITTEE of the Institute of Vitreous Enamellers has been formed under the chairmanship of Mr. J. H. Gray, to investigate organic suspension agents used in vitreous enamelling.

Shipbuilding and the Steel Shortage

Speaking at the launching of a 24,400-ton motor tanker, built for the Gulf Oil Corporation of the United States, Mr. R. Boardman, managing director of the Furness Shipbuilding Company, Limited, Haverton Hill-on-Tees, the builders, revealed that his company was planning to revolutionise, if necessary, the design of tankers to overcome the threatened steel shortage. Experts said that the steel output would be reduced in the future, and if so, shipbuilders must find ways and means of overcoming the difficulty.

"I for one," he said, "accept it as a challenge that it is our duty as naval architects to find the means to maintain the necessary strength for safety, but to reduce the weight of steel to give carrying capacity and ensure prompt delivery." On the other hand, he said, steel-makers might be able to find an alloy steel which, with less weight, would still have the same strength to comply with the requirements of the classification societies.

Mr. Boardman disclosed that his company had orders in hand to keep it fully occupied for seven years, the orders including two 32,000-ton tankers.

Stimulant to British Industry

The far-sighted attitude of many American firms in allowing overseas visitors and even competitors to see their factories was praised by Sir Norman Kipping, director-general of the Federation of British Industries, when he addressed the opening session of the first international conference of manufacturers in New York recently. Attended by 200 leading western European industrialists, the conference was devoted to discussions of means of increasing productivity with United States manufacturers. Commenting on the visits to the United States of British productivity teams, Sir Norman said that their findings had stimulated discussion and action throughout British industry. Fifty-four teams, comprising 800 men and women, had already crossed the Atlantic and of these 39 had submitted carefully-considered reports. The interest aroused by these visits can be gauged by the fact that 400,000 copies of the reports have been sold.

The conference, which was sponsored by the American National Association of Manufacturers, lasted for three days.

Greenwood & Batley's Action

Legal proceedings instituted in the High Court in January, 1950, by Greenwood & Batley, Limited, manufacturers of electric mining locomotives, of Leeds, against the Logan Mining Machinery Company, Limited, Lochee, Dundee, and against Stanley Birkett West, William James Walker, and Fred Wooler (formerly employed by Greenwood & Batley and later by the Logan Mining Machinery Company), have been completed. Greenwood & Batley, Limited, sought, *inter alia*, an injunction to restrain each of them from making use of Greenwood & Batley's confidential drawings, photographs, and information, for the return of all such drawings, etc., and for an inquiry as to damages and costs.

A statement issued by Greenwood & Batley, Limited, says that "these proceedings were entirely successful."

THE STEEPLEJACK & ENGINEERING COMPANY, LIMITED, Nottingham, has secured contracts for the construction of three 250-ft. chimneys, two of which will be erected on the site of the new coking plant at Wingerworth, near Chesterfield, for the National Coal Board, and the third for a coke oven at Stanton. Each chimney will weigh 1,450 tons and the use of about 1,200,000 bricks will be involved in the contracts.

Radiographic Techniques for Examining Steel Castings*

This report describes an investigation carried out by members of the non-destructive testing sub-committee of B.I.S.R.A. into the relative merits of a number of radiographic techniques suitable for use on steel castings. The techniques examined are listed below, and whilst they do not represent all the possibilities, it is considered that they cover most of the methods likely to be used in general industrial radiography.

Procedure

For the investigation, four cast-steel plates were obtained, each 15 by 12 in., with the main faces machined, the finished plate thicknesses being $\frac{7}{8}$, 2, 3, and 4 in. respectively. All the plates were manufactured to contain extensive castings defects, consisting principally of "centre-line" shrinkage, whilst the thinnest plate also contained some sand and slag inclusions. The thicker sections of 5, 6, and 8 in. were built by using the 4-in. plate, which contained the most severe defects, with additional thicknesses of rolled steel.

Radiographs were obtained on each thickness using a number of different radiographic techniques, and an attempt was made to compare their quality.

The techniques investigated were limited to those likely to be suitable for the examination of plates of uniform thickness and some may not be suitable for castings where a rapidly changing section has to be radiographed on one film. To limit the number of techniques investigated, and because tungstate screens are normally employed only when the exposure time would otherwise be too prolonged, it was decided not to use the slower, fine-grain tungstate screens, but to confine the investigation to a pair of high-speed screens; fine grain (Crystallex) film was used with the metal screens except where the exposure time for this film would have been too long to be practical.

To simplify comparison of the radiographs, film densities as close as possible to 1.8 for lead-screen techniques and 1.4 for tungstate screens were used in conjunction with the standard processing technique.

Focus Film Distance

To ensure that the definition obtained on the radiographs should be dependent on the film-screen combination and quality of radiation employed, and not on the size of the focal spot of the particular X-ray tube used, the largest possible focus-film distance was used. It was intended originally that all the X-ray exposures should be made with a focus-film distance of 60 in., so that the effect on the definition of using tubes with different focal-spot sizes would be minimised, but it was found necessary in order to keep the exposure times within practicable limits, to reduce the distance to 36 in. for the 6-in. and 8-in. specimens with lead screens and to increase it considerably with tungstate screens at 400 and 1,000 k.v. on the $\frac{7}{8}$-in. and 2-in. plates. The gamma-ray exposures also, were made, as far as possible, with a source-film distance of 60 in., so that the definition obtained on the radiographs was dependent on the film-screen combination used, and not on the geometric conditions. This could not however be effected with the thicker sections and a compromise had to be made between large source-to-film distances and practical exposure times. Some difficulty was experienced later in comparing the definition on radiographs taken with different source-to-film distances because of the slight differences in projection of some of the flaws.

Edge Masking

A considerable amount of edge-masking of the plates was necessary with the X-ray technique, particularly when tungstate screens were employed. This was not necessary with gamma-ray exposures. The radiographic techniques employed are given in Table I in which the definition and contrast in the radiographs resulting from each technique have been compared. Each specimen thickness has been treated independently, and there is no correlation between one thickness and the next, *e.g.*, letter *A* means that this technique is considered to be the best for that particular thickness; letter *E* signifies that this is considered to be the fifth best method. There is no quantitative significance in the lettering; a change from one letter to the next indicates only that one radiograph is better than the other.

The defects in the 4-in. plate when built up to 8 in. of steel by the addition of another 4 in. between the defects and the film were not sufficiently pronounced to produce radiographs with enough detail to enable comparisons of the four possible techniques to be made on the 8-in. plate. Furthermore, 8 in. approached the practical limit of the 1,000 k.v. set, hence the results given for this thickness are tentative.

Detailed Results

$\frac{7}{8}$-in. Plate.—Eight different techniques were compared for this thickness and the radiographs varied considerably in quality. Only the technique *l* could be regarded as useless, but with techniques other than *a*, *b*, *d*, and *e*, some fine detail became indiscernible. These four may be considered satisfactory techniques for this thickness, although there was a considerable variation in quality between them.

* Paper SC/AC/15/51 of the non-destructive testing sub-committee of the Steel Castings Division of the British Iron and Steel Research Association, printed in the *Journal of the Iron and Steel Institute.*

TABLE I.—*Classification of Radiographic Techniques.*

Technique and Radiation	Screens.	Film.	¼-in. plate.		2-in. plate.		3-in. plate.		4-in. plate.		5-in. plate.		6-in. plate.		8-in. plate.	
			Contrast.	Definition.	Contrast.	Definition.	Contrast.	Definition.	Contrast.	Definition.	Contrast.	Definition.	Contrast.	Definition.	Contrast.	Definition.
X-rays.																
(a) 110 kv.	Tungstate	Salt-screen type	*A*	*B*												
(b) 200 kv.	Lead	Crystallex	*B*	*A*												
(c) 250 kv.	Tungstate	Salt-screen type	*D*	*D*	*A*	*A*										
(d) 250 kv.	Lead	Crystallex	*C*	*B*	*C*	*C*	*C*	*D*								
(e) 400 kv.	Lead	Industrex *D*			*A*	*B*	*A*	*A*								
(f*) 400 kv.	Tungstate	Salt-screen type	*E*	*E*	*E*	*F*	*E*	*B*								
(g) 400 kv.	Lead	Crystallex	*E*	*E*	*E*	*C*	*C*	*F*	*C*	*E*						
(h) 1,000 kv.	Tungstate	Salt-screen type			*C*	*C*	*G*	*C*	*A*	*A*	*A*	*B*	*A*	*B*		
(j) 1,000 kv.	Lead	Crystallex	*G*	*E*	*C*	*C*	*C*	*G*	*E*	*C*	*C*	*C*	*C*	*C*	*A*	*A*
(k) Gamma rays from radium or radon	Tungstate	Salt-screen type	*H*	*H*	*G*	*G*	*G*	*G*	*B*	*D*	*A*	*A*	*A*	*A*	*A*	*A*
(l)	Lead								*C*	*A*	*C*	*C*	*C*	*D*		

* This technique was included on the 3-in. plate, as the use of fine-grain film (technique *e*) required a very long exposure time.

Some dendritic structure associated with shrinkage in the plate could be seen only with technique *b*; with this thickness it is a greater advantage to have the superior definition obtainable with fine-grain film (technique *b*), than to have a slight increase in contrast with poorer definition (technique *a*).

Although some very small defects were lost and the fine structure of the shrinkage was not discernible, the main defects in this plate was still shown with techniques *g*, *h*, *k*, and for much radiography of cast steel of this thickness such techniques would be satisfactory.

2-*in. Plate.*—Seven different techniques were used, but the range of quality in the radiographs was much smaller than on the $\frac{7}{8}$-in plate. With technique *l* only the rough outline of the larger defects could be decided; this technique would be suitable only for the detection of very gross defects but any of the other techniques would be suitable for casting examination of this thickness.

Some shallow defects which were shown with techniques *c* and *e* were not discernible with technique *d*, and for the highest-quality radiographs either *c* or *e* should be used. There is little to choose between these two and, provided that fine-grain film with metal screens are used, it would appear that with this thickness of specimen the kilovoltage employed is not critical.

3-*in. Plate.*—The defects in this plate were not so varied in size as in the $\frac{7}{8}$-in. and 2-in. plates and were relatively shallow. Eight techniques were tried, and three, *g*, *j*, and *l*, were found to be unsatisfactory; the extent of the defective area was not clearly defined although there were some indications of the worst defects.

The remaining techniques, *d*, *e*, *f*, *h*, and *k* may all be considered satisfactory; there was only a small difference between them in the contrast obtained, but there was a progressive deterioration of the definition, most noticeable with techniques *d*, *h*, and *k*, which made it more difficult to recognise the nature of the defects. Techniques *e* and *f*, therefore, produced the highest-quality radiographs.

4-*in. Plate.*—On the thicker plates the number of possible techniques was more limited, and five different methods of examination were tried.

All five showed most of the defects, and would be satisfactory for many castings, but there was a considerable difference in radiographic quality between the two radiographs taken with lead-screen techniques *h* and *k*, and those with salt-screen techniques *g*, *j*, and *l*. These latter did not show some of the more shallow defects, and the poorer definition made interpretation very difficult.

5-*in. Plate.*—Radiographs on this thickness were possible only with 1,000-k.v. X-rays and with gamma-rays. There was a considerable difference in quality between the radiographs taken with lead-screen techniques *h* and *k* and those with salt-screen techniques *j* and *l*, these latter showing the larger but not the smaller defects. There was little apparent difference between 1,000-k.v. X-rays and gamma-rays from radon for this thickness.

6-*in. Plate.*—The defects in this plate were relatively shallow and assessment of the radiographs was not very easy. The lead-screen radiographs,

techniques *h* and *k*, were considerably better than the salt-screen techniques *l* and *j*, although these latter showed most of the defects. All four techniques would probably be suitable for much casting radiography of this thickness, although with *l* and *j* there might be some difficulty in deciding the exact nature of the defects by reason of the poor definition.

Gamma-rays gave a slightly better-quality radiograph than 1,000-k.v. X-rays, but the differences were not great.

8-*in. Plate.*—The defects were too shallow to enable a satisfactory assessment of the different techniques to be made; apparently this thickness was beyond the practical limit for 1,000-k.v. X-rays and the only technique investigated that was suitable used gamma-rays obtained from radon.

General Conclusions

The results suggest that good definition on a radiograph is of more importance than high contrast when they are alternative, although they are not necessarily independent. Since it is necessary to recognise the nature of a defect as well as its presence, it was concluded that on the thinner plates, the use of fine-grain film at the higher kilovoltage yielded better radiographs than tungstate screens.

The use of tungstate screens with 1,000-k.v. X-rays and with gamma-rays has apparently little purpose; the screens have only a low intensifying factor with very hard radiation and the results are always inferior to those obtained with lead screens.

Gamma-rays from radon or radium and 1,000-k.v. X-rays differ little for up to 5 in. of steel but there are indications that gamma-rays will give better results with greater thicknesses.

The techniques investigated do not cover all the possibilities but it is considered that the assessment of those listed will serve a useful purpose. A radiograph should always be taken by the best practicable technique, and it is hoped that this report will give some guidance on the loss in quality to be expected when techniques other than the best are used.

Another Long-service Celebration

Robey & Company, Limited, Globe Works, Lincoln, held their fourth long-service celebration on December 14 in the works canteen, when over 300 employees with over ten years' service were entertained by the directors. The scheme now includes 317 members who have service ranging from 10 to 58 years. Presentations were made by the chairman and managing director, Mr. W. T. Bell, O.B.E., J.P., who incidentally has the longest service of any member of the firm.

Presentations included a diploma for 50 years' service to Mr. H. Robinson, diplomas for lesser periods down to 35 years to other qualified workpeople, and savings certificates for each completed five years' service to all with over 10 years. Refreshments were served and a variety show was presented. Votes of thanks were accorded to the directors and, finally, Mr. E. F. Needham, who has served 40 years with the company, was congratulated by Mr. W. T. Bell on his appointment as Sheriff of the City of Lincoln, an office which was held by Mr. Bell's father in 1884.

Old Stagers

Through the courtesy of Mr. T. Makemson, M.B.E., the secretary of the Institute of British Foundrymen, we are printing below a list of members who joined the British Foundrymen's Association during the period 1904 to 1910.

Name.	Branch.	Date.
R. L. Rankin	Scottish	1904
D. A. Aston	London	1905
K. M. H. Burder	East Midlands	,,
J. N. Chadwick	Lancashire	,,
J. T. Goodwin, M.B.E.	Sheffield	,,
W. H. Meadowcroft	Lancashire	,,
A. Bowman	London	1906
M. H. Curnow	Birmingham	,,
S. H. Russell	East Midlands	,,
F. Andrew	Lancashire	1907
C. Fontaine	Wales and Monmouth	,,
A. L. Key	Lancashire	,,
D. Langdale	Scotland	,,
J. Parkinson	West Riding	,,
R. J. Shaw	London	,,
H. Sherburn	Lancashire	,,
V. C. Faulkner	London	1908
R. D. Welford	West Riding	,,
T. G. Hilton	Lancashire	1909
V. Jobson	East Midlands	,,
J. S. Morehead	Scotland	,,
J. Pell	Lancashire	,,
H. Bunting	East Midlands	1910
F. J. Cree	London	,,
M. S. Kenyon	Lancashire	,,
W. Oxley	Sheffield	,,
W. Rawlinson	Lancashire	,,

Three of these old stagers, Mr. Faulkner (1926), Mr. Goodwin (1927), and Mr. Russell (1928) have presided over the Institute, whilst about ten of the others have presided over their branches. May they all enjoy a further long period of membership.

Care of Baths

The British Bath Manufacturers' Association, Limited, 145, St. Vincent Street, Glasgow, C.2, have issued a folder for the guidance of the merchant and a leaflet for the householder. Quite different from the American mentality which is insistent on something "nu," this group of manufacturers is doing its best to ensure long life for their productions. There is a realisation that abuse often takes place and reference is made to the amateur photographer, but there is also the case of Jones Minor whose interest in chemistry is only too often carried out in the bathroom, with dire results in the bath. The reviewer has no criticism of the folder destined for use by the merchant, but the one for the householder should stress the fact that the surface finish is porcelain or glass and this by nature is brittle. However, the service being given by these two publications is commendable even though the result will be a lowered demand for baths in the future!

Working Population's Decline

The country total working population declined in October by 3,000 to 23,479,000. Colliery manpower fell by 900 in the month, while the metals, engineering, and vehicles group gained 21,000 to 4,171,000. In the basic industries there was a contraction of 34,000 to 4,157,000.

The number of unemployed increased by 26,700 to 290,000, but of this figure only 88,700 had been out of work for more than four weeks.

House Organs

Bradley's Magazine, No. 48. Published by Bradley & Foster, Limited, Darlaston Iron Works, Darlaston, Staffs.

An outstanding feature of this quarterly magazine in "readableness" to coin a new word. This issue contains an important article on the spectrographic analysis of refined iron. This method is gradually ousting straight chemical analysis because it shows up trace elements, which under modern foundry practice are quite capable of causing much trouble. The account of the methods used is couched in simple language and is easy to follow. The second paper is on malleable castings, whilst extracts from current literature make up the balance.

The Half Wheel. The journal of Barnards, Limited, Norwich. Vol 3, No. 2.

This issue has been used to commemorate the 125th anniversary of the establishment of the company. Since its inception it has made a variety of products ranging from mining machines to wire netting. It has made very commendable progress on which the reviewer offers his congratulations. The magazine has 72 pages and is nicely illustrated. Many of the contributions are original and interesting. The Half Wheel in future is to come out half-yearly, which in the reviewer's opinion is a retrograde step.

Carron Cupola, Vol. II, No. 4. Issued by the Carron Company, Carron, Stirlingshire.

This issue announces that new accommodation has been acquired next door to the old London office at No. 14, Upper Thames Street, London, E.C.4. Mr. B. W. Payne, the manager of the company, in the leading article, makes an appeal for increased honesty by the population as the present low standard is putting up the cost of living by the appointment of "supervisors to supervise supervisors." He might usefully have quoted the statistics of pilfering on the railways to reinforce his argument.

Albion Works Bulletin. Vol. 5, No. 7. Issued by John Harper & Company, Limited, Albion Works, Willenhall, Staffs.

This issue carries the statement that during July, August, September, 2,700 tons of grey iron and meehanite were produced with a scrap loss of 6.3 per cent. Taking into consideration the high quality of components made by this firm, this achievement is noteworthy. With this issue comes as an enclosure a graph which shows not only the trend of the export of this firm's goods, but enables a comparison to be made with the overall export of iron and steel. The picture disclosed should act as an incentive to the whole of the personnel. The bulletin also announces the acquisition of a new works at Poole, which is to be managed by Mr. A. T. Mason.

Book Reviews

Workshop Books: Machine Moulding. Second revised edition of U. Lohse, by Dipl. Ing. Hans Allendorf, published by Springer-Verlag, 20, Reichpietschufer, West Berlin, W.35. Price 3.60 D.M.

In this book are described the conditions necessary for the successful application of machine moulding; the essential construction of the moulding machines; packing of sand by mechanical stamping, by pressing, shaking and slinging; parting of pattern and mould by lifting lowering, straight-draw and turnover methods; design, operation and maintenance of moulding machines, and protection from dust, sand preparation and moulding machine drives; machines for the production of special shapes through hand-stamping, hand-pressing, compressed-air pressing, shaking moulding machines, shake and press moulding machines, and Sandslingers; snap-flask moulding in Germany and America; core-making machines, the solidification of sand by hand and by mechanical methods such as core-blowing machines.

The individual machines and processes are described with the aid of 137 diagrams and this book enables the practical foundryman to gain an introduction to the principles and practice of all sides of machine moulding.

The Instrumentation of Open-hearth Furnaces. By the Steelmaking Division Open-hearth Instruments Sub-committee of the British Iron and Steel Research Association. Published by George Allen & Unwin, Limited, 40, Museum Street, London, W.C.1. Price 30s. net.

The British steelfoundry industry does not nowadays use many open-hearth furnaces, but in some cases they draw up the output of furnaces the main output of which is steel for ingots. For the firms which do employ this method of making steel, this book is invaluable. For the foundry owner, however, there is a lesson to be learnt from this logical presentation of the subject of furnace control through instrumentation, as for him it is a problem still to be solved in relation to foundry processes. The book is divided into two parts, the first of which covers the function of Instruments; Recommended Instrumentation; Principles Governing the Operation of Instruments; Panel Layout and Location and Automatic Control. Part two details the features of the various instruments utilised. In the foreword, Sir Charles Goodeve recalls the story of a visit by a metallurgist to a hardening shop, only to find it was shut down because "T'fish was dopey." This fish was kept in the quenching tank where its liveliness was apparently indicative of the suitability of the contents for the conduct of the work. There are still a few "dopey fish" in the foundry industry. This is a thoroughly readable book, well illustrated and efficiently indexed, and as such can be unreservedly recommended.

V. C. F.

A 31 PER CENT. INTEREST in Diesel Equipment Company, Limited, Vancouver, a selling organisation operating on the Pacific coast of Canada, has been acquired by the Brush Electrical Engineering Company, Limited, the parent company of the Brush ABOE group. One of the main functions of Diesel Equipment Company, Limited, will be the selling of large Diesel engines, mainly marine, and generating sets manufactured by Vivian Diesels & Munitions, Limited, and Vivian Engine Works, Limited, the two Brush ABOE group subsidiaries with factories in Vancouver.

MANUFACTURERS of domestic washing machines, commercial laundry and dry-cleaning equipment, in the United Kingdom, who wish to arrange for the assembly and sale of their products in Canada, should write to Mr. A. M. Gibson, J. H. Connor & Son, Limited, 207, Montcalm Street, Hull, Quebec, marking their letters for personal attention. The Board of Trade, Commercial Relations and Exports Department, Thames House North, Millbank, London, S.W.1 (reference, CRE(IB) 76029/51), should be notified of any action taken.

Rôle of the Metallurgical Department in Works Control

By V. W. Childs

This lecture was given as part of a presidential address by the Author on assuming the chairmanship of the East Anglian section of the London branch of the Institute of British Foundrymen.

The rôle of the metallurgical department in works control varies considerably; it depends on the policy of the management as to what its ramifications should be, but the tendency in mass-producing companies is for it to be as wide as possible. Frequently, it covers all aspects of quality-control of raw materials, control of technical processes (which is part of quality control) and finally control of the quality of the finished product. This rôle covers a very large field. The importance of scientific control at every step in the manufacture of castings has long been recognised. All raw materials entering the plant must be subjected to careful scientific tests before being accepted. Under normal conditions, assuming to-day's conditions as abnormal, rigid specifications should be adhered to by suppliers of raw materials such as pig-iron, steel, coke, oils, non-ferrous metals, etc. In respect of certain of these materials it is not possible nowadays to make selective purchases and where only one grade of a material is available the metallurgical department has to modify its methods accordingly in order to obtain the best results. Sand used for making moulds and cores must be subjected to different tests, including the measurement of grain size. Not only should raw materials be carefully analysed and tested, but regular tests should be carried out on all processes throughout production. The following remarks are intended solely to generalise and no hard-and-fast ruling in intended, hence the introductory title of " Rôle of a Metallurgical Department in Works Control " is made to precede these remarks which are complementary to a film to be shown.

Raw Materials

Depending on the scope given the metallurgical department the control should embrace all bought-in metals used in the melting processes, together with quality control of fuels and fluxes. This range of materials includes pig-irons, steel and cast-iron scrap, alloy additions, non-ferrous ingots, virgin metals and the fuels, usually coke and fuel oil. When these are purchased they should adhere to a specification agreed to by both producer and customer and where it is not possible always to insist on the quality such as in the case of fuels, particularly coke, a regular qualitative check should be introduced in order, first to learn of the quality and secondly to establish some degree of grading to permit discrimination in consumption. In this respect it is obvious that a systematic method should be adopted by the stock-yard department to keep separate the various qualities of the same material. It is considered that this is the only practical means by which metallurgists operating melting plants may know in advance what metal or fuel is available.

There are several ways of stacking raw materials; one way proved to be satisfactory is that commonly known as the two-heap system, which permits one heap to be consumed or drawn-from, whilst the second is being allowed to accumulate as materials are received. Apart from simplifying the control of quality, the method is of great assistance in stock-taking and checking actual consumption against book or recorded consumption—always a difficult problem when comparatively large tonnages are involved.

In the film which was to be shown, an attempt had been made to show how different types of pig-iron and scrap could be stacked in an orderly manner yet efficiently from the point of view of quality-control. When once material has been accepted, the next important operation is that of selecting the correct size of scrap, and, where pig is sand-cast to assure that only sizes proportionate to furnace dimensions are used. Many troubles can and do ensue if, for example, too large a size of steel scrap is used in cupola melting. The reverse seldom occurs, but caution should be exercised where only very small scrap is available. This point makes clear the need of establishing where practicable a system for grading the material according to size.

Other Spheres of Activity

So far, reference has not been made to foundry consumable materials, such as, silica sands, moulding sands, coal-dust and bonding agents. If these are to be used efficiently and economically it is most important that their properties and characteristics be known and to have a set quality standard.

When once the department has confidence in the materials available, its attention should then be directed as to their use. Obviously, the next control should be in the foundry where the melting units must be scientifically operated and where all sand, both for moulding and coremaking must be used in a predetermined manner decided upon by the metallurgical department. By this method, foundrymen, and here is meant foremen and chargehands in particular, are able to concentrate upon output and labour problems.

Heat-treatment in all its aspects is essentially a

Metallurgical Department in Works Control

metallurgically-controlled operation. Most ferrous metals require some treatment in order to bring out certain properties, whether it is improved machinability, stress-relieving, or hardening. To obtain the best possible results, a scientific approach must be made, every metal is a law unto itself and it is the metallurgist's special knowledge of individual metals which will decide the type of treatment to be adopted. Generally speaking, the main factors to be considered are:—

(1) The atmospheric conditions in the furnaces or ovens; (2) temperature requirements based on the critical points; (3) duration of heating cycle, and (4) cooling speeds.

The Laboratory

The laboratory has and probably always will be treated with a degree of reserve by production departments; this, of course, should not be the case, because it is the duty of that department to produce facts and, however unpalatable they might be, they should be considered and applied. Very often, it is said, certain results are obtained which are diametrically opposite to theory, but it can be stated with an air of confidence that the full facts of such a case could not have been fully known. The rôle of the laboratory can be split into several sections—there is the routine side which produces regular analyses, determination of properties of metals and materials which are most necessary to plant metallurgists; there is then the research and development side which can be a modest supplement to the department or a widely-embracing section where fundamental research is carried out. It is obviously important that new developments of outside sources be studied and experimented with to permit the adoption of new methods and ideas; this applies particularly to metallurgy, as there are many unsolved problems.

It is not intended to relate details of methods of tackling problems and carrying out checks; there is, however, one very important point to be made; that is, when once information is obtained, it should be passed out to the plant quickly to permit speedy action by the personnel producing the goods. To give information speedily and accurately calls for modern equipment and for apparatus employing well-tried methods of analysis. In these days, when practically all materials are bought and sold to specification, it is important that the fullest information be known of their properties, and this is where the rôle of the metallurgical department comes into full prominence.

The short film which followed this lecture was a silent one apart from a brief commentary by Mr. Childs. The film was not intended to be a story of any particular production; it showed elements of control exercised by the metallurgist, and was taken at the works of Crane, Limited, Ipswich, to whom grateful acknowledgment was made.

Jute Mill Orders

Big orders for jute mill machinery have now been placed with Dundee and Angus engineering firms by the Pakistan Government. Mr. G. Faruque, chairman of the Pakistan Jute Board, told our Scottish correspondent that the total would be £3,500,000 and might exceed even that figure. Mr. Faruque, who heads the Pakistan trade delegation, said that negotiations have been successfully concluded in a series of meetings with representatives of Dundee industry. Letters of confirmation are now being exchanged. "We have given them very big orders, and our Dundee friends now have as much work as they can manage up to the end of 1954," he said. "Machinery for spinning, weaving, finishing—everything from A to Z in the jute industry—is included, excepting electrical motors, and they don't make those, otherwise they might have been included, too. Prices have gone up a great deal since the time we placed our first orders with Dundee. We had, in fact, to pay even higher prices than we expected, but that, I suppose, was inevitable. I am utterly confident that the Dundee firms will do their best for us in the way of deliveries and other details. They are all good friends of ours."

The firms concerned are:—James F. Low & Company, Fairbairn, Lawson Combe Barbour, Limited, T. C. Keay, Limited, and their associated company, Lawside Engineering & Foundry Company, Limited, Urquhart Lindsay & Robertson Orchar, Limited, Douglas Fraser, Limited. James Mackie & Sons, Belfast, are also included. It is not possible at this stage to indicate in what proportion the orders will be divided among the different firms. Mr. Faruque and his colleagues in the trade delegation returned to Pakistan last week.

Welding and Notch-Bar Testing

Notch-bar testing and its relation to welded construction was the subject of a symposium organised by the Institute of Welding in association with the Joint Committee on Materials and their Testing, which was held at the Institution of Civil Engineers in London, on December 5, and at which Prof. E. C. Rollason, Liverpool University, presided. Today the problem of assessing the relative merits of steels by means of notched bars has become not only of acute importance owing to the greater appreciation of the significance of notch-toughness in welded structures, but has also become immensely more complicated owing to the multiplicity of new tests which have been made, and continue to be developed. It was during the last world war that failures in some all-welded Liberty ships accentuated the consequences of inferior notch-toughness.

Harland Development

Harland Engineering Company, Limited, are forming a wholly-owned subsidiary under the name of "Harland Drives, Limited" with Mr. K. W. Atchley as chairman, Mr. F. H. Maddox—now manager of the drive department—as managing director, Mr. R. C. Mortimer—chief engineer of the drive department—as technical director, and Mr. C. A. Atchley. Mr. C. A. Atchley is retiring from the position of managing director of the parent company at the end of the year, when he will be 70 years of age. He will be succeeded by Mr. R. W. Weekes, while Mr. K. W. Atchley will continue as works director coupled with that of chief of engineering.

NEWTONS (IRONFOUNDERS), LIMITED, are planning extensions to Albion Foundry, Miles Platting, Manchester.

Synthetic Resins in the Foundry*

Further Discussion of T.S.30 Sub-committee Report

Mr. G. L. Harbach, A.I.M., assisted by Mr. P. G. Pentz, B.SC., of the British Plastics Federation (both members of I.B.F. Sub-committee T.S.30), addressed a meeting of the Birmingham branch of the Institute of British Foundrymen held at the James Watt Memorial Institute on the above subject and what follows is a report of the discussion which ensued. Such aspects of synthetic-resin corebonding practice as the drying of differing sizes; possible elimination of the cereal ingredient; di-electric drying; economics and control were mainly dealt with.

MR. GRAHAM, who proposed the vote of thanks, said he had been interested in the field of synthetic resins from the very early days, and was privileged to serve on the T.S.30 Committee with Mr. Harbach during the two years he spent preparing the Report. They had met six or seven times, and on each occasion found information was coming in rapidly which had put new light on the subject. Information was received from many sources, including some foundries, although perhaps not so many as they would have liked.

It was appreciated that difficulties would be experienced in changing over to synthetic resins and in his experience it was a bold step to take, but once the change was made, it was advisable to forge boldly ahead. Resin-bonded sand had to be treated as a new material and not compared with standard materials which had been used for a number of years. The opposition to synthetic-resin coils to-day was diminishing rapidly, and he thought that before long, with the information which would be available, an interesting Paper could be compiled on the progress of its production and its use, and from a practical point of view, this should prove interesting. Mr. Graham said that Mr. Harbach had done very useful work to the foundry industry in the early days of his experiments, and his leadership was invaluable on the T.S.30 Sub-committee.

MR. SMITH said many foundries had already had experience of the use of synthetic resins, but that Mr. Harbach's lecture had given some new lines of approach.

MR. HARBACH, replying, said with reference to the point made by Mr. Graham, he did admit that at the time they were working on out-of-date information in the early days, when very few people had much information to give. All they could do was to base their findings on their own experience. The trend to-day showed that larger firms were tackling the synthetic-resin project rather than smaller concerns.

Drying of Large and Small Cores Together

MR. TWIGGER asked about the drying of large and small cores together. This, he said, had always been a problem, and he believed that it also existed with synthetic-resin binders. He asked whether there was any great advantage with the synthetic-resin binders in handling the small and large cores in the same coreshop.

MR. GRAHAM said that they dried cores weighing up to 4½ cwt. and some as small as 5 to 6 lb. They had three continuous stoves, but to segregate the cores into three differently-timed stoves would be an awkward operation; no selection was practised as long as ¼-in. and 12-in. thick cores were not expected together. The middle course was taken. They set the stove to give about 200 deg. C., working plus or minus 10 deg. It was oil-fired and the actual cores were baked for about 40 min. The large cores came out " green," dried about 4 in. solid, but they were vented very well using very large tubes, probably 3- to 4-in. dia. for the largest. These helped to get the moisture away and to allow the heat to harden the resin in the centre. They found that, provided the vents were well brought out, there were no defects due to undried centres of cores. The very small cores did tend to get more heat than they should; sometimes the edges were slightly overcooked, but all the cores were sprayed. (He would like to put in a point of warning here; it was that spraying with plumbago allowed the core-plates to get covered with plumbago and the trays became very slippery to handle. They then sprayed with a white core paint and, after the cores had done one circuit of the stove, if they needed blacking, this was done whilst hot. Jacket cores were treated separately, the temperature in this case being about 240 deg. C., which gave a rapid bake. There was a change of colour, but no loss of strength. They would stand an enormous amount of heat before breaking down.

Elimination of Starch

Mr. Graham said his firm were at present working on a process of eliminating starch completely; they felt that, when this was done, the latitude of baking would be wider than before. The combination of a starch, resin and water was not desirable. When starch was used, there was a certain amount of absorption and there was a limit to the amount of water which could be used. Thus, with a given ratio, the starch took up so much water, and would not allow the resin to get as much baking as was required. Very wide ranges of sizes of cores should be baked separately, but anything from about 3 to

* Report of sub-committee T.S.30 of the Institute of British Foundrymen, printed in the JOURNAL, July 5, 1951.

9 in. were permissible together, providing the cores were sprayed. If they were sprayed with paint instead of water, they got more protection.

MR. PENTZ said that what Mr. Graham had said could be modified, in that it was possible, with synthetic resins, to bake large or small cores in the same stove, provided the temperature was not excessive, and somewhat longer times could be given. It was possible to bake over a very wide range of times at a given temperature. Where it was necessary to segregate, then high-frequency di-electric baking could be used. It was impossible to overbake in this case, but the wide differences in air-gaps between different size ranges limited treatment to one size at a time. Mr. Pentz said there was one other point on baking he would like to make: Mr. Harbach had given the figures for a minimum baking time of 30 min. at a temperature about 200 to 250 deg. For a core of the size of a tensile test-piece, baked at a temperature of 230 deg., a time of 15 to 20 min. was normally recommended. This would give maximum strength.

Synthetic-resin Cores on Core-blowers

MR. HANCOX said that Mr. Harbach had mentioned that some founders were producing synthetic-resin bonded cores on core-blowers. For some time he had been using U.F. and P.F. resins for hand-made work, but they felt that eventually they would have to be used with batteries of core-blowers in conjunction with a continuous stove. Sagging difficulties had repeatedly been encountered, and possibly extra jigging and inspection of cores would be entailed. He would like to know what experience Mr. Harbach had of blowing resin-bonded sand for cores.

MR. HARBACH said that he thought the same mixture could be used as for the hand-made cores.

MR. HANCOX said they had tried using 10 per cent. red sand, and also an addition of bentonite. They still got a modicum of sagging which prevented them from adopting the new material for "blowing."

MR. PENTZ said that the real problem was that it was more difficult to make a resin-bonded sand that would blow well at a reasonable moisture content. On the other hand, the problem of blowing sand was even greater where the blowing was a push action rather than one in which there was an air stream carrying the sand. He suggested the problem could be at least partially solved by using more suitable types of blowers, or perhaps by extra venting of the boxes.

Size of Casting

A MEMBER asked Mr. Harbach whether he could say what was the maximum weight of casting which could be used with a U.F. resin-bonded core, and also if he had any information about continuous di-electric drying equipment which he believed was now becoming available.

MR. HARBACH said that U.F. resins were being used for castings up to 15 cwt. Regarding di-electric heating, he thought that this was rather a problem for the future so far as this country was concerned. The question had come up at the Newcastle-upon-Tyne Conference, and he had pointed out that there was nothing in this country available and, even if there were, it would be too expensive for shop use in the majority of instances.

MR. WILLETTS said in at least one foundry where they were making a particular job, the metal thickness varied from 2 to 10 in. The casting itself was completely surrounded with U.F. resin-bonded core. The total weight would be approximately 3 tons. Heavier jobs were being tackled, but the one in mind was a standard production job.

MR. PENTZ said he knew of one foundry which was proposing to instal a large high-frequency baking oven. He thought this would be over 100 kw. capacity, and it was used for baking the largest cores which the firm would make. The company had found that the maximum advantage of di-electric drying was on large cores weighing about 2½ cwt., the baking time being about 20 min. against about two hours in continuous ovens. The cost was claimed to be substantially lower. Generally, it was claimed that the use of the high-frequency method reduced, if not eliminated, strains set up during baking.

Economics

MR. DUNNING asked about the economics of synthetic resins as compared with the more conventional core-binders.

MR. HARBACH replied that if a foundry was at present working on a binder content of around 2½ per cent. for an oil-bonded core, then costs with resin-bonded might be about even. The U.F. resin was cheaper than the P.F., and on a long-term forecast it was likely to remain on about that ratio. Generally speaking, he believed resin-bonded cores were cheaper than oil-bonded.

MR. PENTZ agreed with Mr. Harbach for the U.F. resin, a P.F. resin was more expensive; this was partly due to shortage and the high price of phenol.

MR. MARSH said that he understood that in some cases the resins tended to deteriorate over a period of time and that care had to be exercised in their storage.

MR. PENTZ replied that much depended on the storage temperature; U.F. resins could be stored for about 3 to 12 months, and P.F. rather longer.

MR. WEAVER referred to the sample test-piece exhibited and said that he presumed that when the furnace had been heated to 230 deg., this was over a gradual cycle.

MR. PENTZ said that the particular oven which had been used was brought up to temperature before putting in the cores at all. It had been found that in the smaller foundries there was sometimes a tendency to put cores into a warm oven, before the desired heat had been reached. This was inadvisable, because it caused a good deal of drying out and therefore a decrease in green-strength. If it was impossible to avoid doing this, the cores should be sprayed with water first. Regarding continuous

ovens, Mr. Pentz said that if synthetic resins came to be generally adopted, the design of ovens might be modified. The sooner a resin-bonded core was got into a hot oven the better. Many small cores were made with resins and baked in continuous ovens for 45 min.; some recent work had shown that the best results were obtained at a high oven-temperature with correspondingly shorter times.

Control

MR. GRAHAM said that, as a matter of routine and control, his firm placed a control test-piece in the oven every hour. These helped to form a record of the baking process throughout the day. When the cores had been round the continuous stoves, the maximum temperature reached could be estimated from the cores. It was found that results were generally about 200 to 250 lb. down in comparison with the laboratory oven. If the continuous-oven temperature exceeded 210 deg. C., a rapid fall-off in dry-strength could be expected.

MR. HARBACH stressed that usually the temperature in the stove was much lower than shown by the pyrometer.

MR. DUNNING asked whether dry, powdered synthetic resins could be used for core mixes, as he had the impression that most resins were supplied as fluids.

MR. PENTZ said most of the resins were liquid because they were much cheaper to produce than powdered resins.

MR. WEAVER endorsed Mr. Harbach's remarks in relation to the variation of temperature in the continuous stoves from that shown by pyrometer readings. At one time he had experienced trouble with inefficient drying, and it had occurred to him to get a portable pyrometer. The difference in readings shown graphically had confirmed his belief that the importance of control test-pieces was most important.

Scabbing

A MEMBER asked whether Mr. Harbach had ever experienced trouble with core scabbing, and whether this was due to insufficient drying.

MR. HARBACH said this was not a thing which normally happened with resins, but that insufficient drying was probably the cause.

MR. GRAHAM said that they applied a coat of white core-paint and blacking, and their experience had been that, if the paint was materially stronger than the core, there was no flaking off into the metal.

MR. BUSHALL asked whether the member had blacked the core in the "green" state. There was, he said, a tendency when the core was blacked in the green state to use the black rather too thickly. When blacked or sprayed green, the wash should be considerably thinner and applied in a fine spray rather than a brushed-on paint. If this were not done, scabbing from the core had been experienced.

MR. TWIGGER, in bringing the discussion to a close, expressed thanks on behalf of the meeting to Mr. Harbach and to Mr. Pentz for the way they had dealt with questions.

"C" Process

The *Iron Age* of November 15 prints an article describing the making of castings by the "C" process by Builders Iron Foundry, Providence, R.I., U.S.A. The process is being used for the manufacture of Meehanite iron castings and other components made in aluminium. The rate of production is of the order of 90 to 110 moulds per 8-hr. day, using a standard 13½-in. by 19¼-in. patternplate. Stress is laid on the extreme care necessary in the production of the patternplates in view of the close registration of the mould needed. The article states that "C-" Process castings can be held to a tolerance of 0.002 to 0.003 in per in. Thus a 4-in. long casting can be turned out to within 0.008 to 0.012 in. and for a 6-in. component between 0.012 and 0.18 in. Practice has shown that these tolerances can be attained only when the desired dimensions are within the mould face. If the dimension goes across the joint of the mould, the tolerance varies directly with the size and bulk of the casting. This may be three to four times the tolerance indicated, but is still better than in ordinary sand practice.

Summarising the present state of the process, the Author, Mr. A. W. Calder, Junr., of Builders Foundry, states:—

(1) The casting is limited by the size of the moulding equipment operated by the foundry.

(2) The casting is limited by its adaptability to being moulded by this method.

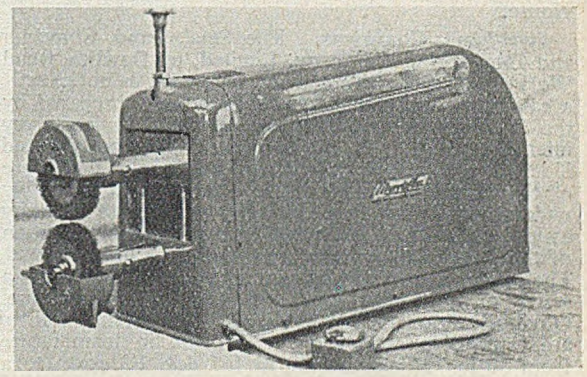
(3) At Builders, with the present moulding and pouring equipment, the casting cost would be about the same as for a sand casting.

(4) The cost savings obtained from the reductions of machining and finishing time should be balanced against the cost of the pattern equipment. It is surprising how quickly this cost can be amortised.

[The abstracter would add that the reduction in the weight of sand to be handled must be an important factor.]

New Brushing Machine

B. O. Morris, Limited, of Briton Road, Coventry, have sent us details of a twin-brushing machine, which is illustrated below. Two models are made, in one of which the brushes project 14 in. and on the other 4 in. The top upper brush is mounted on a spindle which is adjustable by a screw feed and locking nut to give a gap distance of ⅛ in. The machine is operated by a foot switch, which must be pressed for continuous running, as the release of this pressure automatically stops the machine.



New Catalogues

Engineering Products. Three catalogues received from Ransomes & Rapier, Limited, Ipswich, cover the range comprising self-priming water pumps, non-tilting concrete mixers and contractors' plant. They all take the form of four-page leaflets and the illustrations chosen are interesting and well laid out.

Shot-blasting Plant. The well-known firm of Sisson-Lehmann, of 42, Boulevard de Latour, Maubourg, Paris 7,. have sent us an 18-page well-illustrated loose-leaf catalogue covering airless shot-blasting machines and auxiliary equipment. Whilst the front cover of the binding is printed in French, the contents are set out in excellent English. The usual rotary-table type is dealt with in some detail, including one model carrying on the main rotating plate a series of auxiliary ones for taking care of complicated castings. Then there are the barrel types and tunnel machines. Altogether a good range of plant in a specialised field is shown. The catalogue is available to our readers on writing to Paris.

Refractories. General Refractories, Limited, of Genefax House, Sheffield, 10, have recently issued, nicely assembled in a neat folder, a series of nine uniform data sheets of the different types of basic bricks they manufacture. On one side there is a general description of the brick and the chemical and physical test data. On the reverse are three coloured graphs showing the thermal conductivity, refractoriness under load and maintained-refractoriness under load. The colours used are bright and attractive and have been well chosen. So far, but few basic bricks are used in the foundry industry, but nevertheless current developments indicate that foundrymen should have a knowledge of the properties of these refractories. The data sheets are available to our readers on writing to Genefax House.

Industrial Vacuum Cleaning and Air Filtering. The reviewer had no conception of the extent to which vacuum cleaning has been applied in industry until he perused an extremely interesting catalogue (Publication No. 5006) recently released by the Sturtevant Engineering Company, Limited, Southern House, Cannon Street, London, E.C.4. Pictures and descriptions of fixed and portable plant in generating stations, gas plants, boot-and-shoe factories, laundries—almost everywhere except foundries. The catalogue is nicely arranged and set out. A second catalogue (No. 7104) details the construction and application of the "Precipitation" electrostatic air filter. As the foundry industry has to grapple with the problems of air pollution, managements should be getting together as much trade literature as possible, and these catalogues should be included. Both are available on writing to Southern House.

Steel-band Conveyors. The Steel Band Conveyor and Engineering Company, Limited, of Dawlish Road Works, Selly Oak, Birmingham, have sent us not exactly a catalogue, but a mimeographed booklet prepared by the Sandvick Steel Works of Sweden. It is a very interesting little book, but its interest would be enhanced if it had been edited by a person well versed in the use of the English language. The English used is readily understandable but not sufficiently polished to be easily assimilated. Of real technical interest is the application of the steel-band conveyor to the cooling of used sand. The system is operated by running the steel band over a series of quite full tanks of water under pressure. Obviously flow-offs are provided. The results quoted are impressive and report a decrease in temperature from 50 to 75 deg. C. (120 to 167 deg. F.) down to a constant figure of 28 to 30 deg. C. (82 to 86 deg. F.) in 2 mins. Most of the other applications dealt with are worth studying and those wishing to do so should write to Selly Oak.

Iron Die-castings. The Eaton Manufacturing Company, of 9771, French Road, Detroit 13, Michigan, U.S.A., has sent us four catalogues covering various phases of their activities. The one the reviewer liked best was "The Eaton Permanent Mold Foundry," as through a series of beautifully-coloured sketches the reader is taken on a picture tour of the works, starting with the reception office right through to the despatch by road or rail. The first works established in 1920 as the Vassar Company has developed to become the largest grey-iron die-casting company in the world. The cycle of manufacture is now two to six minutes, using two men or three where cored castings are being made. In none of these pamphlets is there any reference to output. The type of iron used is much the same as is normal in this country except that the phosphorus is lower at 0.20 to 0.25 per cent. The four pamphlets cover a description of the works, a technical description of the process, types of castings normally sold to various industries and a technical Paper on the process.

Foundry Sand Testing Equipment. There are a number of new instruments featured in a catalogue (No. 368) issued by Ridsdale & Company, Limited, 234, Marton Road, Middlesbrough, such as for instance the valuable shatter-index tester, introduced by Mr. J. J. Sheehan. The catalogue, of the loose-leaf type, now runs to 40 pages, which indicates the growth of the technique of sand-testing. It now warrants the inclusion of an index and perhaps even coding to facilitate telegraphic business. The firm co-operates with Dietert, the well-known American house for foundry sand-testing and the catalogue shows how complete is the range of instruments now available. The apparatus described and illustrated covers the testing for moisture, permeability, green and baked strength, and hardness, together with numerous accessories. As this is the firm in this country supplying a complete range of sand-testing apparatus it should obviously be in the hands of every foundry manager, except, of course, die-casters. It is available to our readers on writing to Middlesbrough.

Foundry Mechanisation. From Paterson Hughes Engineering Company, Limited, Bedford House, Bedford Street, London, W.C.2, comes a catalogue—which is Section 2 from a larger publication—covering the mechanisation of foundries. It is logically set out so as to deal with the handling of the raw materials from the stockyard to the cupola; getting the metal from the cupola to the mould; mould handling; knocking-out; casting cooling conveyors; fettling shop; core-shop, and pipe-core spinning machines. The method adopted to cover such a wide field within the compass of sixteen pages has been to use photographs of actual installations carrying longish captions or sometimes an explanatory paragraph. The layout has been helped by the intelligent use of colour. Throughout there is stress laid upon experience the firm has accumulated and with it a striving to incorporate this in the latest installations. This is all to the good, as changes and improvements cannot carry a title giving the 1952 installations, the brand "Super Lion" or "Speedicast Superior." It is on these grounds that the frequent issue of new pictures is needed, and consequently the wise executive will do well to secure a copy of this new publication. It is available to our readers on writing to Bedford House or for those living in South Africa to Paterson Hughes Engineering S.A. (Pty.), Limited, P.O. Box 811, Johannesburg.

Gaseous Annealing of Malleable Castings

Operations at William Lee & Sons, Dronfield

By J. C. Mantell

Twelve months ago a standard Birlec 300 k.w. elevator type electric malleablising furnace was put into commission at William Lee & Sons' foundry, Dronfield, to operate the patented gaseous method of annealing whiteheart malleable castings. Since that time, comprehensive and accurate records have been kept of the 90-odd heats annealed, and monthly digests of data have been derived from these day-to-day observations. The results from this one installation will be of interest to all malleable founders.

Type of Castings Annealed

The range of William Lee's production is probably as wide as that of any other British whiteheart foundry; castings are manufactured for the electrical, agricultural, mining and quarrying machinery, automobile, textile machinery and general engineering industries. These users demand a variety of properties from, for example, the toughness and wear-resistance of the agricultural implement, to the machinability required from an automobile steering box. The castings vary considerably in weight, size and section as is plainly shown in Figs. 1 and 2. The two axle-box housings (Fig. 1), for example (the largest whiteheart castings regularly produced in this country), weigh respectively 2 cwt. 3 qr. 21 lb. and 3 cwt. 3 qr. 22 lb. with a maximum section of 4 in., whilst the smallest casting in Fig. 2—a wing-nut (A)—weighs only 2 oz. Other interesting components on this composite illustration are the 28-lb. wheel (B) for use in a gang mowing-machine; the 3-lb. fork carrier (C) for a motor-cycle frame and the 5½-lb. steering-box casting (D) for the automobile industry. Altogether the William Lee concern produces 50 tons of castings per week, about 20 per cent. of which are at present annealed by the gaseous method.

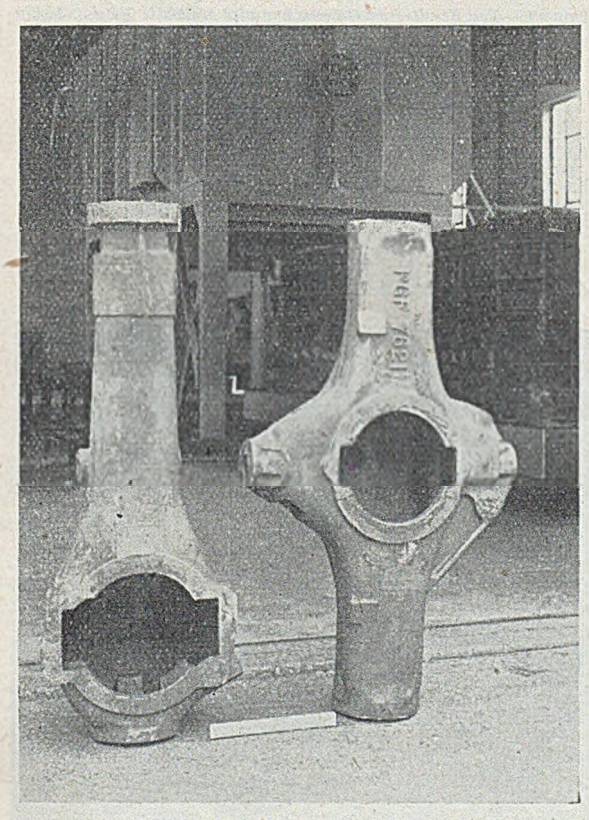


FIG. 1.—*Two Large Heavy-section Axle-box Housings which are satisfactorily Annealed by the Gaseous Method.*

Annealing Cycles Employed

At present, two cycles have been adopted as standard: a long cycle of 5 days overall for sections over 3 in. and a shorter 4-day cycle for smaller castings. At this foundry, as at many others to-day, some difficulty is experienced in maintaining the desired degree of control over metal composition, due to the variability of raw-material supplies, particularly pig-iron and coke. This increases the difficulty of employing minimum annealing cycles, and while the cycles specified are perhaps somewhat longer than strictly necessary, the extra time and cost involved are felt to be more than off-set by the consistent machinability and quality maintained.

The composition of the metal lies within the following figures:—

TC, 3.33 to 3.43; Si, 0.53 to 0.79; Mn, 0.19 to 0.33; S, 0.179 to 0.190 and P, 0.064 to 0.072 per cent.

The two cycles in detail are:—

	Long (hrs.).	Short (hrs.).
Heating to 1,050 deg. C.	10	10
Soaking at 1,050 deg. C.	83	60
Spheroidising slow cool and rapid cooling to discharge temperature	27	26
Total cycle	120	96

Charge Loading

From experience, William Lee's have arrived at the most economical method of loading the charge on the furnace bogie. At first, a comparatively light load was used; the first four heats averaged only 4¼ tons of castings—a figure which has been steadily increased to an average of 6½ tons of castings for the last six heats. Normally four 7-in. tiers of castings are loaded on the bogie, although a large axle-box housing occupies two tiers. To

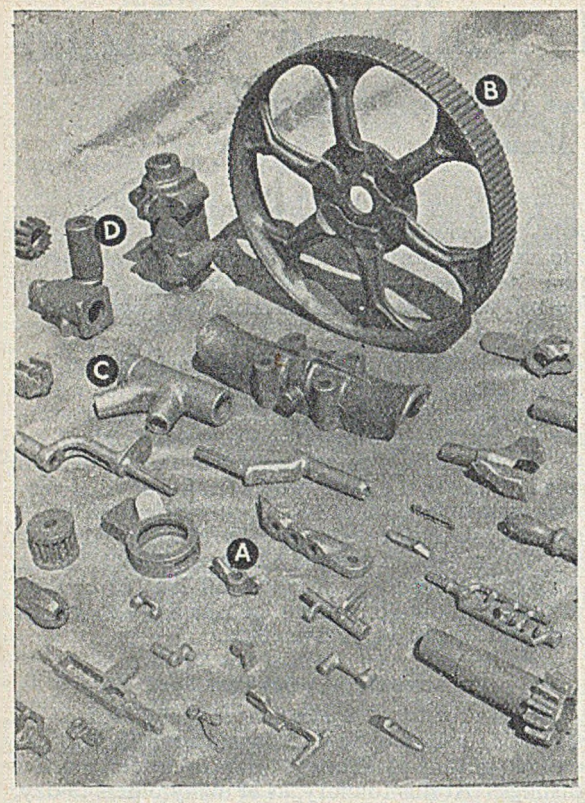


FIG. 2.—*Selection of Castings Regularly Annealed by the Gaseous Process. The initials are Referred to in the Text.*

achieve maximum charge density, smaller castings are packed closely inside and around the larger ones; this course is particularly followed when a very heavy-section casting is included in the bogie, the adjacent small castings thus providing a large surface area to give adequate carbon evolution. These sections are, as far as is possible, loaded near the hearth where the temperature is slightly lower. A loaded bogie and furnace are shown in Fig. 3.

The original mild-steel charge plates are still in use, *i.e.*, each set after 2,500 hours at temperatures of up to 1,050 deg. C. They are reversed after each heat, to minimise distortion and to avoid disturbance of the charge resting on them. The supports have been so designed as to provide an ample ledge on which the charge plates can settle down during the heat. The total weight of charge plates and supports in each charge is 2½ to 3 tons.

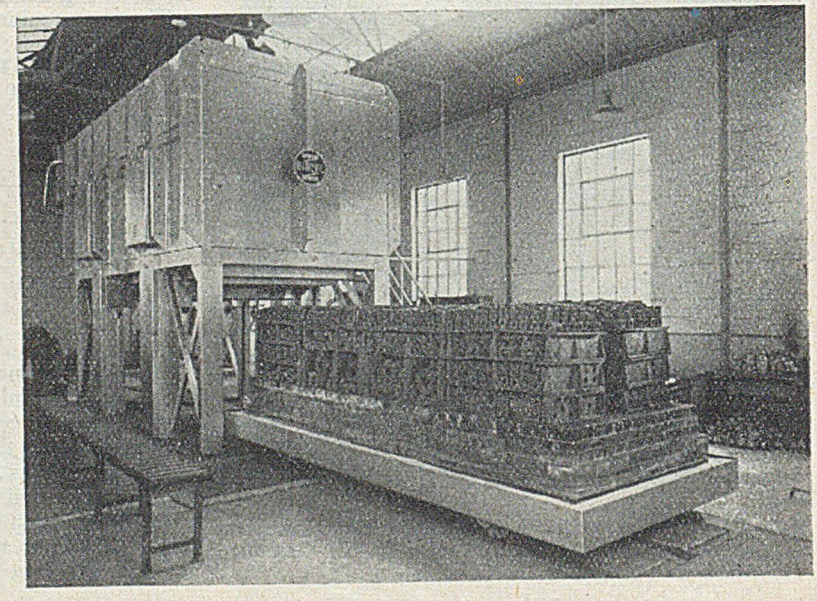


FIG. 3.—*Furnace and its Bogie, showing the Method of Loading the Castings. Four Axle-box Housings can be seen on the Hearth.*

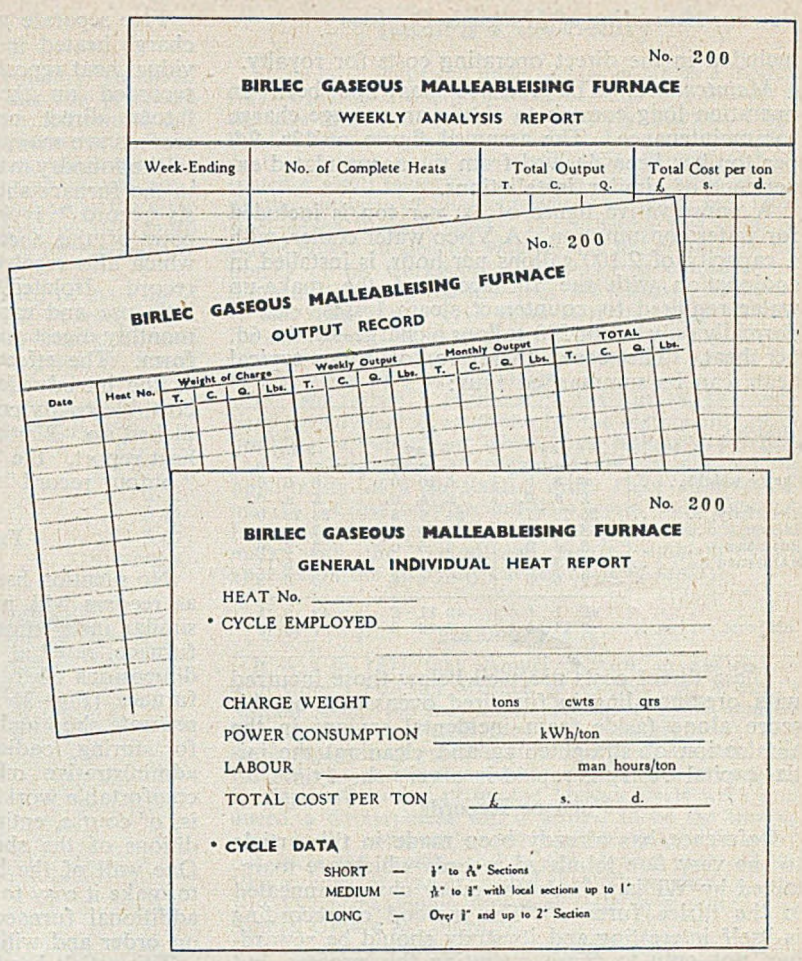
Results

The results obtained from the Birlec furnace are excellent both as regards finish and metallurgical properties, and many of the firm's customers are themselves specifying work " to be annealed by the new process " in preference to the conventional oven-annealed work. The castings emerge from the furnace in a scale-free condition, requiring no subsequent cleaning and the proportion of castings requiring straightening has been reduced to about 4 per cent., comparing with 20 per cent., by previous methods. No difficulty is experienced in straightening the small proportion of work which shows distortion.

Standard test-bars have from time to time been included in the furnace charge and the results have been carefully recorded. Random selections are also made from each charge for fracture and machinability tests and the results are entered on the " heat history sheet." All large castings have a cast-on test-piece, which is removed and used for the required tests before despatch of the job to the customer. Two examples of test-bar figures are given, in Table I with the two grades of B.S.S. 309 listed for comparison.

TABLE I.—*Test Results from Gaseous annealed Malleable Using 0·564 in Dia. Bars.*

Ref.	Heat-treatment.	Yield stress, tons per sq. in.	Max. stress, tons per sq. in.	Elongation per cent. on 2 in.	Min. bend, deg.
B.S.S. 309 (Grade 1)	—	12	22	4	45
B.S.S. 309 (Grade 2)	—	13	24	8	90
William Lee Test-bar	4-day total cycle	17.99	29.85	8.5	90
"	5-day total cycle	16.74	25.08	8.5	90



No. 200

BIRLEC GASEOUS MALLEABLEISING FURNACE

WEEKLY ANALYSIS REPORT

Week-Ending	No. of Complete Heats	Total Output T. C. Q.	Total Cost per ton £ s. d.

No. 200

BIRLEC GASEOUS MALLEABLEISING FURNACE

OUTPUT RECORD

Date	Heat No.	Weight of Charge T. C. Q. Lbs.	Weekly Output T. C. Q. Lbs.	Monthly Output T. C. Q. Lbs.	TOTAL T. C. Q. Lbs.

No. 200

BIRLEC GASEOUS MALLEABLEISING FURNACE

GENERAL INDIVIDUAL HEAT REPORT

HEAT No. _____

* CYCLE EMPLOYED _____

CHARGE WEIGHT _____ tons cwts qrs

POWER CONSUMPTION _____ kWh/ton

LABOUR _____ man hours/ton

TOTAL COST PER TON £ _____ s. _____ d.

* CYCLE DATA

SHORT — ½" to ⅞" Sections

MEDIUM — ⅞" to 1" with local sections up to 1"

LONG — Over 1" and up to 2" Section

FIG. 4.—*Three of the Five Records kept for each Heat Annealed in the Electric Furnace.*

It can be seen that the properties are generally above those required to meet B.S. Grade 2 Specification.

Cost of Process

William Lee & Sons, moreover, keep accurate records of the direct operating costs of each heat. These are tabled under power, labour, royalties, maintenance and water, no consideration being given, on the foundry floor, to overhead costs such as those for supervisory staff, or to depreciation. These latter items can be easily computed when required.

Power.—Two tariffs operate at Dronfield; one for week-day daytime consumption and a reduced charge for night-time and week-end use. To avoid the necessity of night attendance, of operating staff, the annealing programme is so arranged that the "spheroidising slow cooling" period (which requires manual control) takes place during the daytime. This sometimes results in higher power costs than otherwise would be the case but shows economies in labour costs and ensures greater personal convenience. Three examples are quoted in Table II of the information recorded:—

TABLE II.—*Electricity consumption according to Cycle.*

Heat No.	Weight of charge. t. c. q.	Length of cycle, hr.	0.891d. per kwh.	0.583d. per kwh.	Total kwh.	Kwh. per ton	Total power cost. £ s. d.	Power cost per ton. £ s. d.
88	6 8 0	96	1,029	7,632	9,561	1,494	25 13 11	4 0 3
91	6 10 0	120	4,343	7,363	11,706	1,800	34 0 3	5 4 8
92	6 5 0	120	4,180	7,219	11,399	1,823	33 13 0	5 5 10

TABLE III.—*Direct Labour Costs for Gaseous Annealing.*

Heat No.	Charge weight. t. c. q.	Loading (hr.)	Unloading (hr.)	Total labour (hr.).	Labour (hr.) per ton.	Total cost at 118s. per wk. £ s. d.	Direct labour cost per ton. £ s. d.
88	6 8 0	44	19	63	9.8	8 8 10	1 6 4
91	6 10 0	38	18	56	8.6	7 10 1	1 3 1
92	6 5 0	40	18	58	9.2	7 15 5	1 4 10

It can be seen that the longer cycle, with its comparatively longer soaking period, involves a higher average consumption of electricity.

Labour.—The furnace is tended by two men who are responsible for loading and unloading the charge-bogies. They also undertake some of the transport of the castings to and from the furnace shop, although labour for this purpose is not charged to "direct operating costs." A skilled supervisor also devotes considerable attention to the furnace, charge control, etc., and his time, too, is similarly not charged. Figures for the same three heats as quoted above are shown in Table III.

It can be seen that, in fact, only about two-thirds of the two men's wages are charged to direct operating costs but, even allowing for their full wage, labour costs are not high.

Royalty.—An average payment of 10s. per ton is

Gaseous Annealing of Malleable Castings

included in the direct operating costs for royalty.

Maintenance.—The furnace has not been in operation long enough to obtain an average charge for maintenance. The assumed figure of 13s. 9d. per ton has been derived from the accumulated experience of similar installations.

A conservative figure of 1s. per ton is included for water consumption. A Visco water cooler, with a capacity of 2,100 gallons per hour, is installed in conjunction with the furnace, and the make-up water required to counteract steam losses, *etc.*, is normally only about 500 gallons a charge—or 1s. 6d. per heat. The costs, therefore, of three typical heats can be summarised thus:—

Heat No.	88	91	92
Cycle	4 day	5 day	5 day
	t. c. q.	t. c. q.	t. c. q.
Charge weight	6 8 0	6 10 0	6 5 0
	£ s. d.	£ s. d.	£ s. d.
Electricity	25 13 11	24 0 3	33 13 0
Labour	8 8 10	7 10 1	7 15 5
Royalties	3 4 0	3 5 0	3 2 6
Maintenance	4 8 4	4 9 4	4 5 11
	0 6 5	0 6 6	0 6 3
	42 1 6	49 11 2	49 3 1
otal cost per ton	6 11 4	7 12 6	7 15 3

These direct costs are well below those incurred with ore-annealing in fuel-fired ovens and on this score alone (aside from incidental savings in the elimination of straightening and cleaning) the initial capital outlay is repaid in a very short time.

Furnace Records

Reference has already been made in this article to the very fine tabulated records which are maintained by William Lee's for every charge annealed in the Birlec furnace. The method of recording is itself interesting and its study should be rewarding, not only to those operating this process, but also to others who have similar heat-treatment work to supervise.

Five separate *pro formæ* are completed for each charge heated in the furnace. The "general individual heat report" summarises the data which are recorded on the "heat-history sheet" and the "total direct operating costs" record. These records are maintained in duplicate, one copy going to the foundry manager and the other being retained in the furnace shop. In addition a "weekly analysis record" is kept in triplicate—the additional copy of this sheet being sent to the management which also receives the second copy of the output record. Isolated sets of figures are, of course, of little use and each set of data is compiled into a monthly digest and the results are plotted in graph-form. The effect of any change in practice, such as the introduction of a longer cycle, on output, cost, electricity consumption *etc.* can thus be easily picked up. Blank copies of the "general individual heat report," the "weekly analysis report" and the "output record" are shown in Fig. 4.

Furnace Installation

No mention has been made of the furnace itself, as readers will probably be already familiar with similar installations. It is a standard elevator type furnace, rated at 300 kw. and having charge space dimensions of 14 ft. by 5 ft. by 2 ft. 6 in. The furnace (Fig. 3) is accommodated in an entirely separate shop and generous space has been allowed for storing, loading and unloading castings, for an administrative office and for generally providing comfortable working conditions. The process itself is, of course, entirely clean and the light, airy conditions of the shop never deteriorate appreciably. One wall of the building is of a temporary nature to make it easy to build extensions to accommodate additional furnaces. A second furnace is already on order and will be installed late in 1952.

This article has been prepared by the courtesy and with the full co-operation of William Lee & Sons, Dronfield.

Advice on Exporting to the U.S.

This country is faced with the very great problem of carrying out its rearmament programme while at the same time preserving its economic stability and independence. It is, therefore, more important than ever to increase the level of exports, particularly to dollar markets. With this in mind, the Board of Trade has issued a new publication entitled "Exporting to the United States of America." It is hoped that this booklet will be of particular value to those exporters who have not yet got a foothold in the all-important United States market. Compiled in the Board of Trade with the help and advice of the Consular Department of the British Embassy in Washington, it is in no way an economic survey in the general sense, but is rather an attempt to evaluate the more immediate and practical problems which confront the exporter.

The booklet, which is obtainable from H.M. Stationery Office, price 2s. 6d., gives a brief but comprehensive outline of the main features of the United States market, the problems connected with selling goods there, and some suggested methods of approach. Included in its seven chapters is one dealing with current United States Government regulations.

Battelle Memorial Institute

Every technologist throughout the world has heard of the Battelle Memorial Institute, a research foundation established in Columbus, Ohio, yet few have much real knowledge of either its scope or size. They are aware that it undertakes sponsored and pure research but it is doubtful if they realise its immensity. The writer learnt much of its activities from reading a recently-issued well-produced propaganda brochure. It has no fewer than 1,600 people on its staff and each year is visited by 18,000 people, housed in 550,000 sq. ft. of floor space, and spends on research $9,000,000 annually. Included in the building is a well-equipped foundry. The brochure referred to is very interesting and is available to our readers on writing to the Institute.

Latest Foundry Statistics

According to the Bulletin of the British Bureau of Non-Ferrous Metal Statistics the output of copper-base castings during October was 7,159 tons and 54,442 for the past two months, as against 36,966 during the corresponding period of last year.

Olivo Prize

The International Committee of Foundry Technical Association's Award of Honour was this year presented to Mr. René Deprez. The prize, which is shown in our illustration, consists of an exact reproduction of the original " Perseo " of Benvenuto Cellini, which is in the National Museum in Florence (height about 600 mm.) in bronze, made by the lost-wax process and by the same methods and in the same alloys as used by Benvenuto Cellini, together with a smaller one to be retained by the recipient.

According to the description published in the *Vita* of Benvenuto Cellini, the melting of the " Perseo " was accomplished in two parts; this has been confirmed through the analysis made on the original by Bearzi and Somigli. The actual analyses are:—

" Perseo "	*Per cent.*	" Medusa " (under the feet of the " Perseo ")	*Per cent.*
Cu	95.37	Cu	92.65
Sn	2.29	Sn	6.32
Pb	0.98	Pb	0.45
Sb + As + Bi ...	0.15	Sb	0.47
		Ni	trace

The reproductions have been presented by Commandatore Mario Olivo of Milan. The execution of these works of art will be made under the supervision of Mr. Bruno Bearzi, who has made a restoration of the " Golden Gates " of the Baptistery of the Dome of Florence (Ghiberti) and the metallurgical part will be done by his collaborator Dr. Guglielmo Somigli, under the supervision of the *Sopraintendenza ai Monumenti* through the courtesy of the *Direzione delle Belle Arti.*

Osborn's Centenary

Many large industrial undertakings began in a modest way—often as a one-man business—and this was so in the case of Samuel Osborn & Company, Limited, Clyde Steel Works, Sheffield, 3, which is due to celebrate its centenary next April. In April, 1852, Samuel Osborn rented a small factory now known as Brookhill Works, on the outskirts of Sheffield, where he made files from steel which he purchased. The grinding was done by water power in nearby valleys and the cutting in the homes of his workpeople, of whom he employed no more than 30. In the first year his turnover amounted to less than £764. Five years later he began to melt his own steel. He pioneered the introduction in Britain of machines for cutting files and was also among the first to grind files by machinery.

In 1867, when a partnership was formed, the company already had a reputation for the high quality of its products, a reputation which was jealously guarded, and it is on record that Samuel Osborn rejected the opportunity of a substantial order from an overseas market because only second-class wares were required. In those early days the company acquired the corporate mark with the " Hand and Heart " emblem which appears on the company's letter heading to-day.

Turning Point

It was in 1871 that Samuel Osborn, in association with Robert Forester Mushet, developed " R. Mushet's Special Steel," the first self-hardening tool-steel and the first tungsten tool-steel produced. Already in 1868 the company had purchased the nearby Clyde Steel and Iron Works, and in these works, equipped with melting, forging, and rolling plant, the Mushet steels were produced, a development which proved to be the turning point in the company's history. The company's activities increased rapidly and in the closing years of the 19th century it was estimated that 50 per cent. of the world's self-hardening tool-steel trade was retained by Samuel Osborn & Company.

Such rapid increase of trade, however, brought its own dangers, and the company was caught by the financial stringencies arising from a trade recession in America which coincided with a period of increasing costs at home. Shortage of capital to finance the increased trading forced Samuel Osborn into the position of filing his petition. His workpeople rallied to his side and made a voluntary offer to accept reduced wages for two years. An arrangement with his creditors permitted Osborn to recover without taking advantage of that offer, and in 1884 he completed repayment of all outstanding debts and accumulated interest. From this time onwards the company followed the course of improvement of products and expansion of its productive capacity. From the original " R. Mushet's Special Steel " has been developed the whole range of high-speed steels now produced under the trade name " Mushet."

At an early stage in the history of the company small steel castings were successfully produced at the Clyde Steel and Iron Works. In 1885 it was decided to purchase Rutland Works to house the company's foundry, which has grown to be among the foremost steel-foundries in the country. The purchase of the Regent Works in 1915 made another large addition to the company's manufacturing resources.

With the changing dimensions of the business, the structure of the company has altered from time to time. In 1905 the partnership was converted into a private limited company, and in 1920 it became a public company with its shares quoted on the Sheffield Stock Exchange.

Positioning Loose Pieces

By "Checker"

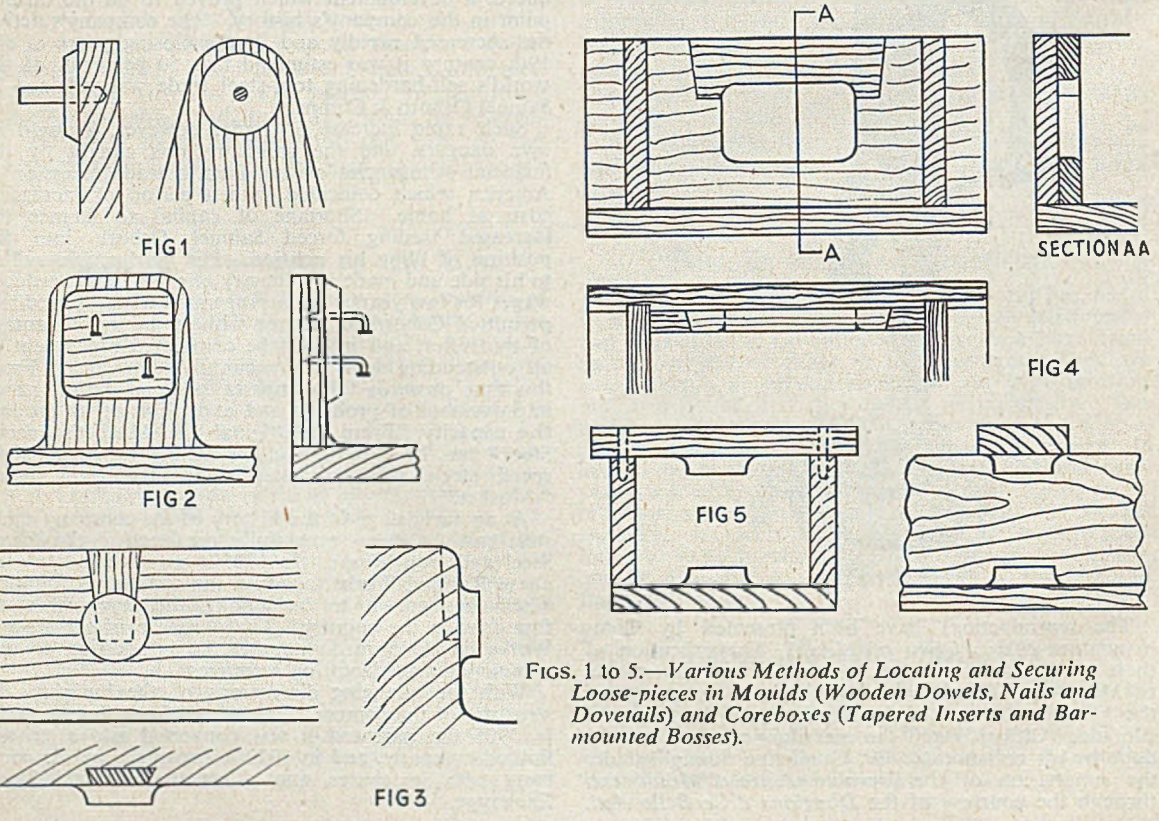
It is important that all loose-pieces which have to be used on wooden patterns and coreboxes, should have some suitable method to give correct and accurate positioning. Many ways can be used to achieve this end, depending upon the class of pattern equipment that is being made. If a cheap pattern in pine is being made, loose-pieces will be held in position by a cheaper and quicker way than if a more expensive one is wanted in mahogany from which large numbers of castings will be required.

On the cheaper types of patterns from which only one or two castings will be produced, no elaborate means of positioning is necessary. In these instances, loose-pieces such as bosses, etc., can be satisfactorily held in position by using a central wooden peg, as shown in Fig. 1. Wooden dowelling is generally used, of ¼-, ⅜- or ½-in. dia., according to the size of loose piece which is to be held. Provided care is taken to ensure the hole is not drilled out of centre, any round bosses must automatically be held in the correct position. It is advisable to cut the length of dowels to leave a reasonable amount protruding to give a comfortable grip when the peg is being withdrawn. When facings which are not circular have to be left loose on a pattern, it is always advisable to use two dowel pegs; this will ensure that the loose facing will be firmly held and cannot slip from position. Sometimes nails can be good substitutes for wooden dowels.

Fig. 2 illustrates a loose-piece on a pattern, in this instance a square facing, held in place by two nails. It will be noted that the ends of the nails are turned over at right angles. This is done by using a pair of pliers, or, with thicker nails, by holding them in a vice and shaping with a hammer. The purpose is to give the moulder a better grip on the nails when they are being withdrawn prior to the completion of the mould. It is also advisable with these square or irregularly-shaped facings and bosses, to mark clearly their outer shape on the pattern, and so give a reliable guide to their proper position. It will be noticed that, with the two loose-pieces already mentioned, a taper has been shown round their outer edge to replace a fillet. This is common practice in many patternshops when making patterns as cheaply as possible, for it eliminates the thin feather-edge which would result from working a radius round.

PATTERNS FOR REPETITION WORK

With the better class pattern work from which larger production will be required, it is essential that more elaborate methods for holding loose-pieces in position should be employed. The most common in use is the dovetail, as shown in Fig. 3, for it gives an easy and correct positioning of any loose-piece to which it is applied. Such a method will withstand a considerable number of moulds being made off before the dovetail and recess become too slack to allow reasonably-accurate positioning. When this does happen, the pattern should be returned immediately to the pattern-shop for repairs or replacement of the dovetail portion. Loose-pieces in coreboxes must also be placed in their correct position; Fig. 4 illustrates a corebox



FIGS. 1 to 5.—*Various Methods of Locating and Securing Loose-pieces in Moulds (Wooden Dowels, Nails and Dovetails) and Coreboxes (Tapered Inserts and Bar-mounted Bosses).*

Personal

MR. A. H. HOLDEN gave a lecture earlier this month on modern furnace technique, at the Derby School of Art, to members of Derby Society of Engineers.

MR. T. J. MAKIN retires at the end of the year after 21 years as secretary and a director of the Brightside Foundry & Engineering Company, Limited, Sheffield.

MR. A. HOSKER has been appointed production manager of Leyland Motors, Limited, in succession to Mr. J. Thorpe, who has been seconded to the Ministry of Supply.

MR. R. D. BROWN, formerly the European representative of Richard Sutcliffe, Limited, manufacturers of mechanical handling plant, of Horbury (Yorks), has been appointed sales manager of the company.

SEVENTY-FIVE-YEAR-OLD SIR ERNEST CANNING, chairman and managing director of W. Canning & Company, Limited, electro-platers' engineers, of Birmingham, is leaving on a two-month business tour of South Africa.

MR. G. GORDON JACKSON, managing director of the Engineering Centre, Glasgow, has been appointed Regional Controller in Scotland for the Ministry of Supply, in succession to Mr. H. M. McIntyre who is retiring shortly.

MR. H. B. CLARK has asked to be released from the position of secretary of Babcock & Wilcox, Limited, engineers, of London, as from December 31 and will then take up special duties with the company. He will be succeeded as secretary by MR. L. W. COLE.

MR. S. A. HORTON, foundry superintendent of Ley's Malleable Casting Company, Limited, Derby, recently gave a lecture on "Patternmaking in Foundry Production" at the Technical College, Chesterfield. Among those present were Mr. Hyde, of Hyde's Foundry, Chesterfield. The chairman was Mr. Redfern, general manager of Bryan Donkin, Limited.

FOUNDRY MANAGER of the heavy construction division of Newton Chambers & Company, Limited, Thorncliffe, near Sheffield, MR. F. GREAVES is visiting Milwaukee in the United States under a scheme for the regular exchange of technical information between Newton Chambers & Company and the Koehring Company, with which it is associated in the manufacture of excavators.

PRESENTATION of a cocktail cabinet was made to SIR ARTHUR MATTHEWS, former managing director of Thos. Firth & John Brown, Limited, at a recent gathering in Sheffield in appreciation of his work for forgemasters' organisations. Sir Arthur was chairman of the Heavy Forgings and Railway Tyres, Axles, Solid Wheels, and Disc Wheel Centres Conference from its inception in 1945 until last June.

MR. JAMES M. PRENTIS, B.Sc., research assistant in concrete technology at the Imperial College of Science and Technology, London, has been appointed lecturer in mechanical technology at Aberdeen University, where he will take up his new duties at New Year. Mr. Prentis was formerly with a firm of civil engineering contractors in London and Edinburgh for three years until March, 1949, when he went to the Imperial College.

AFTER AN ASSOCIATION with the Consett Iron Company, Limited, extending over more than 10 years, MR. H. V. TOMLINSON, a local director and works production manager, has resigned both appointments. MR. W. E. WARD has been appointed works production manager, taking over the duties resigned by Mr. Tomlinson, while MR. F. B. GEORGE and MR. G. M. NAVE have been appointed general works manager and assistant general works manager, respectively.

MR. D. J. HOPLEY has been appointed managing director of Oldham & Son (India), Limited. He succeeds MR. EDGAR OLDHAM, who was seconded to the Indian company to set up its initial organisation, and is returning to England to continue his work as chief technical officer, overseas control division, of the parent company, Oldham & Son, Limited, Denton, Manchester. Mr. Hopley has already taken over at the factory at Saidapet, Madras, where motor-car batteries are now being produced for the Indian market. Mr. Edgar Oldham is remaining on the board of the Indian company.

THE BOARD OF TRADE has announced that MR. NEVILLE BLOND, who has been employed in an honorary capacity by various Departments of State without a break since 1942 and who for the last two years has been adviser on North American trade to the Board of Trade, will give up this appointment from December 31 in order to be able to devote more time to his private business. The President of the Board of Trade has expressed warm appreciation of the services which Mr. Blond has rendered to the Board and to British export trade during both his special mission to the United States in 1948-49 and subsequently in London.

Obituary

A PARTNER IN John Cunningham & Son, iron and steel merchants, of Workington (Cumberland), MR. J. F. CUNNINGHAM has died at the age of 46.

MR. PHILIP ERSWELL SYMONS, managing director of the Shipston Engineering Company, Limited, Shipston-on-Stour (Warwick), died suddenly on December 12.

WORKS MANAGER of the North British Steel Foundry, Limited, Bathgate (Scotland), for the past 29 years, MR. JOHN PAUL, who joined the company as foreman blacksmith in 1907, died on December 17.

THE DEATH has occurred of MR. SYDNEY LISTER, technical director of Thomas White & Sons, Limited, woodworking machinery manufacturers and iron-founders, of Laighpark, Paisley. He had been associated with the company for over 35 years.

THE DEATH has occurred, at the age of 77, of MR. GEORGE W. TODD, formerly general manager of the old shipbuilding firm of Wood, Skinner & Company, Limited, Bill Quay-on-Tyne. He served his apprenticeship with the company, later becoming managing director of Jarrow Hoppers, Limited.

Positioning Loose-pieces

(*Continued from previous page*)

which has an opening at one side in such a position that a loose-piece is essential at the top and includes the two corner radii also. This can be made as shown with both ends of the loose portion tapered to form a dovetail shape. With these tapered ends the loose-piece cannot move forward out of position.

Occasions also arise when a corebox has to be constructed in such a way that a boss or facing must be positioned on the corebox top-face. When this happens, it has, of course, to be worked as a loose-piece, and so as to guarantee it will always be placed in its correct position, it should be fixed on a bar. This bar must be long enough to rest on the corebox sides. Fig. 5 shows how this is done with a dowel at each side to ensure the loose-piece is always placed in the same position. Wooden dowels can be used and glued into the loose bar as shown, but a much better job can be made by using metal pattern dowels for this purpose.

News in Brief

BRITISH RAILWAYS cleared 198,681 tons of iron and steel from the principal steelworks in the week ended December 8.

SHEFFIELD UNIVERSITY has started a course of Sunday morning lectures on industrial relations for steelworkers in the district.

A CANTEEN for workers of Alex. Shanks & Sons, engineers, Dens Iron Works, Arbroath, was opened for service recently and is operated by Industrial Caterers, Limited.

A REPEAT ORDER for 100 automotive engines for installation in crawler tractors has been placed by John Fowler & Company (Leeds), Limited, with Leyland Motors, Limited.

AT AN EXTRAORDINARY SPECIAL MEETING of the shareholders of Allied Ironfounders (Ireland), Limited, at Dublin last week a motion to change the name of the company to Waterford Ironfounders, Limited, was passed unanimously.

AN IMPORTANT ORDER from the New Zealand Government Railway for 10 30-ton Diesel-mechanical locomotives for shunting and light train working has been received by the Hunslet Engine Company, Limited, Leeds.

ORDERS FOR three cargo vessels received by John Lewis & Sons, Limited, Aberdeen, together with existing orders, will ensure continuous working until 1954. One of the new ships, a timber carrier of 3,100 tons d.w., will be the largest vessel ever built on the River Dee.

SCOTTS' SHIPBUILDING & ENGINEERING COMPANY, LIMITED, Greenock, has secured orders for two motor tankers, one of 12,000 tons gross for Overseas Tankship (U.K.), Limited, London, and the other of 11,350 tons gross for the Star Whaling Company, Limited, Channel Islands.

EMPLOYEES of Thos. Firth & John Brown, Limited, and Firth-Vickers Stainless Steels, Limited, will be able to attend a special film show in the City Hall, Sheffield, in January, when two films made by the Brown-Firth Research Laboratories film unit of the companies' steel processes will be shown.

A SCIENCE LIBRARY was opened Dec. 14 at Balliol College, Oxford, by Sir Harold Hartley, F.R.S., honorary Fellow of the College. Built with donations to the Balliol College War Memorial Fund, it will also be available for the use of undergraduates from the neighbouring Trinity College.

TUFNOL, LIMITED, manufacturers of electrical insulating materials, of Birmingham, have announced that its Midland area sales office has moved to Cornwall Buildings, 45, Newhall Street, Birmingham, 3. The telephone number is still Central 5651, but the telegraphic address has been changed to Tufnol, Birmingham 3.

THE DIRECTORATE OF NITROGEN SUPPLIES will come to an end on December 31. As from January 1, 1952, matters concerning the production of ammonia and the provision of ammonia to industry will be the responsibility of the Ministry of Materials, Division 2, Branch 2A, Horse Guards Avenue, London, S.W.1.

AT A MEETING of the Tees Conservancy Commission it was reported that during October imports totalled 294,623 tons, the highest figure since October, 1948. Exports amounted to 103,154 tons, or 23,415 tons less than October, 1950. The falling-off in exports was due to reduced shipments of coal and manufactured iron and steel.

BRITISH ALUMINIUM COMPANY, LIMITED, announce that Mr. W. H. Platt, assistant sales manager (wrought products), is retiring on December 31, 1951, after 41 years' service in the sales division of the company, and that Mr. C. F. Batstone will combine the functions of principal assistant sales manager with those previously carried out by Mr. Platt.

THE DIRECTORS of the Atlas Steel Foundry & Engineering Company, Limited, propose to increase the capital from £75,000 to £175,000, and issue out of the development reserve 50,000 bonus shares of £1 each, fully paid, in the ratio of two shares for every £3 of ordinary stock held on December 14. Each share will later be converted into units of 5s. each.

MONSANTO CHEMICALS, LIMITED, announce that as from January 1, 1952, the wholly-owned subsidiary company, Silicon (Organic) Developments, Limited, will be absorbed entirely by the parent company. From that date all operations will be carried out under the name of Monsanto Chemicals, Limited, and correspondence should be addressed to Silicon Chemicals Department, Victoria Station House, London, S.W.1.

THE WORKS of Bruce Peebles & Company, Limited, engineers, of Edinburgh, will close on Monday evening, December 31, and reopen on Friday morning, January 4, and no goods will be received or despatched during the holiday period. The company also announce that as from December 20 the address of the company's Manchester office will be 26, Corporation Street, Manchester, 4 (telephone: Deansgate 7106).

THE CONSETT IRON COMPANY, LIMITED (Co. Durham), has held an exhibition on a site adjoining its works to give the general public an insight into the company's activities. The exhibition was opened by Mr. H. Boot, managing chairman of the company, and models of a new slabbing and blooming mill, continuous billet mill, a new brickworks, and a model of the entire works showing proposed developments were shown. The works has an annual output of 42,000 tons of pig-iron and 550,000 tons of steel ingots.

THE EDUCATION DEPARTMENT (TECHNICAL) of the Nigerian Government has recently established a trade centre at Kano, where instruction will be given in a wide range of trades, and is asking for catalogues, price-lists, etc., of tools, equipment, and machinery from interested manufacturers in the mechanical, electrical, and motor engineering trades. Literature should be sent to Dr. J. Harris, Deputy Director of Education (Technical), Technical Education Office, Yaba, Nigeria. Any queries should be made to the Board of Trade, Commercial Relations and Exports Department, Thames House North, Millbank, London, S.W.1 (reference, CRE(IB) 77445/51); telephone: Victoria 9040, extension 3005.

THE UNITED KINGDOM TRADE COMMISSIONER at Montreal has reported that the 1952 Eastern Canada All Electrical Show will be held in the Exhibition Hall of the new "Palais du Commerce" building, Montreal, from March 10 to 14. The product groups that may be shown comprise all types of electrical equipment from motors to television sets. United Kingdom manufacturers who feel their agents might participate should advise them to apply for space to Eastern Canada Exhibitions, Inc., Le Palais du Commerce Building, Berri Square, Montreal. The Board of Trade, Exhibitions and Fairs Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: Chancery 4411, extension 436), would be interested to know of any firms which decide to take part.

Raw Material Markets

Iron and Steel

Most foundries are resuming operations today (Thursday) after having been closed for the Christmas holiday since last Friday. During this period a considerable amount of repairs and maintenance work to cupolas and foundry equipment has been carried out. The holidays brought welcome relief to executives and buyers, who for some time have been faced with many difficulties and anxieties by the shortage of raw materials, particularly pig-iron and scrap. During the holiday foundries generally remained open to receive deliveries of materials.

The upward trend of pig-iron production is encouraging, but the prospects of additional supplies of the foundry grades of pig-iron being forthcoming are rather remote, due principally to steelmakers' heavy demands. Indeed, if the shortage of scrap persists, further encroachment on the furnaces for supplies of steelmaking pig-iron may be necessary. Foundrymen are thus very concerned about future supplies of pig-iron and hope that it will be possible for additional furnaces to be blown in. This would call for increased ore and coke supplies. At the moment, furnaces are receiving barely sufficient supplies of coke to maintain outputs.

Foundry coke consignments are reaching consuming points fairly regularly, but few users are able to augment stocks. The reduction in the allocations of coke to the foundries in order that additional supplies may be sent to the blast furnaces is most unfortunate. No difficulty is experienced in procuring ganister, limestone, and firebricks, while ferro-alloys can usually be obtained to meet the needs of the foundries.

No relief is being obtained by the re-rollers in the supply of semi-manufactured steel, and short-time working continues. Most of them are closed this week; they can well afford to do so with the available supplies of steel semis. There is heavy pressure for all sizes of sections, bars, and strip. The demand for sheets is sustained, but the sheet re-rollers are in need of much larger quantities of sheet bars in order to step up their output. All available material suitable for conversion is readily accepted, but scarcity is not confined to prime material; defectives and crops are arising on a reduced scale owing to lower outputs at the steelworks.

Non-ferrous Metals

All concerned with the tin market were a good deal heartened on Monday of last week, when at the close of the midday session the market stood at £925 for both cash and three months. It is the earnest hope of those interests which value the London market as a hedging medium that a contango may become a permanent feature of trading in tin on Whittington Avenue.

It is now more than two years since the free market in tin was re-established, and the market has passed through a difficult time, with very wide fluctuations in values, due in no small measure to stockpiling activities in the United States followed by withdrawal as a buyer on the world market, at any rate from Malaya. This year America's imports of tin metal and concentrates have been on a much smaller scale than normally and certainly well below the 1950 level.

Stocks across the Atlantic are now depleted and it would appear to be inevitable that the Reconstruction Finance Corporation should figure as a buyer again before very long. The huge Texas smelter, with an annual capacity of about 40,000 tons of tin production, has to be fed, and it is safe to say that this plant is not, at present, working at anything like its full power.

Copper continues scarce, not because of any decline in production but on account of the defence drive in the United States and a tendency in many directions to hoard metal. Recent figures published in New York show that deliveries to fabricators in countries outside the United States in November were at the highest level recorded since these statistics were started some four years ago. According to the U.S. Copper Institute, deliveries totalled 95,170 short tons, against 89,495 tons in October. Production of crude copper was returned at the very satisfactory total of 121,549 tons. This is, of course, also in respect of territories outside the U.S.A.

December may not show up so well, for it has been announced that coal deliveries to the Northern Rhodesian mines have fallen off, and that in consequence mining operations will be suspended for four days over Christmas.

London Metal Exchange official tin quotations were as follow :—

Cash—December 19, £930 to £932 10s.; December 20, £917 10s. to £922 10s.; December 21, £915 to £917 10s.

Three Months—December 19, £923 to £925; December 20, £912 10s. to £915; December 21, £912 10s. to £915.

New Ore-carrying Wagons

An entirely new type of wagon for conveying iron ore from Tyne Dock to the works of the Consett Iron Company, Limited, Co. Durham, has been designed by British Railways and 30 are now being built at the Shildon works. The wagons are constructed of steel specially selected to stand up to abrasive conditions and to resist atmospheric corrosion. They are carried on two four-wheel bogies, have a tare weight of 28 tons 13 cwt., and will hold up to 56 tons of ore. Hand and power brakes are provided. A novel feature of the wagons is the provision of side-discharge doors (four on each wagon) which can be operated throughout the train simultaneously by means of compressed air controlled from the locomotive footplate. The doors can also be operated individually by levers on the wagons when required. The compressed-air cylinders on the wagons for opening or closing the doors are charged by the locomotive whilst the train is in motion.

It is anticipated that about 1,250,000 tons of ore will be conveyed by these wagons each year, and the first train of the new wagons is expected to be brought into service in the spring.

Notes from the Branches

East Anglian Section

The East Anglian section of the Institute of British Foundrymen held their first post-war dinner and concert at the Oriental Café on November 9, 49 members being present. The president, Mr. V. W. Child, welcoming the guests, said he was very pleased to see so many past-presidents at this function, also many members and their friends: he hoped that this dinner would be the forerunner of many, and considered it might very well become an annual social event. The evening's programme was in the nature of an impromptu affair, and an excellent film on enamelling, shown by courtesy of Crane Limited, provided a pleasing interlude. The arrangements for the dinner and concert were under the direction of Mr. H. S. Ward.

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

(*Delivered, unless otherwise stated*)

December 21, 1951

PIG-IRON

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

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

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

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

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

Cold Blast.—South Staffs, £17 5s. 6d.

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

Spiegeleisen.—20 per cent. Mn, £22.

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

FERRO-ALLOYS

(*Per ton unless otherwise stated, delivered.*)

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

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

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

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

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

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

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

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

Metallic Chromium.—98/99 per cent., 6s. to 6s. 3d. per lb.

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

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

SEMI-FINISHED STEEL

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

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

Sheet and Tinplate Bars—£12 16s.

FINISHED STEEL

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

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

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

Tinplates.—52s. 1½d. per basis box.

NON-FERROUS METALS

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

Tin.—Cash, £915 to £917 10s.; three months, £912 10s. to £915; settlement, £915.

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

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

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £211 10s.; rolled zinc (boiler plates), all English destinations, £209 10s.; zinc oxide (Red Seal), d/d buyers' premises, £205.

Other Metals.—Aluminium, ingots, £124; antimony, English, 99 per cent., £365; quicksilver, ex warehouse, £73 to £73 10s.; nickel, £454.

Brass.—Solid-drawn tubes, 25d. per lb.; rods, drawn, 32½d.; sheets to 10 w.g., 30½d.; wire, 31½d.; rolled metal, 28¾d.

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

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £245 to £280; BS. 1400—LG3—1 (86/7/5/2), £260 to £300: BS. 1400—G1—1 (88/10/2), £330 to £360; Admiralty GM (88/10/2), virgin quality, £330 to £360 per ton, delivered.

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

Phosphor Bronze.—Strip, 38½d. per lb.; sheets to 10 w.g., 40¾d.; wire, 43½d.; rods, 38½d.; tubes, 36¾d.; chill cast bars: solids 4s., cored 4s. 1d. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 2s. 7¾d. per lb. (7%) to 3s. 7½d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 3s. 1¾d. (7%) to 4s. 1½d. (30%); to 12 in. wide × .056, 3s. 2d. to 4s. 1¾d.; to 25 in. wide × .056, 3s. 4d. to 4s. 3¾d. Spoon and fork metal, unsheared, 2s. 10¾d. to 3s. 10½d. Wire, 10g., in coils, 3s. 7¾d. (10%) to 4s. 7½d (30%). Special quality turning rod, 10%, 3s. 6¾d. 15%, 3s. 11½d.; 18%, 4s. 3¾d. All prices are net.

Recent Wills

FILLMORE, FRED, one of the oldest members of the Birmingham Iron Exchange £77,413

BAILEY, A. O., managing director of the Bromsgrove Casting Company, Limited, Bromsgrove (Worcs) £3,263

WATSON, W. M., executive director of A. Wood & Sons (Middlesbrough), Limited, iron and steel stockholders £4,319

BOUGHTON, E. M. W., manager of the Birmingham works of the British Thomson-Houston Company, Limited £15,945

GRAHAM, MAJOR A. J. G. M., a director of the British Tin Investment Corporation, Limited, and other companies £96,787

PHILLIPS, R. B., chairman and joint managing director of R. B. Phillips & Company, Limited, iron and steel merchants, etc., of Llanelly (Carmarthenshire) £20,975

SUGDEN, FRED, a director of Taylor & Atkinson (Leeds), Limited, manufacturers of stainless steel fittings, and Drawn Metal, Limited, Leeds, and other companies £55,377

HAMILTON, JAMES, works director of Handley Page, Limited, who evolved the split-construction and unit assembly method of aircraft production which has been copied throughout the world £41,765

ABBOTT, V. F., retired iron, steel, and coke works manager of the Wgan Coal & Iron Company, Limited, who for 25 years taught metallurgy at evening classes at the Wigan Mining and Technical College £37,083

STANLEY, R. C., the discoverer of "Monel," the white alloy of nickel and copper, and who was chairman of the International Nickel Company, Limited, and a member of the boards of other companies including Babcock & Wilcox, Limited, and the United States Steel Corporation £4,287

COOKE, E. H. W., a director of the Birmingham Small Arms Company, Limited, the Daimler Company, Limited, Lanchester Motor Company, Limited, and Transport Vehicles (Daimler), Limited, and chairman of the Birtley Company, Limited, who had been comptroller of Associated Electrical Industries, Limited £23,580

INTESTATE

RAMAGE, GEORGE, managing director of the Cape Engineering Company, Limited, Warwick £7,493

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference CRE(IB) can be obtained from the Commercial Relations and Exports Department (Industries Branch), Board of Trade, Thames House North, Millbank, London, S.W.1 (room or telephone number stated).

BEXLEY, January 9—Manhole covers, frames, galvanised iron inspection covers, etc., for the Borough Council. The Borough Engineer and Surveyor, Council Offices, Bexleyheath.

BRUSSELS, January 9—Castings and foundings, for the Belgian State Railways. Room 1086 (CRE(IB) 77773/51).

CAMBRIDGE, January 4—Cast-iron kerb outlets, gully grates, frames, etc., for the County Council. Mr. F. E. Bayliss, county surveyor, Shire Hall, Cambridge.

CHICHESTER—Castings, for the West Sussex County Council. The Clerk of the County Council, County Hall, Chichester.

CUMBERLAND, January 21—Gully grates, etc., for the County Council. The County Surveyor, Citadel Chambers, Carlisle.

HERTFORD, January 26—Gully grates, etc., for the Borough Council. The Borough Engineer and Surveyor, The Castle, Hertford.

LONDON, E.C, January 14—Castings, for the Finsbury Borough Council. The Borough Engineer, Finsbury Town Hall, Rosebery Avenue, London, E.C.1.

LONDON, S.E, January 9—Cast-iron gully grates, frames, manhole covers, etc., for the Camberwell Borough Council. Mr. J. Clapp, borough engineer and surveyor, Town Hall, Camberwell, London, S.E.5.

LONDON, S.W, January 30—Iron castings, iron and steel, etc., for the Lambeth Borough Council. Mr. F. Batterbury, borough engineer, Town Hall, Lambeth, London, S.W.2.

LONDON, S.W, January 21—Iron castings for the Battersea Borough Council. The Town Clerk, Town Hall, Lavender Hill, London, S.W.11.

WOLVERHAMPTON, January 10—Iron castings, for the Borough Council. The Borough Engineer, Town Hall, Wolverhampton.

CLASSIFIED ADVERTISEMENTS

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

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

SITUATIONS WANTED

FOUNDRY METALLURGIST, B.Sc., requires executive position. Experienced in grey iron and malleable. Foundry and laboratory control. Anywhere.—Box 1448, FOUNDRY TRADE JOURNAL.

AGENCY, Office Management.—Retired Manager, Grey and Malleable Ironfoundry, for London and South; fully qualified Metallurgist.—Box 1421, FOUNDRY TRADE JOURNAL.

FOUNDRY / GENERAL MANAGER (age 45), M.I.B.F., A.M.I.P.E., life experience, grey and malleable jobbing, semi, full mechanisation, specialist repetition, auto-cylinder, etc., commercial, sales, excellent trade contacts, fully conscientious to development, organisation, practical man, metallurgist, sand, metal control, etc., able to get results through experience, desires change to small Midland foundry, with prospects of directorship on salary/results basis. Post must be capable of at least £1,500-£2,000 p.a. Strict confidence.—Box 1446, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

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

METALLURGICAL CHEMIST required for routine analysis of Aluminium and Aluminium Bronze Alloys to A.I.D. Standards, also Physical Testing and Microscopic analysis.—Write to VOWLES ALUMINIUM FOUNDRY CO., LTD., Bank Street, West Bromwich, in the first instance.

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

GRAVITY DIE-CASTING FOREMAN required, Light Alloy Foundry, Bristol area. Possible assistance on housing.—Applications, stating age, experience and salary required, to Box 1449, FOUNDRY TRADE JOURNAL.

A TECHNICAL REPRESENTATIVE well connected with the Foundry Industry is required by a well-known firm of manufacturers of Corebinders, etc., to cover London and the South-East. Ownership of a car will be considered an advantage, although not an essential.—Box 1444, FOUNDRY TRADE JOURNAL.

FOREMAN required for small partly mechanised foundry, also plate and loose patterns, one accustomed to Rate Fixing, able to work on floor, for firm engaged on Ranges, Grates and Engineering Castings, "Baxi" Patent Fires and Products; small house will be found if required. Apply in writing, stating full particulars, age, wage required and experience.—RD. BAXENDALE & SONS, LTD., Engineers and Ironfounders, Albert Street, Chorley.

SITUATIONS VACANT—*Contd.*

IRONFOUNDRY.—HEAD FOREMAN wanted for Foundry in London on small to medium sized jobbing work. Part plate production. Must have thorough knowledge of trade, including cupola management. Metallurgical knowledge not necessary. Previous experience essential. Rent free house with job.—Write, giving full particulars and salary required, to Box 1445, FOUNDRY TRADE JOURNAL.

FERRANTI, LTD., have the undermentioned pensionable staff vacancy: A young ASSISTANT FOUNDRY METALLURGIST for development work. Candidates preferably not over 25 years of age, should have Higher National Certificate in Metallurgy or Licentiateship of the Institution of Metallurgists. Ref. J.D.Met.—Forms of application from MR. R. J. HEBBERT, Staff Manager, Ferranti, Ltd., Hollinwood, Lancs. Please quote reference.

WORKS ENGINEER aged between 30 and 45 required for a Steelfoundry in Yorkshire. A first class experienced person is required to take full control of steel foundry maintenance and future development. The applicant must possess drive and initiative and have good organising ability and only men with previous foundry experience should apply. Write giving details of experience to date with salary required, all of which will be regarded in the strictest confidence. A house will be found for the successful applicant.—Box 1431, FOUNDRY TRADE JOURNAL.

A VACANCY exists for a first class CHIEF METALLURGIST in a modern Steelfoundry. It would be preferable if the applicant had experience of converter and arc furnace practice together with a wide knowledge of steelfoundry practice. The position will only be filled by a person having had previous experience of modern practices and one having a practical and progressive outlook coupled with the ability to integrate research and development work into actual production. Please give, in confidence, full details of age, experience and salary required. Housing accommodation will be found if necessary for the successful applicant.—Box 1432, FOUNDRY TRADE JOURNAL.

REQUIRED, promptly, for re-organisation of old-established Yorkshire Ironfoundry, experienced and energetic FOREMAN (age 40 to 45), to control all operations from raw materials to finished castings. Tactful and used to rate fixing for piecework. Required to produce high-class castings for machine tools, tank plates, jobbing pipes up to 30 in. dia., and general engineering castings in a Foundry used to producing 2,000 tons per annum, but now working to only 50 per cent. capacity. The post would be permanent for the right man, with good house and Staff Pension Scheme. Preference will be given to a really first-class applicant with a commensurate salary.—Applications, giving full particulars of training, experience, and positions held, to Box 1425, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

NON-FERROUS AND CAST IRON MOULDERS required. Good rates. Canteen, etc.—Apply S.E.M., Pitsea Street, Stepney, E.1.

METALLURGIST required to assist Foundry Manager in general administration of modern iron foundry. Must have sound practical experience of all aspects of foundry work. Salary £700-£800. Four-room maisonette available end of January.—ROBERT CORT & SON, LTD., Reading Bridge Ironworks, Reading.

METALLURGIST.—Senior Assistant required by William Mills, Ltd., Aluminium Founders, Friar Park Road, Wednesbury. Experience in light alloys and foundry work; knowledge of X-ray procedure an advantage; age preferably about 30.—Replies, in confidence, to MANAGING DIRECTOR.

FOUNDRY ENGINEER.—Applications are invited for the post of TECHNICAL ASSISTANT to the Manager of a Foundry Company which has developed important new methods of moulding and coremaking. Only Engineers with outstanding technical and education qualifications and between 25-35 years of age should apply. Excellent prospects of advancement exist for the right man. Salary commensurate with age and experience. Applicants must be prepared to travel abroad.—Apply, stating experience in chronological order, to Box No. 3181, MESSRS. MASON-PEACOCK, LTD., 184, Strand, London, W.C.2.

FOREMAN PATTERNMAKER required for West of Scotland Pipefoundry. Applicant must have sound technical training and experience in Bank pipe moulding with Sandslingers and both Greensand and Pressure Castings. Write stating training, age and experience.—Write 29NO, WM. PORTEOUS & Co., Glasgow.

A LARGE Iron Foundry in South Wales has vacancies for TWO TECHNICAL ASSISTANTS. Candidates should be aged 23/30, with H.N.C. or equivalent standard of education, have either Metallurgical or Foundry experience, and be prepared to undertake either development or supervisory work as required. Duties will be of such a nature that they will be developing the individual for further advancement.—Apply, stating age, education, experience, and qualifications, to Box 1429, FOUNDRY TRADE JOURNAL.

A DIE DESIGNER for Gravity Die Casting is required by well-known Firm of Aluminium Founders in London area. Applicant must have had wide experience of modern gravity die technique and be able to supervise design, manufacture and foundry operation. This is a staff appointment, pensionable, and carries a good salary, with excellent opportunity for advancement. Applicants should write, giving full details of experience and qualifications, which will be treated in strict confidence.—Box 1417, FOUNDRY TRADE JOURNAL.

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TECHNICAL REPRESENTATIVE. very old established with the West Midland Ironfounders, requires an Agency for a first-class Corebinder. Car owner.—Box 1454, FOUNDRY TRADE JOURNAL.

BUSINESS FOR SALE

FOUNDRY situated S.W. England for sale, freehold or entertain half-share basis.—Box 1453, FOUNDRY TRADE JOURNAL.

AGENCY

FIRM of Three Technical Representatives, calling upon all Foundries in the North of England, desire to represent Manufacturer of Moulding Boxes, on a commission basis. Other lines may also be of interest.—Box 1426, FOUNDRY TRADE JOURNAL.

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

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URGENTLY REQUIRED.—Air Compressors of all sizes and type with or without Prime Movers.—Box 1455, FOUNDRY TRADE JOURNAL.

WANTED.—The following Moulding Machines by the British Moulding Machine Co., Ltd.: 1 H.P.L.2, 1 R.D.O. and 1 A.T.1. State price and condition.—SLOAN & DAVIDSON, LTD., Stanningley, Leeds.

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680-c.f.m. SULLIVAN, angle type, water cooled, double acting, speed 277 r.p.m. W.P. 100 lb. (will operate at 125 lb.) with intercooler. "V" belt driven from 160-h.p. S/R induction motor by C.E.B., 415/3/50.

600-c.f.m. ALLEY & McLELLAN, Series 18B, vert., 2 stage, single crank, water cooled, with intercooler. W.P. 100 lb., speed 290 r.p.m. "V" belt driven from 160-h.p. S/R induction motor by C.E.B., 400/3/50.

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