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MARCH 19, 1953
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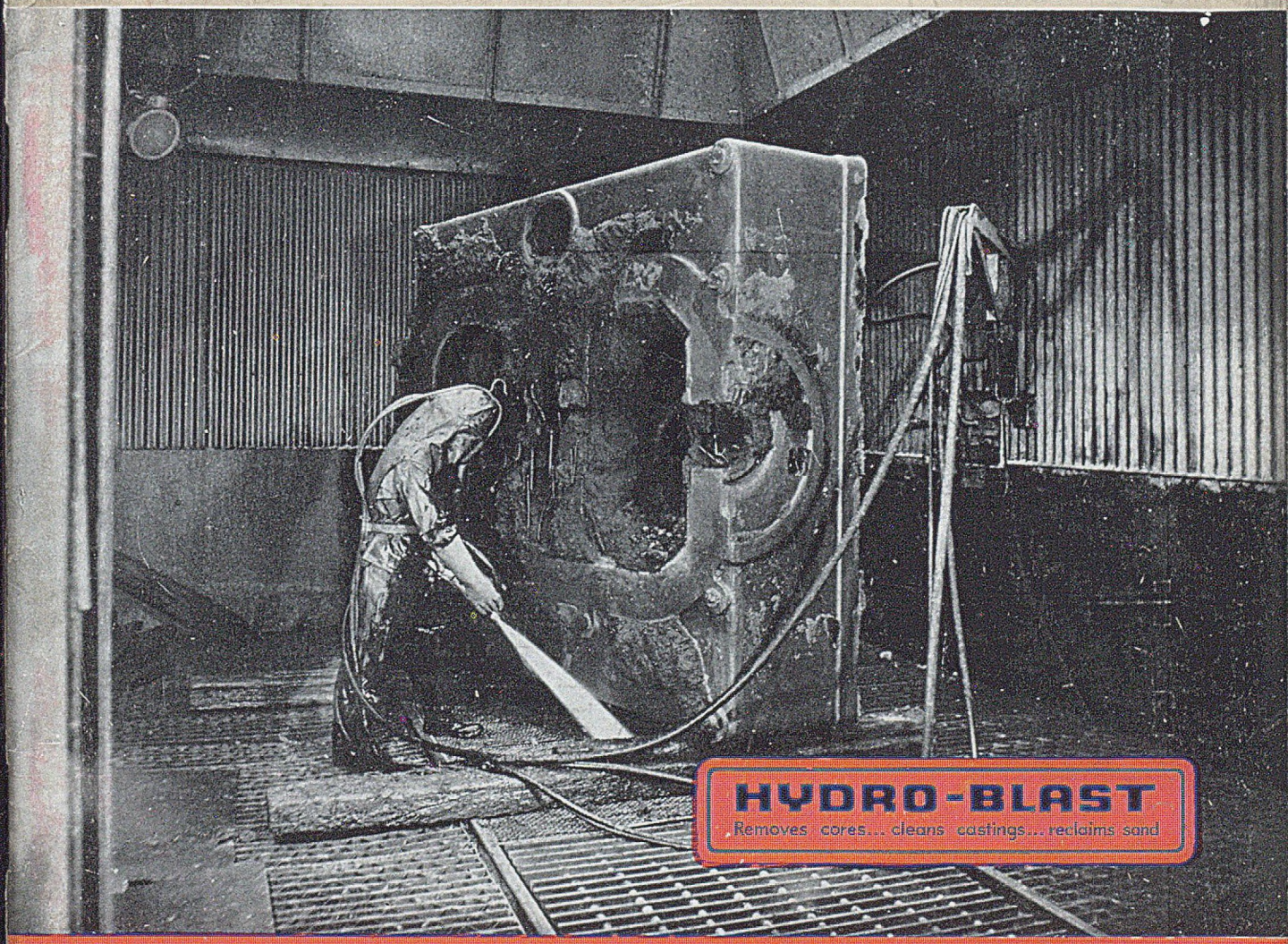

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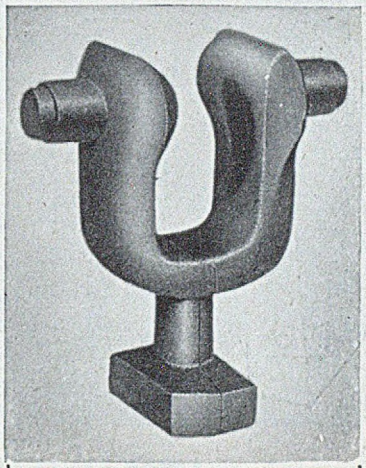

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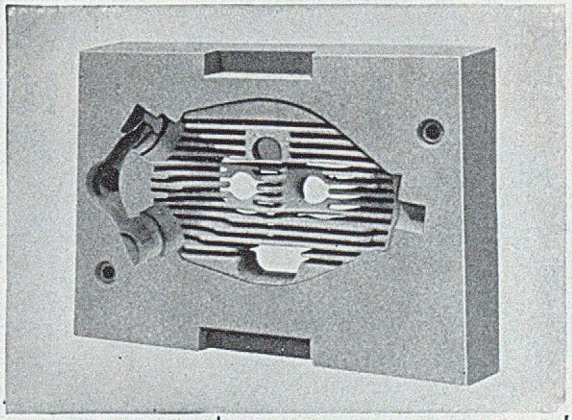

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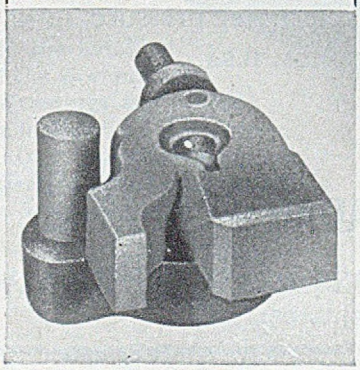

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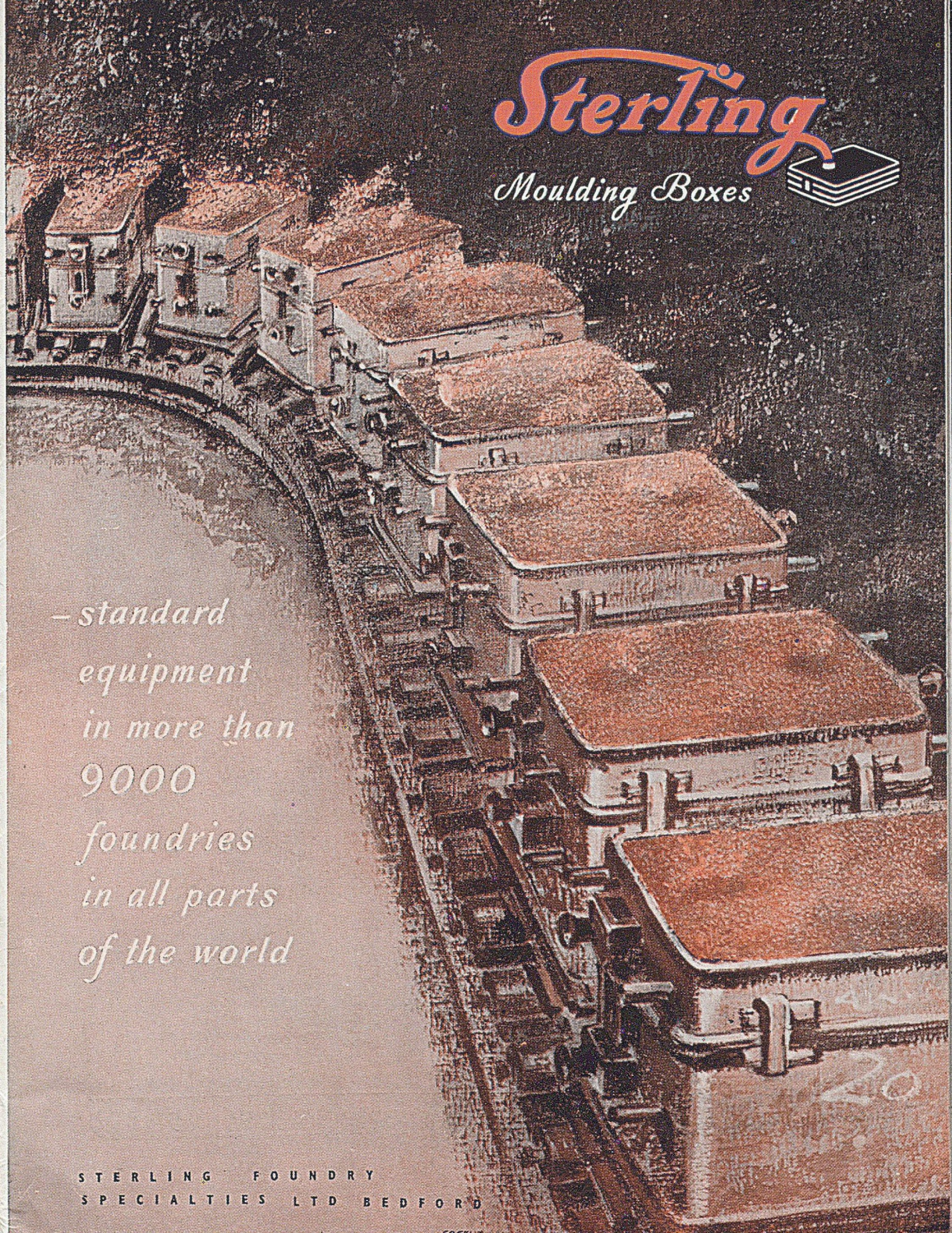
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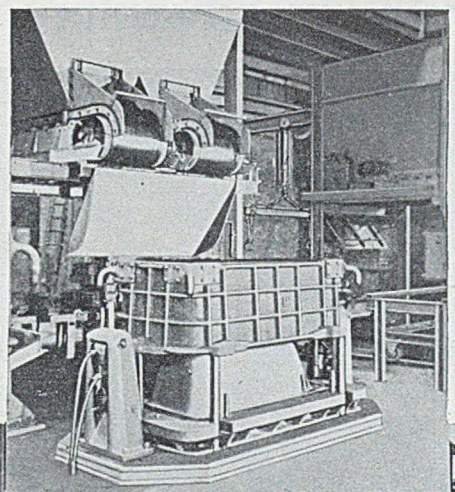

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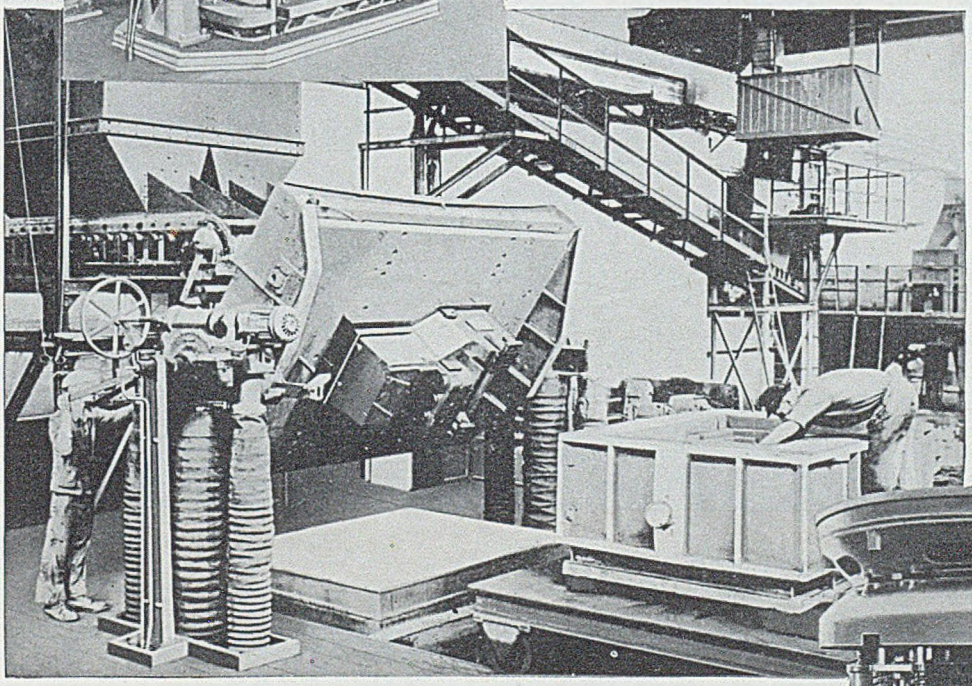

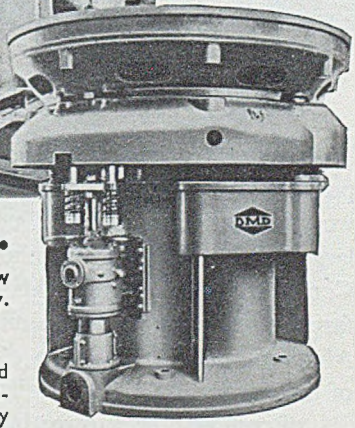

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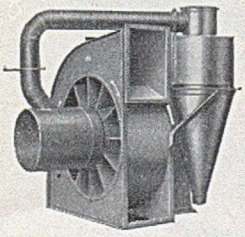

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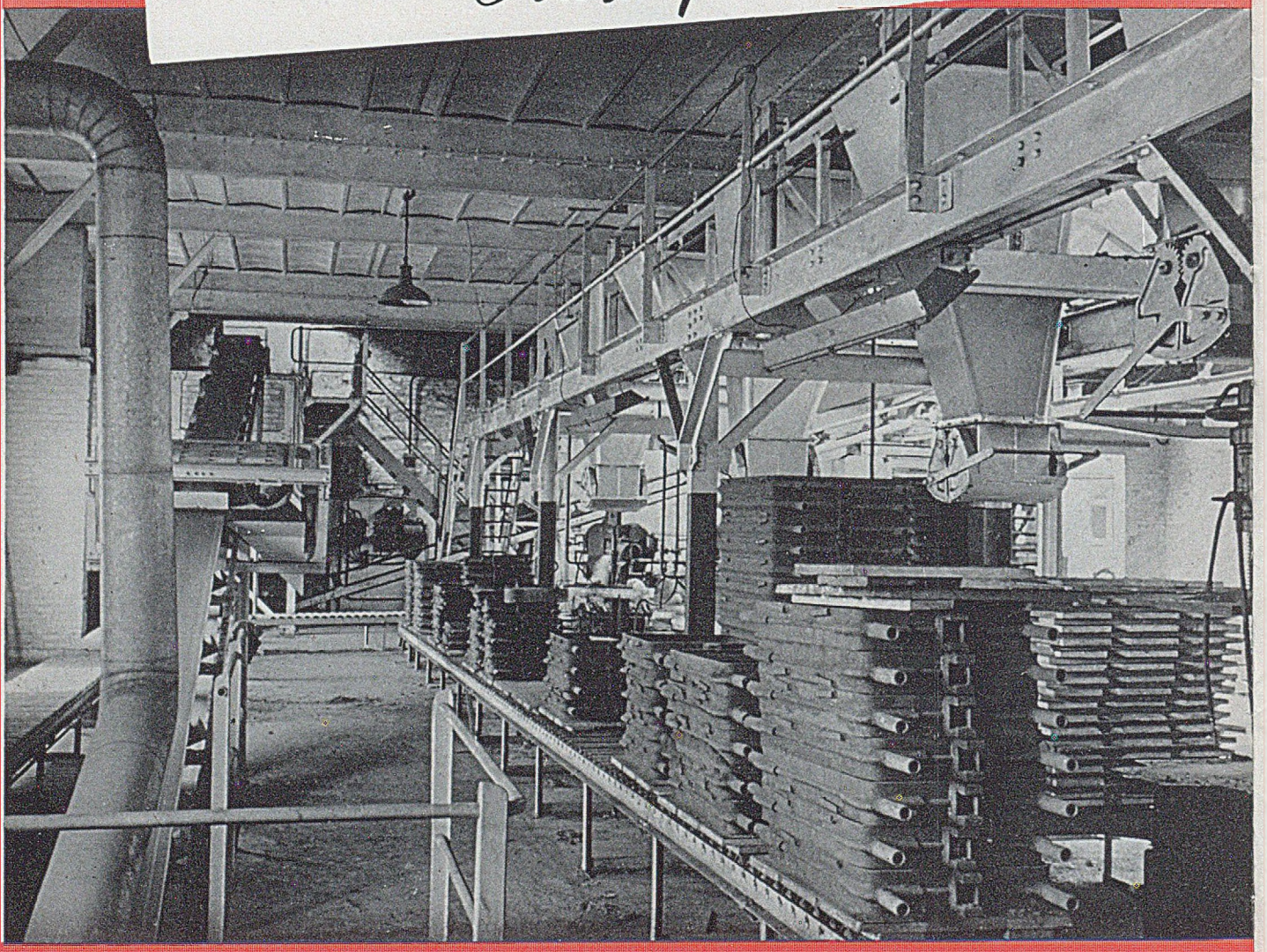

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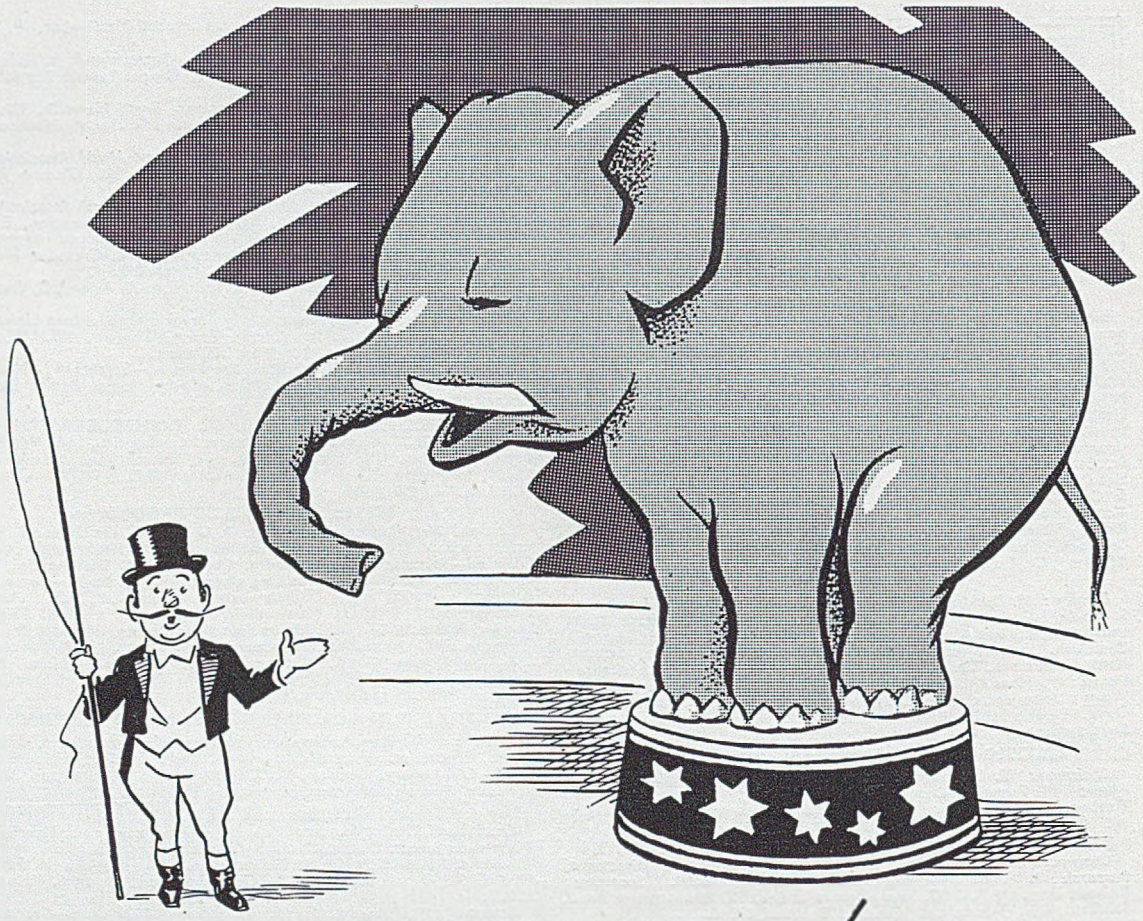

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FOUNDRY TRADE JOURNAL

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PRINCIPAL CONTENTS

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Selling Castings—and Ideas

The sellers' market has virtually ceased to exist, after having held sway for more than a decade. To-day, there is a pressing demand for people capable of selling goods and services to reluctant buyers. The days of "obliging" pet customers, by producing something from under the counter are past, as is also the pernicious system of ordering a thousand components, when only a few hundred are required. There is now the consolation that the orders currently being received are realistic.

The selling of castings is more difficult than any sale direct to the general public, because the buyers are people who cannot be bamboozled by the various psychological appeals made by some advertisers. The "snob," "vanity" and "fear" appeals are lost upon them. Though something can be done in the direction of neat and sensible packaging, extravagance must be frowned upon. Nevertheless, the art of salesmanship must be a prime qualification for the man charged with marketing of castings. There is no B.S.I. standard for buyers, and the appeal has to be varied in each case. All have bees in their bonnets; with some it is promptness in delivery, with others machine-ability or surface finish or freedom from defects, but with all these is worry that a competitor may be procuring supplies at a cheaper rate. With the easing of the markets, the buyers are becoming more "choosey," but they are still loth to break with their established sources of supply and here and there they are returning to foundries which have been unable to furnish castings to them during the rush period. While we deprecate overbuying, the reverse is just as reprehensible, as it procludes orderly planning by the foundries and may result in higher prices.

To-day, the sales manager must assume a more important rôle in the foundry industry. He is eminently well suited for selling such notions as productivity. Should he be told that improved deliveries or the wearing of respirators or safety clothing are urgent needs, then he should apply his salesmanship within the works to such problems. Surely these are less difficult than planning a large-scale selling campaign, especially as a brainwave can be effective. For instance, during the 1914 war, difficulty was experienced in selling war bonds. It was overcome by vending them from tanks and so labelling them. More recently, respirators were in regular use after a talk with a works doctor, associated with practical demonstrations of their effectiveness in suppressing the inhalation of dust. Obviously all "sales" must be accompanied by service and the maintenance of these respirators has been meticulously undertaken by order of the Board. Sales officers freed from the day-to-day worries of works operation, should, if they are worthy of the name, bring bright ideas to bear upon problems involving their art. Fortunately not a few directors are efficient salesmen, which means natural psychologists, and they are amongst the most successful.

Iron and Steel Bill

House of Commons Approval

A warning that if the system set up by the Government's steel denationalization Bill should fail through any lack of co-operation, or for any other means, the iron and steel industry would have no right to expect any mercy from the Opposition was given in Parliament this week by Mr. Duncan Sandys, Minister of Supply. He was winding up the third reading debate on the Iron and Steel Bill, which was passed by the Commons by a majority of 33. Mr. Sandys described the Bill as containing moderate and progressive proposals providing a fair, reasonable and lasting settlement.

Opposition Threats

Mr. G. Strauss, former Minister of Supply, repeated the Opposition's threats of re-nationalization, and said that the Labour party would take such steps as might be necessary at the first opportunity to restore the industry to public ownership.

In his closing speech, which ended 14 Parliamentary days spent on the Bill, the Minister said that the co-operation of the industry was of cardinal importance to the Board. "If there is anything that can safely be assumed, it will be that the steel industry will co-operate. Over many years it has co-operated with successive Governments, and there is no reason to suppose that its sense of public duty will desert it now."

Mr. Strauss, when he wound up for the Opposition, referred to the sale of the industry back to private enterprise and maintained that the only purchasers in the market would be the financial groups, headed by the old owners who were doubtful whether they should purchase their companies. If they made a bid at all, he said, it would be a low one and the Realization Agency would be in a quandary, for it would be faced with the alternatives of selling at a price far below the real worth of the companies, or not selling at all. Strong political pressure would be put on the agency to sell.

Mr. Sandys, however, refuted this and assured the House that the assets would not be sold below a price which the Treasury and the agency considered to be a fair one.

Some Changes

Mr. A. R. W. Low, Parliamentary Secretary to the Ministry of Supply, who opened the debate, declared that although there had been some important changes in the Bill there had been no departure at all from the underlying principles. He said that 82 amendments had been made, and outlined the main changes which had been effected in the Bill. On the compensation clause, he said the Minister had been in consultation with the T.U.C., which had now expressed itself satisfied with the clause as it now stood.

"Photography in the Oil Industry"

Kodak, Limited, are organizing an exhibition at their Gallery, 184, Regent Street, W.1, from March 19 to April 2. The photographs on view are drawn from the Shell Photographic Unit library of over 20,000 pictures.

This exhibition stresses the way in which photography to-day takes its place as a valuable working "tool" as well as providing a means of maintaining up-to-date records of industrial activity. It will be open to the public as follows:—Mondays to Fridays, 9.30 a.m. to 5 p.m.; Saturdays 9.30 a.m. to 11.30 a.m. Admission is free.

British Steel Castings Research Association

Revised Arrangements for Steelfoundry Research

A legal metamorphosis has now been announced which changes the British Steel Founders' Association, Research and Development Division, into the British Steel Castings Research Association. The Chairman is Mr. F. N. Lloyd, B.A., chairman and managing director of F. H. Lloyd & Company, Limited, Wednesbury, who will have the assistance of a Council comprising Mr. A. H. Catton, of Catton & Company, Limited; Dr. C. J. Dadswell, B.SC. (ENG.), of English Steel Corporation, Limited; Dr. E. Gregory, M.SC., of Edgar Allen & Company, Limited; Mr. J. Jackson, of Jackson Elphick & Company, Limited; Mr. C. H. Kain, A.M.I.MECH.E., F.I.M., of Lake & Elliot, Limited; Brigadier A. Levesley, M.I.MECH.E., and Mr. A. B. Lloyd, B.A. (CANTAB), both of F. H. Lloyd & Company, Limited; Mr. R. J. Richardson, of Brown Lenox & Company, Limited; Mr. Frank Rowe, B.SC., of K. & L. (Steelfounders & Engineers), Limited; and Mr. W. Scott, O.B.E., M.I.MECH.E., of Jarrow Metal Industries, Limited; Mr. J. F. B. Jackson, B.SC., A.R.I.C., F.I.M., who has guided the research activities of the Division since its formation, will continue as director of research.

Policy Unchanged

The policy of the B.S.C.R.A. like that of the Division before it, will, in the main, be directed to the translation of the results of research as rapidly as possible into industrial practice. This involves the mobilization, for the benefit of those concerned, of all the best known production techniques and steelfoundry methods. Nevertheless, fundamental research and the sponsoring of long-term projects will not be neglected. The Association thus takes over, in entirety, a well-run and adequately staffed organization, sufficiently well-integrated with industry to carry on work of real value not only to producers of steel castings, but also to engineers who rely on the products of the founders to maintain and expand their exports.

To date, the whole finance required for this research in the steelfounding industry has been provided by firms within the industry itself, but whether or not this position can continue must, of necessity, depend on the nature of the demands made on the resources available.

Index to Vol. 93

The index to Vol. 93 of the FOUNDRY TRADE JOURNAL, covering the period July to December, 1952, has now been published. Copies may be obtained free of charge on application to the Publisher of the JOURNAL, at 49, Wellington Street, London, W.C.2. Regular subscribers, who wish to obtain copies of indices automatically when published, are invited to apply for inclusion on a permanent list.

A.F.S. European Tours

The American Foundrymen's Society have announced the dates during which their members participating in the Paris International Conference will be in this country. These are:—

Tour A, August 25 (Tuesday) to September 1, *tour B*, October 2 (Friday) to October 6; *tour C*, October 9 (Friday) to October 15, and *tour D*, October 24 (Saturday) to October 30.

Institute's Fiftieth Annual Conference at Blackpool

Detailed Programme for June 16 to 19

The fiftieth annual conference of the Institute of British Foundrymen will be held at Blackpool from June 16 to 19, and this year is being organized by the Lancashire branch. Mr. E. Longden, a past-president of that branch, will be installed in the office of president of the Institute at the annual general meeting on the second day. Blackpool has been chosen principally because of the availability of hotel accommodation; although not an industrial centre, careful planning has enabled visits to a number of very important engineering works and foundries, to be arranged by courtesy of the respective managements.

All the conference meetings and most of the social functions will be held at the Winter Gardens (the Church Street entrance should be used). Council and committee meetings and certain ladies' functions, however, are being held at the Imperial Hotel. The Institute is particularly indebted to the companies who are inviting members to inspect their works and some of these companies are also inviting their visitors to lunch and tea. In addition to the items arranged especially for ladies, they are also invited to accompany members at various social functions. Preprints of papers to be presented to the conference will be available to all members whether attending or not. Applications for copies may be made to the secretaries.

It is essential that those who intend to participate should return application reply forms as soon as possible and in no case later than May 23 to the Institute's office in Manchester. A conference office will be established on Tuesday, June 16, at the Winter Gardens in the Palm Café Balcony, and direction cards will indicate the location.

Detailed Programme*

Tuesday, June 16

Afternoon: Council and committee meetings at the Imperial Hotel, North Shore. Open to council and committee members only, who will receive particulars later. Members and ladies make their own arrangements for lunch and dinner.

8 p.m. to 11.30 p.m.: Reception by His Worship the Mayor of Blackpool and the Mayoress in the Windsor Lounge, Winter Gardens, followed by dancing in the adjoining Spanish Hall (evening dress preferred). Church Street entrance to Winter Gardens.

Wednesday, June 17

9.15 a.m.: Annual general meeting in the Baronial Hall, Winter Gardens (Church Street entrance) (members only). Presentation of awards.

11 a.m.: Presidential address by E. Longden, M.I.MECH.E.

11.30 a.m.: Edward Williams lecture. "Aspects of Nuclear Fission of Interest to Foundrymen and Metallurgists," to be delivered by E. W. Colbeck, M.A.

12.45 p.m. for 1 p.m.: Luncheon in the Spanish Hall, Winter Gardens (by kind invitation of the Lancashire branch). (Members and ladies.)

2.30 p.m.: Technical sessions in the Winter Gardens.

5 p.m.: Conference adjourns for buffet tea (by invitation).

7 p.m.: Reception in Windsor Lounge, Winter Gardens by the president and Mrs. Longden (Church Street entrance).

7.30 p.m. to 1 a.m.: Annual banquet in the Spanish Hall, Winter Gardens, followed by dancing (evening dress, decorations).

Thursday, June 18

9.30 a.m. to 12.30 p.m.: Technical sessions.

12.45 p.m. for 1 p.m.: Luncheon. Spanish Hall, Winter Gardens (members and ladies).

2.30 p.m. to 5 p.m.: Technical sessions.

Evening Entertainments. Parties of members and ladies will visit one of the following:—

7.15 p.m. The Tower Circus; 7.30 p.m. Royal Pavilion (Jack Rose Repertory Players); or 8.40 p.m. Palace Variety Theatre (Variety. Revue).

Friday, June 19

Members may select one only of the following visits or groups of visits. Depart by motor coach from corner of Leopold Grove and Church Street (near Winter Gardens).

8.45 a.m.: (1) Vickers-Armstrongs, Limited, Barrow-in-Furness, shipbuilders and general engineers, iron and steel and non-ferrous foundries. Luncheon at Imperial Hotel on arrival at Barrow; high tea by kind invitation of the Company; arrive Blackpool on return about 7.30 p.m.

9 a.m.: (2) Metropolitan-Vickers Electrical Company, Limited, Trafford Park, Manchester. Manufacturers of power-station plant and all kinds of electrical apparatus, iron and non-ferrous foundries (party limited in number); arrive Blackpool on return about 6.30 p.m.

9.10 a.m.: (3) *Morning.* (*a*) Howard & Bullough, Limited, Accrington (constituent of Textile Mechinery Makers, Limited); extensive ironfoundries. Luncheon by kind invitation of the Company. *Afternoon.* (*b*) British Northrop Loom Company, Limited, Daisyfield, Blackburn, makers of automatic looms, ironfoundries; arrive Blackpool on return about 6.30 p.m.

9.20 a.m.: (4) *Morning.* (*a*) Leyland Motors, Limited, Leyland, makers of heavy motor vehicles, ironfoundries and steel foundry, spun bronze castings. Luncheon by kind invitation of the Company. *Afternoon.* (*b*) British Railways Locomotive Works, Horwich, iron foundry for locomotive castings and large new mechanized iron foundry. Call for tea on return journey; arrive Blackpool about 6.30 p.m.

8 p.m. to 1 a.m.: Supper-dance at the Winter Gardens; dancing at 8, supper at 9 to permit of attendance of members and ladies who return to Blackpool late from visits.

Ladies' Events

Tuesday, June 16

4 p.m.: Afternoon tea at the Imperial Hotel, North Shore, by invitation of Mrs. C. J. Dadswell.

8 p.m. to 11.30 p.m.: Reception by His Worship the Mayor and the Mayoress at the Winter Gardens; dancing.

Wednesday, June 17

Morning free.

12.45 p.m. for 1 p.m.: Luncheon in the Spanish Hall, Winter Gardens, by kind invitation of the Lancashire branch.

2.30 p.m.: Mannequin parade by R. H. O. Hills (Blackpool), Limited, at the Imperial Hotel, North Shore. Afternoon tea.

7 p.m.: Reception in the Windsor Lounge, Winter Gardens, prior to annual banquet.

7.30 p.m. to 1 a.m.: Annual banquet, Spanish Hall, Winter Gardens; dancing (evening dress, decorations).

* Times and detailed arrangements are subject to revision. Final arrangements will be shown in the Conference Handbook which will be sent to all members and ladies participating.

Institute's Fiftieth Annual Conference at Blackpool

Thursday, June 18

Morning free.

12.45 p.m. for 1 p.m.: Luncheon in the Spanish Hall, Winter Gardens.

2 p.m.: Depart by motor coach from corner of Leopold Grove and Church Street (near the Winter Gardens) for either of the following:—(1) Visit to weaving sheds of Thomas Moss & Sons, Limited (section of the Amalgamated Cotton Mills Trust, Limited), Lostock Hall, near Preston; or (2) Excursion to Hoghton Tower, Walton-le-Dale, near Preston, a large mediæval mansion with beautiful grounds. Both parties will arrive in Blackpool on the return about 6 p.m.

Evening: As for main programme.

Friday, June 19

9.30 a.m.: Depart by motor coach from corner of Leopold Grove and Church Street (near the Winter Gardens), for Bowness-on-Windermere in the Lake District. Luncheon at the Old England and Royal Hotels, Bowness-on-Windermere, by kind invitation of the Lancashire branch; excursion by motor boat on Lake Windermere; afternoon tea. 4.30 p.m.: Depart from Bowness and return to Blackpool 7 to 7.30 p.m.

8 p.m.: Supper-dance at the Winter Gardens (evening dress optional).

Technical Papers

Wednesday, June 17

2.30 p.m. to 5 p.m.: Two simultaneous sessions.

Session A. Baronial Hall, Winter Gardens (entrance Church Street). Papers: No. 1058, "Shell Moulding," by B. N. Ames (exchange paper from American Foundrymen's Society); No. 1059, "Shell-moulding Process," by D. N. Buttrey, M.SC., A.R.I.C., A.P.I.; and No. 1060, "Pelleted Foundry Pitch," by E. Brett Davies, M.INST.F., T. F. N. Matthews and G. Smart.

Session B. Opera House Foyer (adjoining Winter Gardens—entrance *via* Winter Gardens, Church Street). Papers: No. 1061, "High-temperature Properties of Bonding Clays," by J. White, D.SC., and S. Davison, B.SC.; No. 1062, "Effects of Mould Resistance on Internal Stress in Sand Castings," by Dr. R. N. Parkins and Dr. A. Cowan; and No. 1063, "Growth Characteristics of Ingot-mould Irons in Air and Vacuum," by J. W. Grant, A.M.I.MECH.E. (associate member).

Thursday, June 18

9.30 a.m. to 12.30 p.m.: Two simultaneous sessions.

Session C. Baronial Hall, Winter Gardens. Papers: No. 1064, "Production of Diesel-engine Castings," by J. R. Charlton (member); No. 1065, "Thoughts on the Cupola," by D. Fleming (associate member); and No. 1066, "Foundry Developments in the Textile Industry," by B. Gale (member).

Session D. Opera House Foyer. Papers: No. 1067, "Effect of Pouring Conditions on Shrinkage Unsoundness in Bronze Ingots Cast in Metal, Carbon or Sand Moulds," by W. T. Pell-Walpole, D.SC.; No. 1068, "Production of Centrifugally-cast Nickel-bronze Bearing Shells," by J. Taylor, ASSOC.MET., F.I.M., A.M.I.MECH.E., Z. Stokowiec, F.I.M., A.M.I.MECH.E. (member), and R. S. Jackson, B.SC., A.R.S.M.; and No. 1069, "Report of Sub-committee T.S. 38—Economic Utilization of Copper-base Alloys."

2.30 p.m. to 5 p.m.: Two simultaneous sessions.

Session E. Baronial Hall, Winter Gardens. Films on the suppression of foundry dust, prepared by the Research and Development Division of the British Steel Founders' Association and the British Cast Iron Research Association; and paper No. 1070, "Pressure Feeding of Steel Castings," by C. W. Briggs, U.S.A., and Prof. H. F. Taylor (member), U.S.A.

Session F. Opera House Foyer. Papers: No. 1071, "Modification Methods for High-silicon Aluminium Alloys and their Influence on Structure," by C. Mascré (French exchange paper); and No. 1072, "Mould-reaction in Aluminium-alloy Castings," by Marjorie E. Whitaker, B.SC., A.I.M.

Members intending to participate are reminded that applications for hotel accommodation should be made as soon as possible direct to the hotel and not to the Institute. It is desirable that all hotel accommodation should be booked by May 16 and when booking accommodation it is important to mention attendance at the Institute of British Foundrymen's conference.

Scottish Iron and Steel Production

Production of steel in Scotland is still mounting steadily, and indications are that further improvement in output will be achieved as the year progresses. The latest output figures show that, for the country as a whole, yet another new record weekly average rate was achieved last month. While Scotland's contribution was not so spectacular, there was, nevertheless, a marked improvement over the comparative period of 1952. For steel ingots and castings, the weekly average output was 47,450 tons, compared with 43,990 tons in January, and 40,990 tons in February last year. Pig-iron production was slightly lower than the output in February, 1952, but showed an improvement over January. Supplies of pig-iron and scrap steel are now coming into the Clyde in fairly large quantities, and the various steelworks have now succeeded in building up some reserve.

Despite the country-wide improvement, however, and the fact that the shipyards are receiving an increased allocation of 9 per cent. during this present quarter, the demand for even bigger quotas still persists. There have been instances during recent weeks of launches being delayed because of erratic delivery of plates. As in former years, the shipbuilders' grouse is not so much against the shortage of steel but rather the fact that they are unable to get the right kind of steel at the right moment.

European Coal and Steel Problems

One of the more formidable problems facing the High Authority of the European Coal and Steel Community is the fact that, despite the relaxation of Customs barriers between member countries, consignments are still subject to varying monetary systems when they pass from one country to another. In order to effect a free flow of goods within the pool the Authority must evolve a scheme which will obviate any difficulties caused by differing currencies and tariffs. With a view to achieving this the Authority has decided to form a committee of experts to inquire into the matter and report on the varying aspects of the problem. The findings of the commission must cover an extensive field and be as widely publicized as possible so that the Community may continue to function in an atmosphere of co-operation which does not allow of mistrust and suspicion.

FROM JUNE 10 to 20 the Norwegian Industries Development Association is sponsoring an exhibition, *Automation, Servomechanisms, Instrumentation,* to cover measuring and control techniques, with instruments, apparatus and labour-saving machines which are used in industry and research laboratories.

Mechanized Foundry for Small Blackheart Malleable Castings*

By J. Roxburgh

In these days, productivity is very much in the minds of those connected with industry, and constant attention, too, must be directed towards ever-increasing efficiency in business. As far as foundrymen are concerned, wherever a demand for certain types of castings is fairly constant or recurring in sufficient volume, some form of mechanization should be considered. The highest degree of efficiency, dependent on individual circumstances, should be the aim, even though the plant envisaged has sometimes, of necessity, to have a certain degree of flexibility. What follows is a detailed account of mechanization as applied in a malleable foundry, with emphasis on significant differences as compared with grey ironfounding.

There has always been, and is ever likely to be, controversy surrounding the subject of mechanization with regard to whether it is or is not worth while. To the Author's mind, it is essential to decide that important issue on each individual scheme before ever embarking upon it. Surely it is possible to make a fairly accurate forecast of all the costs that would be involved in the operation of the plant under consideration, from a detailed study of the layout that has been conceived and roughly designed. Such costs would include depreciation, personnel required and their wages, materials, potential achievement as regards output and defective castings, etc. In fact, it would be a comprehensive budget based upon a certain rate of productivity in the plant envisaged from a definite labour force. Without this information in detail, it is unwise to decide to go ahead with a particular scheme.

If the costs, so calculated, are deemed satisfactory, having been based on a certain rate of productivity to yield the level of profit desired, it should be recognized that once the plant has been started up and is being successfully operated, any increase of productivity rate beyond that upon which the budget was compiled, has a much greater effect on the reduction of costs than at first would be thought possible by a direct comparison of the rates.

It should be borne in mind that depreciation is usually a heavy item, and that the cost of production in a mechanized plant should be such as not only to recover the cost of depreciation but to yield a larger profit on the articles than by the previous methods employed. Where high efficiency has prevailed previously, greater difficulty will be encountered in meeting this objective when mechanization is envisaged. Where the possibility of shortage of manpower is likely to arise, mechanization is well worthy of consideration and may be inevitable, as it is recognized that the man/hours per ton can be materially reduced for the same class of work when full mechanization is employed. Provided, too, that a mechanized plant is designed having regard to good housekeeping, safety, welfare and health, then the foundry could become more attractive to new entrants.

In the company with which the Author is associated, there are many classes of work, which could be regarded as falling into approximate categories of large, medium and light work. A mechanized plant has already been provided for a proportion of the large work, whilst plans are well advanced for

* Paper presented to the Lancashire branch of the Institute of British Foundrymen. The Author is attached to Ley's Malleable Castings Company, Limited.

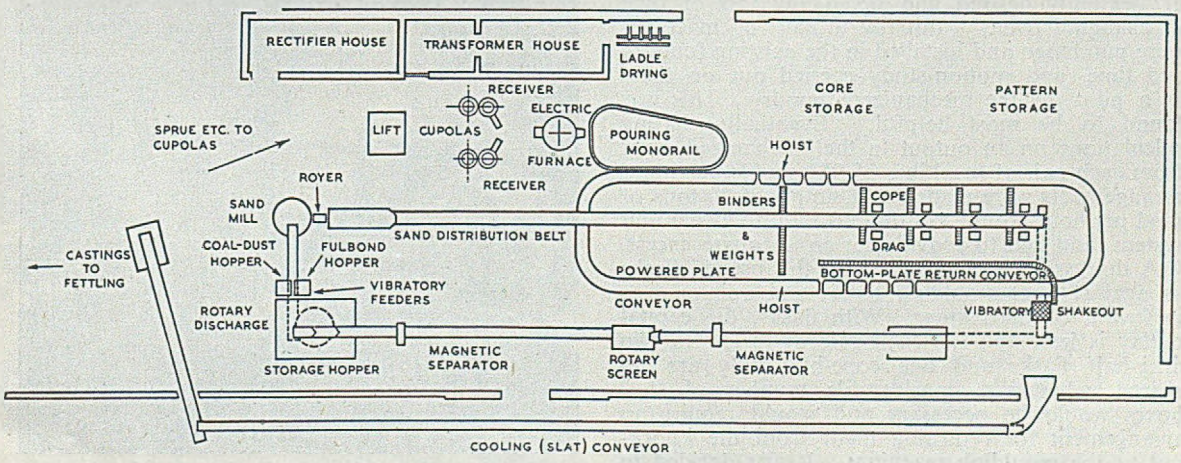


FIG. 1.—*General Layout of a New Mechanized Plant at Ley's Malleable Castings Company, Limited, for producing Castings of the Smaller Weight Range.*

FIG. 2.—*Shake-out Station with the Pallet-type Mould Conveyor at the Rear. Bottom Boards are returned on a Roller Conveyor.*

bringing some of the medium work within a scheme of mechanization. Some of the lighter class of work has now been catered for, as, about three years ago, it was decided to instal a fully-mechanized plant to deal with an output of approximately 50 tons per week of good castings, and the description of this plant forms the subject of this Paper.

Planning the Job

In order to design a plant, certain initial considerations are essential. The work chosen, in this particular case, could be made in shallow moulds, and B.I.C. magnetic squeeze/stripper moulding machines, with a 4 in. draw, were judged to be eminently suitable. Four pairs of machines were to be installed, of which two pairs would be in work at any one time, the other two pairs being used for pattern changes. This afforded the degree of flexibility desired and saved any loss of time in changing over. Initially a pair of machines were purchased and installed in the existing foundry and time- and motion-study carried out on them as a pilot for the mechanized foundry. This was found to be most helpful. Eventually, basing calculations on an output in the mechanized plant from each pair of machines of 95 moulds per hour, arrangements were made for a supply of 20 tons of sand per hour from a continuous mill, to give a unit system sand and to provide for an adequate excess.

A discussion took place as to the use of flasks as against steel moulding boxes and opinion was in favour of the former. With flasks, the capital outlay is less, and for each pair of machines two drag-half flasks and one cope-half only are required, whereas a considerable number of steel boxes would be necessary and would require an arrangement for returning them from the knock-out to the moulding machines. It was decided to use one size flask only, *viz.*, a slip flask 17 by 13 in.

Another important point considered, after some investigational work, was the cooling time required for the various castings from the time of pouring to that of knocking out, a determination which is a major factor in deciding the length of conveyor to be used. After knocking out, it was arranged to allow approximately two hours for the castings to cool sufficiently for handling, this time to be afforded by the installation of an apron conveyor.

When the melting plant came under discussion, cupola/electric furnace duplexing was decided upon, the two cupolas to have receivers and the metal to be transferred from the latter to the electric furnace by crane ladle. In any melting plant of this description, a minimum and a maximum amount of metal per hour should be assessed and, in this particular case, it was estimated that the plant could be operated at between 25 and 45 cwts. per hour, as long as prior notice of the requirements could be given. Provision for building-up a supply of metal in the receiver and electric furnace, before 8 a.m. in the morning, and during lunchtime, was essential for operation at the loading required. The balancing of output on the moulding machines, from the point of view of the weight of metal in each mould, is a very important factor, controlling, as it does, the melting rate per hour required. Thus, proper scheduling, in respect to the various jobs to be made on the plant envisaged, would be essential. The aim should be to keep the demand for metal as constant as possible over the day so as to lessen the metallurgist's difficulties.

From data thus collected and after due consideration, a fully-mechanized plant was designed, and apart from proprietary plant, was manufactured and installed by the associate company of Leys Malleable Castings Company, Limited, *viz.*, the Ewart Chainbelt Company, Limited, Derby. Fig. 1 is a general lay-out of the plant, where the

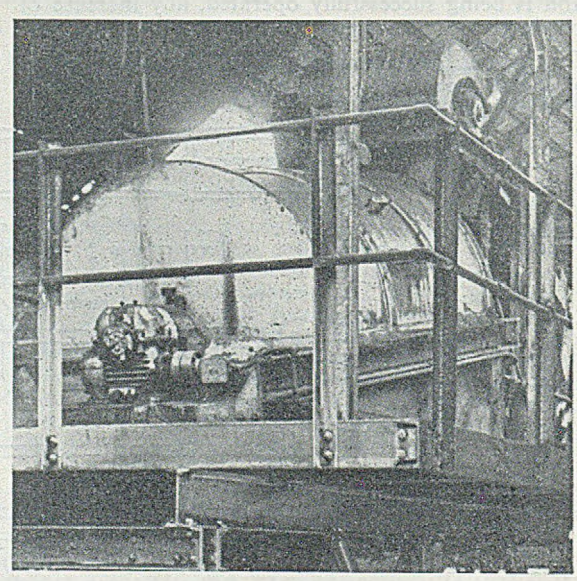


FIG. 3.—*Rotary Screen which re-delivers Sand by Chute on to a Conveyor Belt.*

principal items are shown, to which individual reference is made subsequently. It will be appreciated that, in order to produce the selected castings at the high rate desired, all the equipment and tackle used should be of the highest quality and maintained in that condition.

Moulding Machine Practice

Apart from jobs with irregular joints, it is necessary on each moulding machine to provide a cast-iron stool, machined to size, to support a cast-iron patternplate, 5/1,000 in. under ½ in. thick, upon which the half patterns, usually of brass, are mounted. The patternplate is thus seated below the level of the apron and this ensures a sand joint in the mould. For some joints, other than flat ones, special inserts in the patternplate are required, necessitating special stools. With irregular joints, it is usual to make twin odd-sides, by bedding metal patterns in a proprietary pattern compound in special stools. It has been found that quite a considerable tonnage of castings can be produced from such an odd-side. The machines are of the squeeze/stripper type and the patterns are stripped downwards from the mould. Slip flasks are used, two for the drag and one for the cope, to each pair of machines. These flasks have a 5 deg. taper. The diameter of the pins in the drag-half flask is 0.995 in. and that of the pinholes in the cope half 1 in. Twice each day on each pair of machines, templates are used for checking pin centres and the size of pins and holes.

A top pressure board, made of aluminium, is used, and this carries a block to form the pouring-cup, in the centre of which is a hole. The actual downgate peg is located on the patternplate and, when the cope is squeezed, the downgate peg passes through the hole in the pouring cup and pushes any sand through the pressure board. In this way, the downgate and the pouring cup are automatically formed and are perfectly clean. With some jobs, a flask 6 in. deep is used, and, in one case, two hubs, weighing 11½ lb. each, are made inside this flask. In order to obtain the density of ramming required on the joint, special blocks fitted to the pressure board, and a deep squeeze results. Jobs like these are usually made on a jolt-squeeze machine, but, by adopting the procedure outlined, a squeeze/stripper machine can give the hardness of ramming required. An aluminium bottom-board is used on the drag mould.

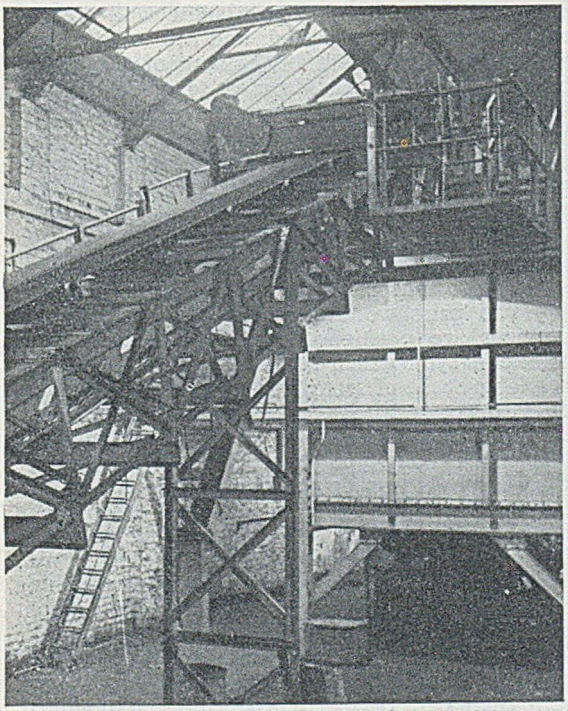


FIG. 4.—*Belt passing at the Top under a Second Overband Magnetic Separator.*

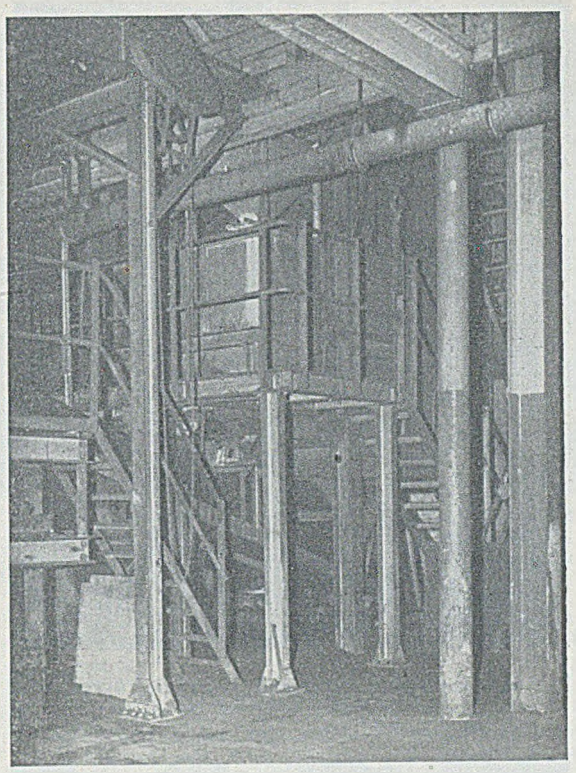


FIG. 5.—*Arrangement of Hoppers and Vibratory Feed Units for adding Coal-dust and Prepared Clay on to the Belt feeding the Continuous Sand Mill.*

Sand Preparation and Handling

Having provided for first-class pattern equipment and moulding tackle, the question of the supply to the moulding machines of a unit-system controlled sand is of major importance. There are two moulds on each pallet of the mould conveyor and, by means of a tilting ramp, these are thrown on to a Sterling vibratory screen, the aluminium bottom-boards being retained on the power conveyor and returned to the rear of the moulding

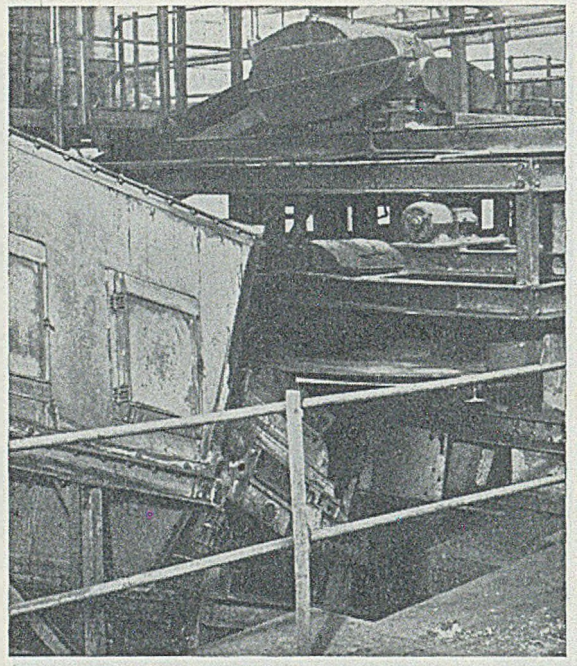


FIG. 6.—*Continuous Sand Mill at the Discharge Point into the Royer which delivers on to a Conveyor Belt 30 in. wide.*

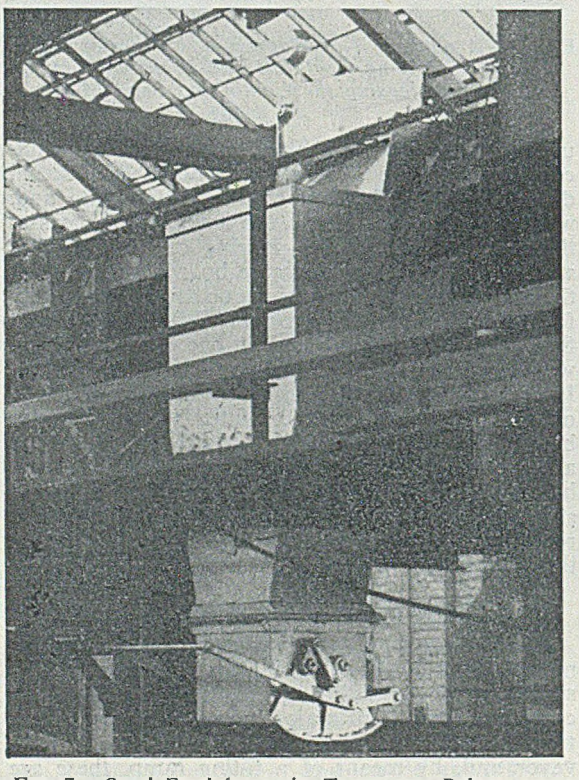


FIG. 7.—*Sand Feed from the Transverse Belt to one of the Overhead Hoppers above the Moulding Machines.*

machines on a gravity roller conveyor (Fig. 2). From the shake-out, the sand travels up a belt conveyor, 24 in. wide, at 100 ft. per min. and at a rate of 20 tons of sand per hour, passing under the overband magnetic separator and through the rotary screen (Fig. 3) into a chute on to another belt. The sand is then conveyed under a second overband magnetic separator (Fig. 4) into a rectangular storage hopper of 50 tons capacity with an 8-ft. dia. rotary feeder discharge on to a belt conveying the sand to the continuous sand mill. From hoppers above, coal-dust and Fulbond are added, by vibratory feed, in correct quantities on to this belt (Fig. 5).

The sand mill has a 10-ft. dia. disc and four kneading rolls. For the maintenance of this mill, there is a 2-ton gantry and hand-operated crane with Wharton block. The sand is discharged from the mill into a Royer, which throws the sand up a belt 30 in. wide (Fig. 6), to be ploughed off into the rectangular hoppers above the moulding machines (Fig. 7). The hoppers have duplex gates and control levers. Any surplus sand not required at any time is taken along the belt to a hopper, from which the sand passes on to another belt, back to the belt under the shake-out, thus completing a closed circuit for the sand.

The properties of the sand in use are closely controlled, a synthetic sand being provided having Chelford sand as its base. The sand is tested every half-hour and the properties sought are:—Moisture, 4 to 4.5 per cent.; permeability, 45 to 60; green-compression strength, 8 to 10 lb. per sq. in.; and shatter test, 65 to 75. It has been found in practice that additions of new silica sand are not required over a long period, and are usually only made for replenishment. A content of about 6 to 7 per cent. coal-dust is aimed at (a grade showing a loss on ignition of 6 per cent., excluding moisture, being used) and the amount added for regular make-up is 0.1 per cent. The addition of proprietary clay amounts to about 0.1 per cent. on the sand used.

Moulding and Conveyor Synchronization

There are four pairs of machines installed, with only two pairs working at any one time. The machines are positioned inside the power-driven pallet conveyor, which has a circuit of 230 ft. and a variable speed of from 7 to 15 ft. per min. There are 51 palettes with a pitch of 4 ft. 6 in. The driving chain is made up of steel roller chain, with a horizontal dog-type caterpillar drive, a P.I.V. variable-speed gear being used. The palettes are mounted as trolleys on solid wheels and Fig. 8 shows the conveyor at one of the corners. The machines are placed one behind the other, with a length of roller conveyor alongside stretching from the drag machine to the power-driven conveyor (Fig. 9).

The rhythm of movement is very well established, and outputs of 140 to 150 moulds per hour from each pair of machines have been obtained, the flask size being 17 by 13 by 6, 5, or 4 in. The best production in any one week so far has been

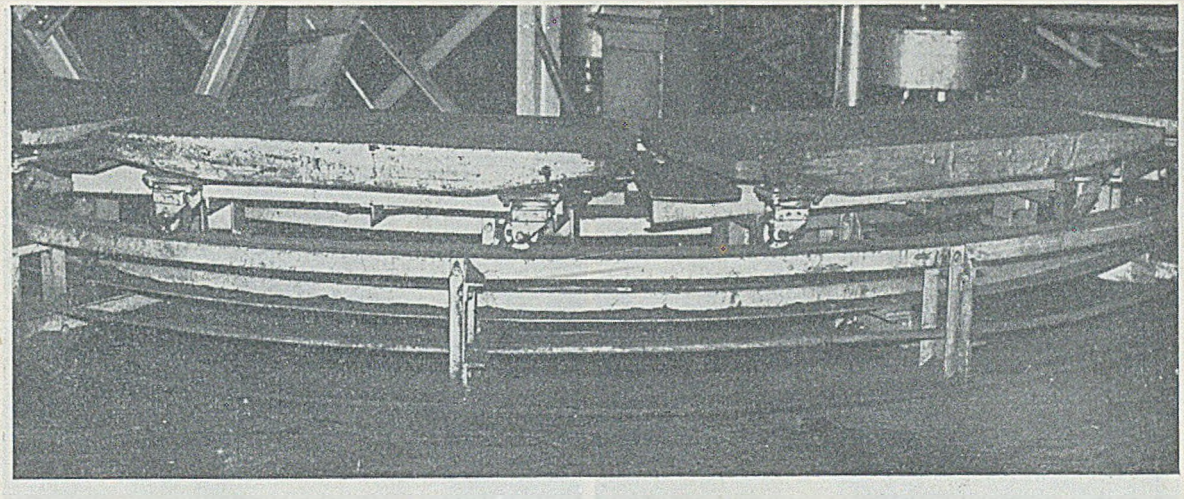


FIG. 8.—*Corner on the Power-driven Mould Conveyor. The Pallets have a Side Skirt to counteract warpage and Castor-type wheels are used.*

61½ tons of castings with an average hourly rate of 130 moulds. Time- and motion-study has been carried out and Figs. 10 and 11 are intended to illustrate the cycle of operations organized in conformity with the study; doubtless they are self-explanatory. Time- and motion-study is of incalculable value in a mechanized plant, and the high production rates obtained would not have been achieved without this work, but, at the same time, credit should be given to the operators for their co-operation.

Cored Work

A special study was made of the effect more highly-cored jobs had on the productivity rates, which were inclined to fall as compared with the normal run of jobs. As a result, a great improvement was made whereby the core-setter (who also

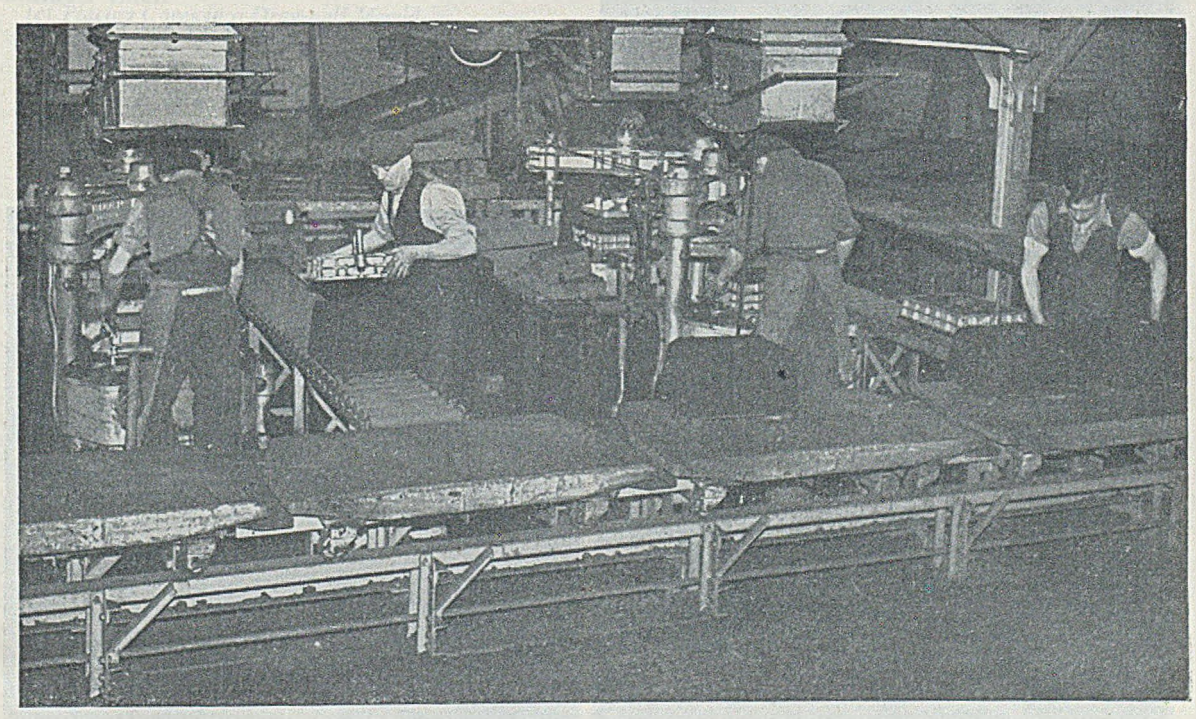
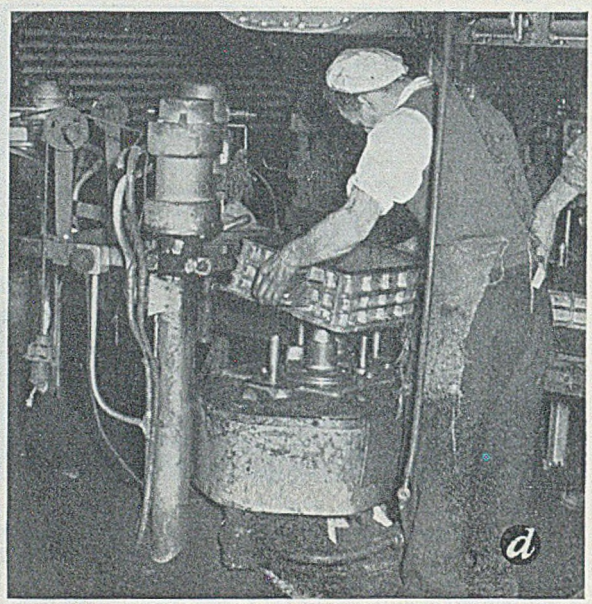


FIG. 9.—*Moulding Operations in progress on Two Pairs of Machines.*



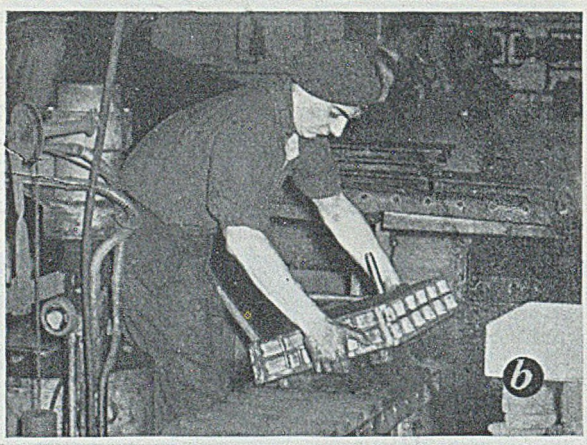


FIG. 10.—*Sequence of Operations for Moulding on the B.I. Machines:*

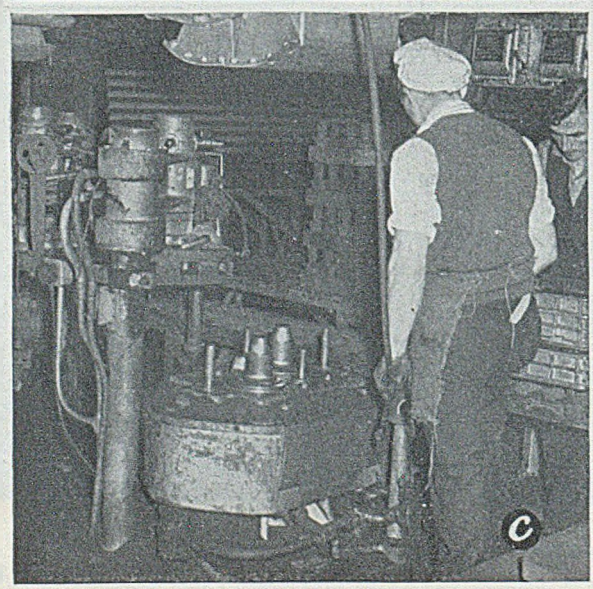
(*a*) *Preparing to Squeeze Drag part Mould.*

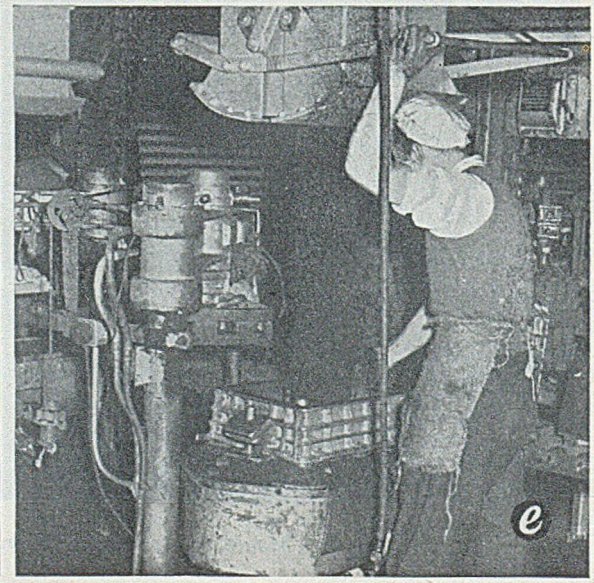
(*b*) *Placing a Drag-half Mould on the Roller Conveyor.*

(*c*) *Operator ready to receive a Cope Flask.*

(*d*) *Placing the Cope Flask on the Machine.*

(*e*) *Operator filling the Flask with Sand.*





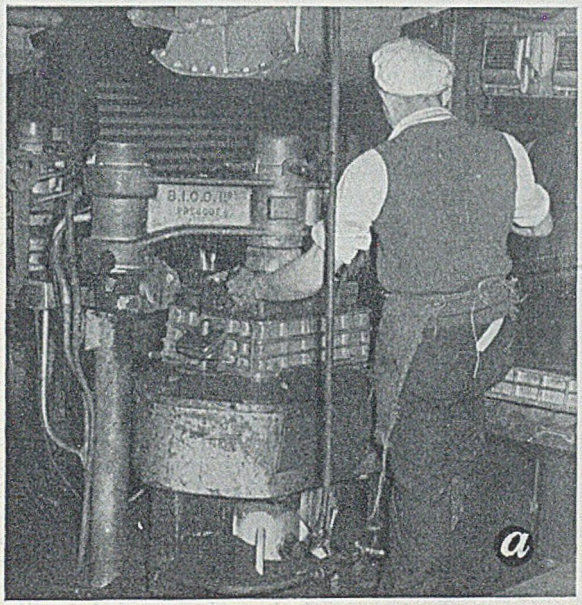


FIG. 11.—*Continuing the Sequence of Operations in Moulding and Core setting:*

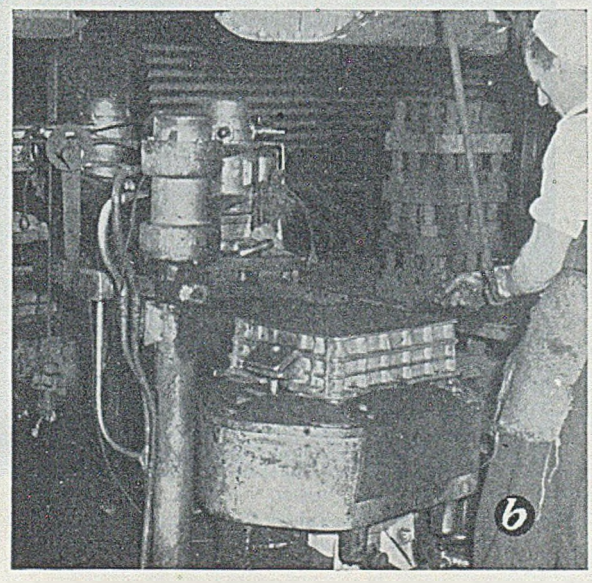
(*a*) *Squeezing a Cope-half Mould.*

(*b*) *Blowing off the Top of the Mould.*

(*c*) *Placing Cores in a Drag-half Mould.*

(*d*) *Closing the Cope on the Drag.*

(*e*) *Core-setter handing Cope Flask to Operator.*



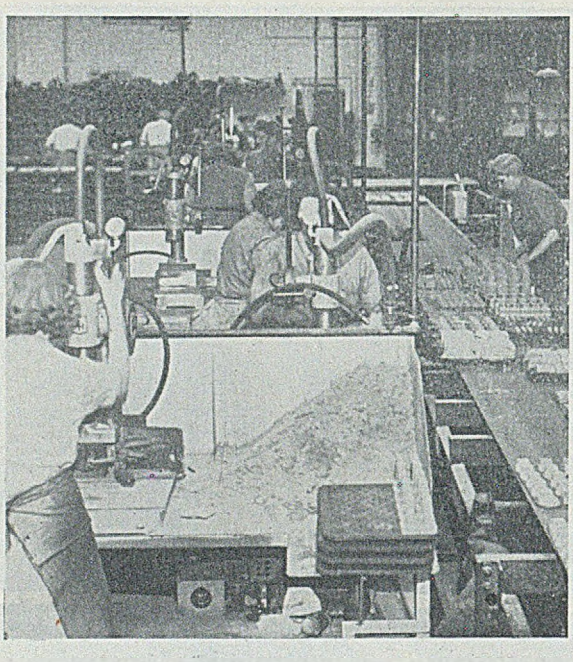


FIG. 12.—*Group of Bench-type Core-blowing Machines alongside the Core Conveyor.*

helped to close the mould) was able to remain in one position and any walking was eliminated. Another length of roller conveyor was introduced for highly-cored jobs and the drag half-mould was automatically conveyed to the core-setter. Likewise, the flask, when split subsequent to casting, was returned along the other conveyor, which was also inclined. The core-setter could thus remain stationary and a structure to contain the necessary cores was built adjacent to him, so that he had easy access to those wanted for the jobs running. Detailed study of movement is essential, and when rhythm is once established, high productivity will follow. Because of the large quantity of cores required, it was decided to produce them in the existing core shop where a number of Osborn & Redford core-blowers were already installed (Fig. 12). The cores are brought to the mechanized foundry and placed in trays in stillages (Fig. 13). The trays when required are handed over the pallet conveyor and stored near the core-setter.

FIG. 13.—*Arrangement of Stillages for holding a Large Number of Core Trays.*

Jacketing, Pouring and Shake-out

When the moulds are completed, they are carried forward on the conveyor to a point where the malleable-iron slip-jackets are put on by hand and the weights are placed on the moulds by means of a Wharton hoist (Fig. 14). On the conveyor directly opposite from this station, the jackets and weights are taken off (another hoist being used), and are returned by gravity roller conveyor to the weighting point. The moulds pass on to the pouring station, where a platform is provided for the men engaged in pouring, an overhead loop monorail, from which the ladles are suspended, being used. It is necessary to have two pouring ladles in the circuit (Fig. 15), and it will be seen that, whilst one man is pouring, the other collects metal from the electric furnace. A third operator stands on the "pulpit," operating the tilting of the furnace. This movement is not centre-line tilting, but is actuated by a horizontal ram to give back tilting,

FIG. 14.—*Operator placing a Binder and Weight on a Mould with the aid of a Wharton Hoist.*

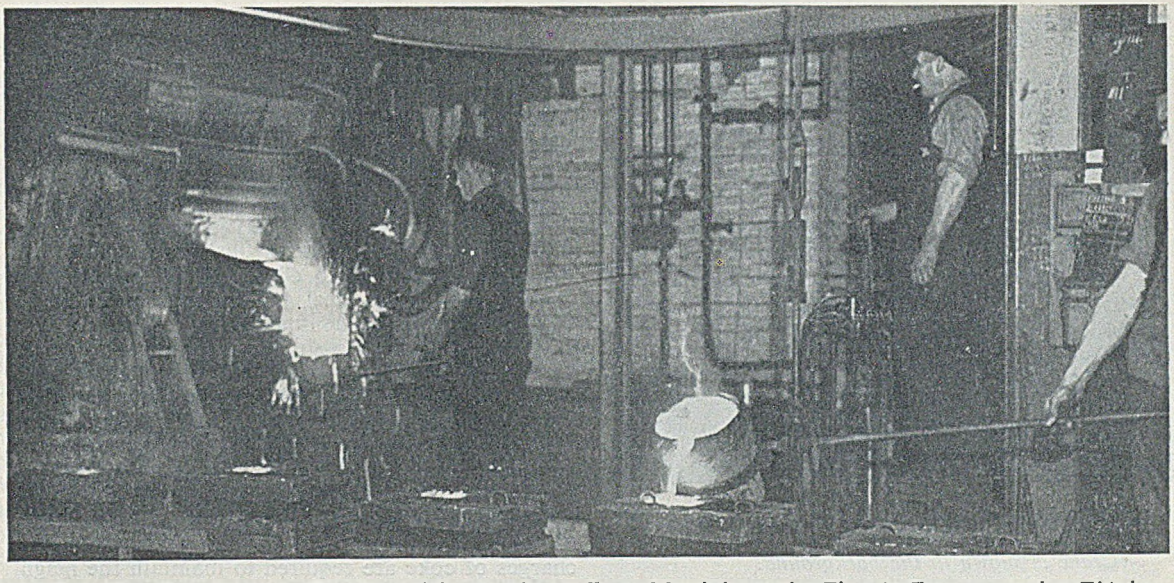


FIG. 15.—*One Operator Pouring while Another collects Metal from the Electric Furnace, and a Third controls the Tilting of the Furnace.*

such that the nose level is maintained and the ladle to be filled always remains at the same height. Each of the three men takes it in turn to perform this job, so that each regularly gets a rest from pouring. It will be noticed that the 120-lb. capacity ladles suspended from the monorail have a spring-loading device, which is in compression when the ladle is full and in tension as it empties.

From pouring to shake-out, a sufficient time elapses for cooling. A cooling tunnel, with ventilation, is not required, as the fumes produced after pouring are of small volume. After shaking out, the castings are thrown down a chute on to an apron conveyor, moving at 2 ft. per min., the conveyor being situated on the outside of the wall in another bay (Fig. 16). This conveyor affords a matter of 1¾ hrs. for cooling before rendering the castings capable of handling. Eventually, the conveyor re-enters the foundry, where the feeders and sprues are knocked off the castings and returned to the cupolas, whilst the castings are collected in trailers and conveyed by electric truck to the cleaning plant.

Melting Plant

Coming to a description of the melting plant, there are two cupolas in use, permitting one to run each day whilst the other is repaired. The cupolas are water-cooled, a feature introduced at the commencement of operation of the plant, because of the lengthy period of operation—11 hrs. per day. There are four tuyeres and a water-cooling box is placed between them. In addition, three sets of eight coolers are arranged above the tuyeres, the total depth of cooling amounting to approximately 5 ft. of the shaft. The cupolas are lined to 20 in. dia., except in the melting zone, where they are flared out to 26 in. dia. Each day the refractories are burnt away back to the coolers, this occurring, judging by experience, somewhere about half-way through the blow. The cupolas are of the front slagging type, as the metal and slag flow directly through a covered channel into a receiver which is slagged through the usual slag notch. No well of metal is allowed in the cupolas. The connecting channel, to which reference has

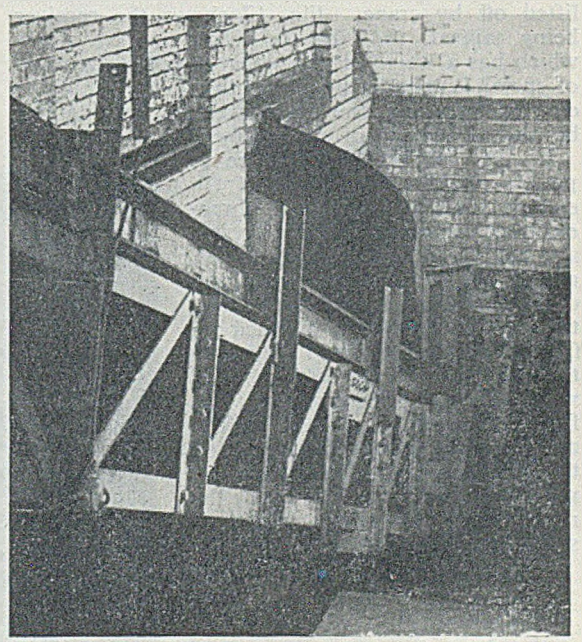


FIG. 16.—*Cooling Conveyor for Castings; it is carried outside the Wall of Another Bay and allows 1¼ hrs. before the Castings are handled.*

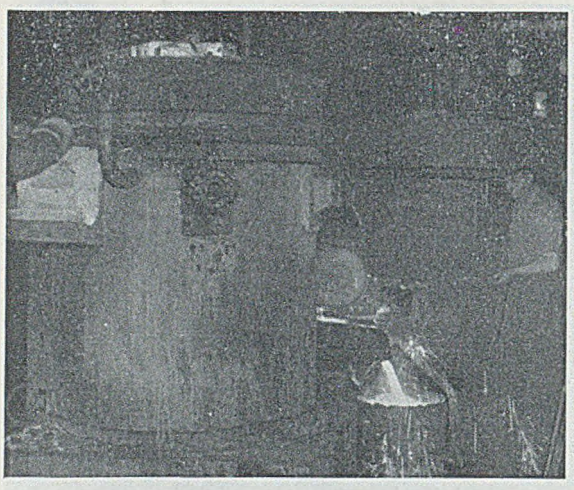


FIG. 17.—*Tapping Metal from One of the Cupola Receivers; a Receiver Roof suspended from a Crane is shown in the background.*

been made, is formed by ramming special ganister around a tapered former, roughly triangular in shape, with 2-in. sides tapered to 1½ in. A new channel is required each day.

The receivers are lined with insulating bricks and 6-in. cupola bricks. Arrangements are made for slagging to take place at two levels. A tapping brick is used in the furnace refractory, the actual hole, rammed with sieved ganister, being made to a former. Re-bricking of the receiver is necessary every six or seven weeks, and for this the roof is lifted off by crane. Fig. 17 shows the receiver being tapped; the ladle is picked up by crane, which has a weigh-scale, so that a definite amount of metal is transferred at regular intervals to the electric furnace. The gas-burner for heating can be seen at the top of the receiver.

In Fig. 18, the metal is being poured into the back spout of the electric furnace, which is a three-electrode, direct-arc, Héroult type, and holding 60 to 80 cwt. of molten metal. When re-lining, two layers of silica bricks are laid in the bottom and covered by a rammed refractory to form the bowl shape and the remainder of the bottom. The walls are lined with ganister. The furnace bottom is repaired weekly, and the walls every three weeks, so that the repairs to this furnace are not a major feature. The life of the roof (made of silica bricks) is somewhat variable.

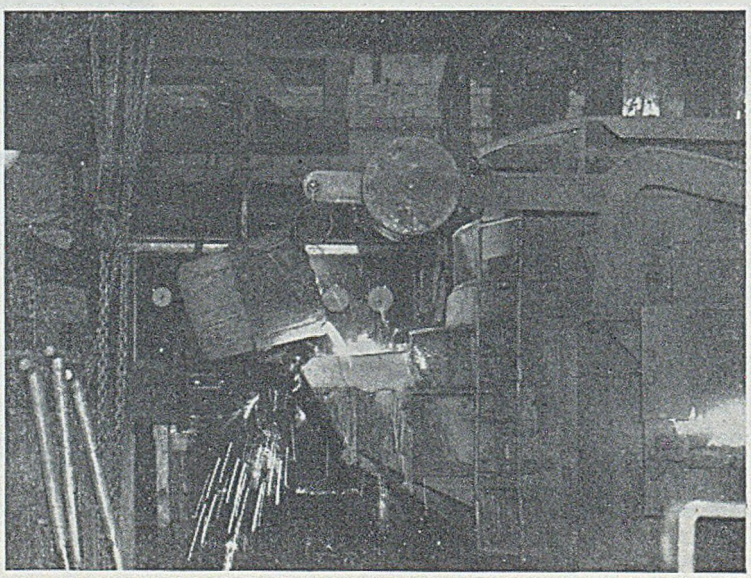
FIG. 18.—*Transferring Metal by Ladle from a Receiver into the Back Spout of the Electric Furnace.*

Metal Provision

The final composition sought in the metal is TC 2.3 to 2.5, Si 0.9 to 1.1, Mn 0.3 to 0.4, and P 0.1 per cent., and no desulphurization is practised. From the receiver, metal with total carbon varying between 2.65 and 2.80 per cent. is obtained, so that it is necessary to charge steel in the electric furnace to reduce the carbon to the desired amount. Additions of ferro-alloys, ferro-silicon and ferro-manganese are also made in this furnace, to adjust the composition. Each charge in the cupola consists of hard scrap, steel and hematite pig-iron.

Pouring should commence at 8 a.m., five minutes after the day-shift employees start work, by which time the electric furnace and receiver should be full of metal. The cupola fire is therefore lit in the early morning by the night shift men and the coke bed is blown up until the coke is incandescent. Previous to charging, the bed is finally taken to a height of 48 in. above the tuyeres. The coke-splits give a ratio of 8 to 1 metal to coke and, during the blow, occasional boosting charges of coke are required to maintain the height of the bed. The receiver is pre-heated by means of a gas burner.

The electric furnace is heated up initially and as the first batches of metal transferred from the receiver are of metal of higher total carbon than later batches, extra steel is added. This transfer of metal from the receiver takes place at regular intervals throughout the day and steel is added to the electric furnace on each occasion. Four test samples per day are taken from the receiver metal, *viz.*, from the first and second full receivers between 9 a.m. and 10 a.m. and again during lunch break from 12.30 to 1.30 p.m., when the receiver and the electric furnace are being filled up ready for re-commencement of pouring at 1.30 p.m. Hourly test samples are taken from the electric furnace and if the control is proving difficult, more may be necessary. Bars for physical testing are also cast



at intervals during the day. The average electrical load on the furnace is 200 to 210 k.w.h. per ton.

Although metal of higher temperature could be obtained it is arranged to melt metal such that the pouring temperature is in the region of 1,450 deg. C. By using duplexed metal, the temperature and the composition are more reliable, and the fear of discovering primary graphite in a casting is practically eliminated, provided graphite-containing materials are restricted to a minimum.

Key to Success

There is no doubt that the skill required in a mechanized foundry rests with the management. They should provide the necessary control if success is to result. The lay-out of jobs must be planned in detail, including gating and feeding. Sand and metal must be to specification, and each day's output of castings should be kept separate. A record of defective castings is needed, together with an analysis of their defects. In the main, the control of metal is more satisfactory than that of the sand and experience has shown that the latter is the cause of more defective castings than the former. Off-match castings, generally speaking, are more likely to occur when flask moulding than where steel moulding boxes are employed. "Shifters" have been found useful in counteracting the frequency of occurrence of off-match castings. With regard to the maintenance, the whole objective should be preventive measures, as it is prohibitively expensive to have plant idle. It is a good idea to have a production board near the moulding machines, on which output can be recorded for each hour from each pair of machines and all down-time can be listed, as well as the causes for it. A comprehensive report, at intervals, of time lost in this way should be prepared and action taken where possible to eliminate recurrent causes.

Finally, personnel engaged in the mechanized plant, including the maintenance staff, should be given adequate incentives, so that the highest output possible from the plant will be regularly obtained, and scrap, waste and down-time kept to a minimum. Higher productivity rates, greater cost efficiency and better-quality castings all can be obtained with a fully-mechanized plant, provided the management have the skill and ability to introduce and maintain the techniques and control required.

The Author takes the opportunity of acknowledging the permission granted to him by the directors of Leys Malleable Castings Company, Limited, Derby, to present this Paper and also the assistance given to him by his colleagues in its compilation.

Following presentation of the Paper, the Author was warmly complimented upon it, in a proposition put forward by Mr. B. Gale, seconded by Mr. C. F. Lawson.

Pattern Additions

By "Checker"

To overcome some of the difficulties in the production of good castings, it is at times necessary for additions to be made on the pattern which are not shown on the drawing. These can, of course, only be incorporated when permission has been given by the appropriate authority, and where no inconvenience or disadvantage will result in the machine-shops, etc.

Chaplets, as is well known, have to be used in some moulds to obtain a correct metal thickness between core and mould. Sometimes, for various reasons, it is found that chaplets of the size required for thin-section castings are not satisfactory and larger ones are used in their place. When this occurs, chaplet bosses can be added on the pattern at convenient places. Their size may vary to suit the individual requirements of any particular pattern, but generally $\frac{5}{8}$ in. square will be found satisfactory. The depth of these chaplet bosses is important, and care and accuracy must be exercised to ensure they are correct, and that the desired metal thickness is obtained.

For instance, where the thickness of a casting is $\frac{3}{16}$ in., and chaplets $\frac{1}{8}$ in. high are to be used, the chaplet boss will extend $\frac{3}{16}$ in. above the pattern face. Thus the desired cavity in the mould to receive the chaplet will then be correct. Fig. 1 shows a chaplet boss on a pattern and such additions can, of course, be made to both top and bottom.

Another instance where a pattern addition was necessary to obtain good castings is shown in Fig. 2. This consisted of placing a spherical-shaped face (shown shaded) on an existing flat boss, the top part of which, when cast previously, had resulted in a slightly

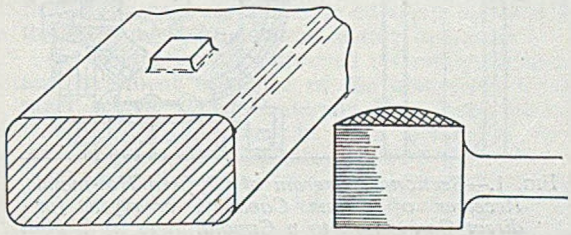


FIG. 1 (LEFT).—*Use of a Boss on a Pattern to adjust the Section to suit the Chaplet Size.*

FIG. 2 (RIGHT).—*"Sink" in a Boss corrected by a Convex Addition.*

sunken surface. Although this face was machined, satisfactory castings were not being obtained. The spherical top was added to counter this shrinkage, and in this way the trouble was eliminated.

IT IS ANNOUNCED by the Wharton Crane & Hoist Company, Limited, that from March 1 its representative throughout Scotland is Fisher, Baxter & Company, 140, West George Street, Glasgow, C.2.

A LICENCE for work amounting to £167,494 has been issued to Dorman Long & Company, Limited, for the construction of a crushing and grinding plant at the Lackenby steelworks, South Bank-on-Tees, Middlesbrough.

Hot-metal Receiver Plants

Equipment gives Flexibility to Cupola Working

Whilst the foundry cupola is an extremely economical method of melting, its output is intermittent, and it suffers from the drawback that it has no considerable storage capacity for metal. Both these points are of considerable importance in a modern foundry, especially in automobile and similar foundries where moulds have to be poured on the conveyor system.

In order to improve the performance of the normal cupola, increasing use is now being made of an adjunct consisting of a hot-metal receiver, either oil- or gas-fired, of the type shown in Fig. 1. Such a receiver, besides providing at all times an adequate reserve of metal, ensures that this is always at the temperature required, usually from 1,440 to 1,500 deg. C., and it will be readily appreciated that, in combination with a normal cupola, the plant becomes far more flexible and better adapted to modern metallurgical needs than the conventional model, however carefully this may be operated. In fact, where working conditions are suitable, the overall production of a foundry may on

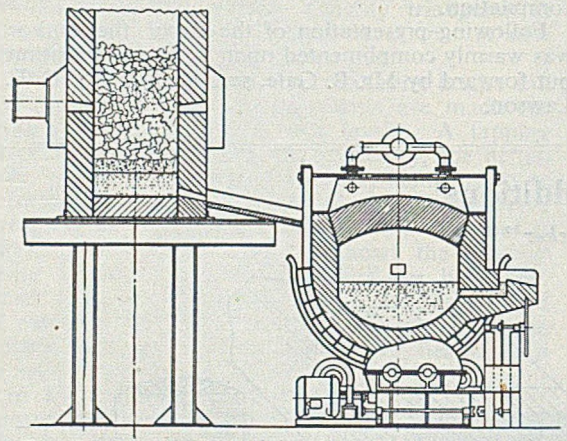


FIG. 1.—*Sectional Diagram of Oil-fired Hot-metal Receiver of 5-tons Capacity, arranged for direct Connection to a Cupola.*

occasions be increased between 30 and 40 per cent. by this additional item of equipment. Fig. 2 shows a receiver of the type described, which is part of a battery installed* in a mechanized foundry in the south of England.

Operation

In operation, the usual method is for the receiver to be heated up at the commencement of the day's work to a temperature which is about 50 deg. above that of the metal tapped, and it will be noticed that the design is such that the cupola metal can be tapped into one end of the receiver at the same time as pouring takes place from it. By this means, a constant through-put is ensured, which obviates any hold-up of production such as is liable to occur periodically when a cupola is used alone.

The main constructional features of the hot-metal receiver can be readily followed from the illustrations. The burner fires into one end of the furnace chamber, and the operation is regenerative, in that the exhaust gases from the chamber are used to preheat the air supply. The latter is furnished by a motor-driven fan and passes through a regenerator arranged in the furnace arch. The oil burner operates with an air supply at 2 lb. per sq. in. The particular receiver installation illustrated is entirely self-contained and fully mechanized. It is under push-button control, but the reduction gearing for the tilt embodies a clutch which enables a hand-wheel to be brought into operation for manual control in the event of any current failure. Silica bricks are employed for lining both for roof and side walls, the life of the receiver lining in regular operation in the average foundry being six to nine months. The design is such as to permit of a complete re-bricking during the period of a week-end shut-down.

The average hourly consumption of a 5-ton receiver of the oil-fired type as shown in Fig. 1 is 12 galls. per hr. when passing through metal at the rate of 10 tons per hr. While the illustrations show a hot-metal receiver installed in connection with a

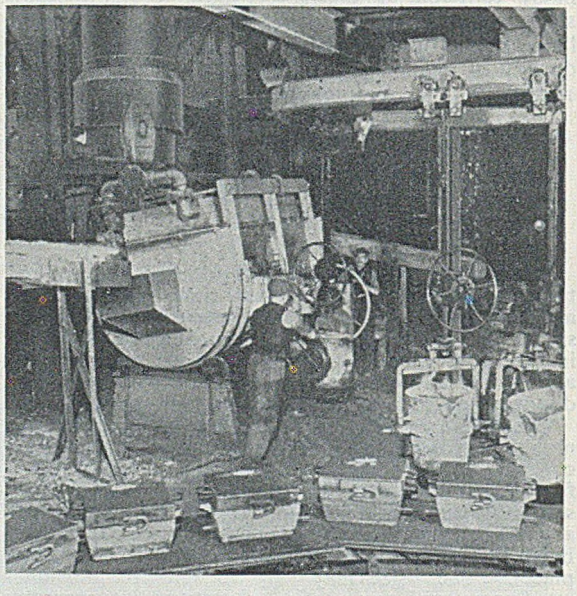


FIG. 2.—*One of a Battery of Hot-metal Receivers serving a Mechanized Foundry.*

single cupola, the arrangement can be varied to suit the requirements of individual foundries. For instance, a single receiver of the stationary type may be fed by a number of cupolas by means of suitable spouts to take the metal to the inlet of the receiver. Alternatively, the receiver itself may be mobile by being mounted upon a 4-wheel bogie, in which case it is afforded the necessary radius of action by fixing flexible pipes to the burners, which permits of a maximum travel up to about 4 yds. In other cases the receiver may be wheeled to a second cupola and re-coupled to fuel and air supply lines at this point.

* By the Monometer Manufacturing Company, Limited, Savoy House, London, W.C.2.

Mass-production Casting by Investment Moulding

Survey of the history and present-day status of the process for producing extremely accurate castings, in which an expendable pattern is almost invariably used.

Historical

The mass production of precision castings in the high-melting-point or "difficult" metals and alloys, by the investment or lost-wax process was a manufacturing technique almost unknown to industry prior to the last war. The simple basic technique of moulding by the lost-wax method has been known and worked for a long time; this art chiefly being practised by jewellers in the reproduction of finely figured or filigree articles, or by firms making dentures and dental inlays, etc. Whilst extremely intricate casting-shapes may be produced by this simple method, the operation is very slow, tedious and only suitable for manufacturing articles in small numbers.

During the war years, however, considerable developments occurred in modification of this basic lost-wax technique, by means of which the investment moulding process was converted into a truly mass-production method. As a result, precision type castings, usually of small weight, *i.e.*, up to about 7 lb., but often of very complex shape, and in a wide range of metals, were capable of being produced economically in large quantities. Valuable facilities were thus provided of a quite distinctive character, which could not be obtained with any other orthodox casting or moulding method.

Salient Features

Briefly, the investment casting process comprises the use of a mould, fashioned from some finely graded refractory slurry in a form capable of being poured into a special flask or container, within which has been mounted a wax replica of the casting required. This replica is completely embedded in the investment, the latter then being allowed to dry and solidify. Small passages are provided at selected points through the wall of the surrounding investment to act as feed runners and outlets from which subsequently to evacuate the wax. After the investment has set, it is heated slightly beyond the melting point of the wax, which latter is then run out through the outlet channel, leaving a cavity of the exact shape and size of the original wax pattern. This cavity will be contained within a one-piece investment mould.

Various kinds of waxes may be used, providing these can be melted and run freely at reasonably low temperatures. Alternatively, other substances may be employed which are capable of being burnt and completely vaporized to leave no residual dross, etc., in the cavity. After dissipation of the wax pattern, the investment is given a further heat-treatment to render it refractory to the molten metal charge and the cavity is then poured with the metal selected for the particular casting. After solidification and cooling, the casting is then removed by breaking up the walls of the investment mould, the latter thereby being rendered unsuitable for further use as a moulding agent. It is clear that, for each single casting produced, a separate wax pattern will be required. The entire process of mounting the wax pattern in the flask, pouring and heating the investment material, etc., will have to be repeated for every casting or every spray of castings made. Modern developments have been directed chiefly to overcome these limitations and to make the process applicable for large-scale repetitive production.

Modern Developments

The success of such development work is mainly attributable to researches made along several important lines, chief of which are as follow:—

(1) The development of superior wax compositions, or synthetic thermo-plastics for making the wax patterns, so that closer dimensional stability and better running properties can be obtained.

(2) Introduction of more economical methods of making the wax patterns rapidly and on a sufficiently large scale to ensure adequate supplies for the later mass production casting operation.

(3) Production of improved refractory materials and treatment sequence of the completed investment mould. Such materials have been selected with special reference to their ability to resist extremely high casting temperatures.

(4) Institution of better ways and means of feeding the molten metal charge into the investment mould to ensure proper reproduction of intricate cavity formations. For certain types of small-size but complex components, the use of centrifugal force for feeding has been found extremely advantageous.

(5) The development of suitable casting alloys which exhibit no measurable scale of variation in the degree of volume change when passing from molten to the solid state, thus making it possible to maintain closer control over precision dimensions on castings.

A typical production schedule of operations may now be related for one typical procedure followed when moulding a precision type casting, for example, a specially-shaped turbine blade. Its form is somewhat intricate, and the material is a high-nickel alloy having great toughness, heat-resistance, and of high melting-point. The part is required in considerable quantities with uniformity of shape and accuracy of dimensions held to fine limits, *i.e.*, plus or minus 0.001 in. per inch. Manufacture of

this component was formerly performed by machining wholly from bar stock, and casting by the precision investment method was selected as the means for eliminating this very costly machining. Parts had to be produced free from "flash" so as to be capable of mounting straight into the rotor after leaving the investment mould.

Production Stages

As a first step in the reproduction of such a casting, an accurate and exact replica of the part is required in order to construct a die from which a sufficiently large number of accurate wax patterns may be obtained. Such a replica may be produced by machining, or moulding. Steel, brass, wood, plaster, or plastic materials are frequently employed for this purpose. Generally, however, aluminium, which has very free machinability, high corrosion resistance, low cost, and takes an excellent surface finish, will be found to give the best results. The dimensions of the master metal pattern have to be carefully determined in relation to those required on the finished casting, and the scale of tolerances to be observed at various locations. Adequate allowances have to be made on critical dimensions to compensate for slight variations occurring from shrinkage of the wax pattern, and the casting metal upon solidification. This allowance may range from 1 to 2 per cent. per inch of dimension.

The die may be produced from such a master pattern in a variety of ways; selection of any particular method being determined chiefly by the degree of complexity of shape of the required casting. Generally, a die will be of the split, two-piece type, so that the finished patterns may be extracted easily. The main parting joint of the die is usually disposed transversely around the centre line of the *largest dimension* of the pattern, to avoid undesirable undercuts in the die cavity. Sectional or composite dies may be necessary, if the component is very intricate.

White-metal Dies

One of the most effective methods of die production, suitable for parts of relatively simple shape, is by casting direct from the master metal pattern. For this purpose, a casting metal of 60 per cent. bismuth, and 40 per cent. tin is employed. For this process, the master pattern is used to impress exact half-cavity formations in some mouldable material (such as plaster of paris) mounted in suitable boxes. The pattern is embedded in the plaster, and the white-metal alloy is poured around the exposed half to produce a hollow shell. This alloy melts at about 188 deg. C., but it should be poured at the slightly higher temperature of about 204 deg. C. to obtain best results. When one shell half has thus been made, the plaster is removed from the master pattern, and a second shell is cast thereon corresponding to the remaining half portion. The respective shell halves are then mounted in steel or Babbitt metal blocks to confer durability, the latter being dowelled to ensure correct alignment of the cavities. Provision has also to be made for clamping the die halves together, to avoid any opening across the parting when molten wax is injected into cavities. Suitable runner channels have also to be machined across the parting joint surface, to convey the wax into the cavity.

It will be appreciated that this method enables any number of negative-cavity shell impressions to be made from a single master pattern, and if the quantity of castings is very large, it is advisable to employ multi-impression dies for making such wax patterns. The white-metal alloy possesses two very important advantages; it has a slight expansion upon solidification, which ensures clear-cut reproduction of finely figured impressions and gives an excellent surface finish.

Sprayed Dies

To produce die cavities by metal-spraying the following procedure is adopted. The metallic pattern is first given a thin, uniform coating of tallow. It is then impressed to the selected half-way parting line into a bed of Plasticine, or plaster. The exposed upper portion of the metal pattern is then sprayed with metal by the usual gun appliance to form a coating of about $\frac{1}{16}$ in. thick. Copper, zinc or aluminium metal may be sprayed for such work. The process is then repeated for the other half pattern, tallow being applied at the parting line edges.

Next, the two sprayed halves of the die replicas are removed from the master pattern and mounted in suitable steel, or Babbitt-metal support blocks, as with the previous method. These blocks are dowelled and equipped with runner channels as for the previous method. Again, one metal pattern may be sprayed a large number of times to produce shell negatives suitable for use with multi-impression dies. The cavity of each successively produced shell will be identical in every minute respect with its predecessor, to a scale of accuracy impossible with ordinary copy machining and tooling methods. From this description, it will be understood the greatest care is essential at the die-making stage, for the accuracy obtained with the shell cavity halves determines that of the finished investment casting.

Dies of this character are relatively inexpensive, and have a very long working life, since the low-melting-point wax material injected therein imposes no severe wearing conditions. After the shell halves have been mounted correctly in the die blocks, a light buffing operation may be necessary on the cavity walls to enhance the surface finish.

Making Wax Patterns

The next step is that of making a supply of wax patterns. This may be performed in one of two ways. The die may be clamped to the platen of a pneumatic, injection-type machine, and the wax forced into the cavities by an injecting plunger acting under a pressure of about 25 to 30 lb. per

sq. in. Alternatively, a large quantity of wax may be melted in an electrically-heated crucible, and small supplies withdrawn by means of hand-operated guns, having an injecting plunger and nozzle for engagement with runner channel in the die. Usually, such hand guns have a pressure of 15 to 20 lb. per sq. in. This latter method proves particularly convenient where only a few simple-type dies have to be filled. For production on a larger scale, the first method is the most economical and reliable.

Special wax compositions are necessary to meet the requirements of precision investment moulding, possessing the following properties:—(*a*) The wax should melt at about 60 to 65 deg. C. Those melting above about 70 deg. C. are classed as high-melting-point waxes, and are generally employed when close precision features are not required in the finished casting. (*b*) Upon solidification, the wax material should be hard, tough and durable to resist distortion tendencies, etc., attendant upon handling when manipulating the pattern into the investment flask. (*c*) The material should have high dimensional stability, and show no measurable variations in volume during solidification. Waxes liable to shrink a considerable amount will entail the provision of greater allowances on the dimensions of the master pattern and die cavities, thus making it more difficult to maintain strict control over sizes of finished castings. (*d*) The wax should run very freely in its melted state, preferably with a complete absence of residues, or gassing. (*e*) The material when solidified should take a very smooth surface finish, with no tendencies towards "pimpling" or rough spots.

5. Typical wax compositions are:—For cases where close tolerances on the dimensions of the finished casting are unnecessary, a wax of the following kind is quite suitable: Paraffin, 60; carnauba wax, 25; ceresin, 10; and beeswax, 5 per cent. For precision requirements, a paraffin wax to the following composition gives satisfactory results: Carnauba wax, 40; rosin, 40; beeswax, 10; and paraffin, 10 per cent. Alternatively, a synthetic plastic/wax composition of the following character will show markedly superior properties over the previously mentioned natural paraffin waxes, and is to be preferred where the finest tolerances have to be maintained on dimensions of the finished castings: Diglycol stearate, 16.5; Acrawax "B," 19.5; ceresin, 42.0; and beeswax, 22.0 per cent.

Preparation for Investment

Upon removal from the die, thin flash fins may occur along the parting line of the pattern and runner-gates will have to be removed. This operation is usually performed by careful manual trimming. Before the wax pattern can be used in the investment mould, feeder sprues and riser heads must be attached. These are welded to the sides of the pattern at carefully selected points, and are fashioned from exactly the same wax material. Afterwards, the complete pattern assembly is mounted on a steel base-plate for fixing within the investment flask. The base-plate is usually attached to the riser and feed heads.

Prior to mounting the pattern in the investment flask for moulding, it is given a film-like coating of an extremely fine refractory. This may be composed of fine silica particles suspended in a liquid to allow application by a simple dipping process. Recent researches have revealed that this film coating of the wax pattern is critical to the quality of the finished casting. To overcome certain limitations associated with use of ordinary simple silica suspensions, an improved treatment and refractory material have been developed successfully. For this, the wax pattern is first cleaned, then is wetted by immersion in a soapy solution. Two coatings of the refractory mixture are applied, this being a special mixture containing organic materials, silicon esters, zircon flour, alcohol, water, and hydrochloric acid. The zircon flour is of extremely fine particle size, *i.e.*, passing a 200-mesh screen. The refractory mixture may be applied by ordinary dipping or spray-gun. The first coating requires from 10 to 12 hrs. to dry, after which the second coat is applied, this taking from 3 to 4 hrs. for complete setting. The silica esters subsequently break down to form a gel which holds the refractory particles closely together and the subsequent application of heat, occurring when the pattern is placed in the investment flask, causes the gel to change into silica, thereby imparting much additional strength to the coating.

The purpose of the coating is to reproduce the high quality surface finish of the wax pattern, and to ensure a heat-resistant skin on the mould cavity after the wax pattern has been dissipated. Incorrect treatment at this stage, or use of unsuitable refractories, may result in serious production difficulties, or to imperfections in the finished casting.

Investment

The treated wax pattern is next mounted in the investment flask. This is usually a hollow (cylindrical) container and may be made of sheet metal, or well-waxed cardboard. No great pressure or internal stresses arise in the use of this flask. The height of the flask needs to be considerably greater than the overall height of the pattern assembly so as to accommodate sufficient investment material and allow for contraction upon setting; generally, 30 to 50 per cent. is adequate. The bottom of the flask is sealed off (with wax) around the metal base-plate affixed to the pattern, so that the whole container is portable. The pattern is situated about centrally in the flask, to allow an equal amount of investment material around all its sides. The investment mixture is of the greatest importance to successful results, and has to be blended from selected refractories in aggregates of different particle size. Ethyl silicate is employed as the binding agent and measured quantities of this refractory mixture are hydrolized with a silicon-ester solution. It is essential that the investment mixture shall be completely inert and incapable of re-acting with the metal used for casting the components. Numerous

compositions are available, according to the character of the casting metal employed, etc., but a typical one is:—

Sillimanite to 30 mesh	3,000 gm.
Sillimanite "FF"	375 gm.
Methylated spirit	827 ml.
Silicon-ester solution	281 ml.
Hydrochloric acid	17 ml.

The silicon-ester solution is made up with condensed ethyl silicate 75, ethyl alcohol 18 and water 7 per cent. by volume.

For filling with the investment mixture, the flask is placed upon a small vibrating table, having an amplitude of approximately ½ in. and oscillating from 250 to 300 strokes per min. The shaking action thus induced causes the slurry to pack closely and tightly around the wax pattern; the particles of the material become compacted well together; excess liquid is brought to the surface of the mass, and air is eliminated from the mould. After about one hour, the investment slurry takes on a certain "set," whereupon all excess material, and liquid, at the top may be removed by sawing.

Drying and Incineration

The investment flask is next placed in a drying oven and remains therein at a temperature of 40 to 50 deg. C., for 8 to 12 hrs., according to the mass of the material. At the commencement of this drying operation, the wax pattern is melted out, and is run into trays for later refinement and re-use. A considerable proportion of the wax can be reclaimed in this manner and used over and over again, providing it is refined.

At the end of the drying period, the flask is removed from the completely hard mould, and further heating is applied to the latter. The temperature is raised to around about 1,000 deg. C., and maintained for from 3 to 5 hrs. In the case of moulds required for use with high-melting-point metals, the heating process is extended to bring mould up to the melting-point of the casting metal. Careful attention has to be given the mould heat-treatment, because moulds cannot be successfully re-heated after substantial cooling, without risk of crack formation.

Casting

The melting and actual pouring of the casting metal is often effected by the trunnion-type electric-furnace. For mass production casting, the furnace should have a rotating table whereon several moulds can be clamped and fed in rapid successive fashion to the furnace so as to give continuous operation. The entire furnace is inverted to permit the metal to flow into the mould cavity, and, subsequently, feeding is induced by the application of air pressure. Pressures ranging from 5 to 80 lb. per sq. in. may be employed, depending on the intricacy of the cavity, the type of metal, and the degree of homogeneity desired. Normally highest pressures are employed with high-melting-point metals.

The grain structure of finished castings can be controlled to a large extent by the temperatures of the investment mould and casting metal. For instance, a coarse-grain structure will result from hot moulds, and fine-grain from cooler moulds.

Generally, after pouring, the mould cools gradually over several hours before it may safely be handled for breaking up to extract the casting. The only trimming necessary for the latter is that needed to remove ingate/runner/riser metal. There will be no parting-line fin, or corresponding flash as occurs with ordinary sand castings or die-castings. Waste metal is usually severed rapidly by band-saw or cutting-off wheel.

Conclusion

The foregoing description indicates numerous practical advantages which have now been embodied in the process, as well as showing how, from an engineering angle, the investment process can quite feasibly be adapted for mass-production casting. Several other advantages and certain limitations may be briefly noted. For instance, with orthodox methods of casting, the presence of deep undercuts, exceedingly thin projections, holes of awkward shape and those whose axes do not lie in a single plane, present considerable difficulty, since cores have to be extracted, and the split die or mould opened to remove the casting or pattern as the case may be. These troubles do not arise with investment moulding. Furthermore, since the investment mould is wholly devoid of parting joints or similar interruptions, closer accuracy can be maintained on dimensions, and "flash" is largely eliminated. Metallurgically, castings have fine, close-grain structure and a high degree of homogeneity. The liability towards porosity due to trapped air or shrinkage is very much less than with pressure die-casting, for example.

Labour costs in operating the process are reasonably comparable to those of die-casting, since unskilled labour may be employed for most operations and machines. Skilled and strict supervision is necessary, however, to ensure adherence to laboratory specifications at all stages. The process is far more limited in respect of size and weight of casting than is die-casting or ordinary sand moulding. It is best adapted for producing small castings, *i.e.*, those whose length does not exceed about 9 in., and having a weight less than about 7 lb. On the other hand, castings weighing a fraction of an ounce may be successfully mass produced using multi-gated wax patterns.

In its modern form, the process is split into numerous simple operations, the performance of which, however, occupies a large floor space, and the use of several conveyor systems for transferring parts. This often involves additional cost and inconvenience. Despite these considerable limitations, precision investment casting has opened up valuable possibilities for the component designer and production engineer to permit economical production of component shapes hitherto impractical by the conventional foundry methods.

Inspection in Industry

A report of a visit to the U.S.A. in 1951 of a specialist team on inspection methods in industry sponsored by the British Productivity Council has now been published. The leader was Mr. L. Sollis, managing director, Highfield Gear and Engineering Works, Huddersfield. Some 22 plants mostly engaged in the light engineering and non-ferrous alloy industries were visited. The report presents an outline of principles and practice approved in both the U.K. and the U.S. that should be valuable alike to small and large firms, and those in other industries besides engineering.

The team concludes that the best British practice in inspection is not behind the best in America. There is, however, a larger enthusiastic following in the U.S. than is evident here. A return to the older custom of placing responsibility for quality on the operative was noted by the team. In the early days of mass production this responsibility tended to be placed on inspection. Now, more effectively, the task of inspection is to inform and prevent rather than to sort into good and bad. Inspection, states the report, is primarily a function of management. In all fields of management and at all levels it is not enough to set up an organization to carry out a process; there must be a continuous check that the organization is fulfilling its purpose. In the plants visited quality control has been given the status of a major management function. The change of name from "inspection department" to one including the word "quality" is significant as indicating that inspection is only one of the tools of quality control.

Copies of the report may be obtained from the British Productivity Council, 21, Tothill Street, London, S.W. (Price 3d.)

I.M.C. Sulphur Allocations Ended

The Sulphur Committee of the International Materials Conference has announced that its member governments have accepted its recommendation to discontinue international allocations for sulphur with effect from March 1.

The committee noted that the substantial improvement which had taken place in the sulphur position over the last six months of 1952 was continuing in the current half year. The committee's review of the situation also indicates that there are reasonable prospects of obtaining a balance between world supply of sulphur and the demand for the remainder of 1953.

Fall in Unemployment

The number of people registered as unemployed at February 16 was 428,800, a decrease of 23,700 since January 12. Of the total, 175,900 had been unemployed for more than eight weeks.

The numbers employed in the manufacturing industries rose by 16,000. This was mainly accounted for by increased employment in the textile and clothing industries. There was a drop of 2,000 in the metal manufacturing industries.

INQUIRIES FOR FACTORIES from firms outside the area during the past two months had been few, but many existing firms were expanding, stated the Board of Trade Controller in a report to the Northern Regional Board for Industry. Nineteen industrial development certificates had been issued during December and January, covering more than 469,000 sq. ft.

Employment Prospects in the North

Employment prospects in the north of England are assessed in "The Northern Region," published by the North East Development Association, 9, Eldon Square, Newcastle-upon-Tyne, 1 (price 1s.). The Association is apprehensive as to the future in the shipping, shipbuilding, and associated industries, and draws attention to the danger of redundancies in coal mining, particularly in west Durham. It stresses the need to continue the search for new industry or new developments in existing industries so as to give greater diversification, and suggests the necessity for a more strict application of the development area policy, especially if the west Durham problem is to be solved.

Attention is drawn to the problem of continuing rural depopulation. The establishment of small industries in rural areas presents a problem, particularly in view of the competing demands of the industrial parts of the development area. The report points out that much will depend on local initiative. This is a matter demanding the attention of rural authorities.

Stewarts and Lloyds, Limited

An expansion of £11,031,474 to £68,659,358 took place in the group assets of Stewarts and Lloyds, Limited, in the year ended September 27, 1952. Net current assets of £19,906,627 compare with £17,787,192 in the previous year. The total of current assets is £39,651,036, against £31,849,378.

The group's profits, totalling £13,394,709 for the full year, compare with £8,371,815 for the preceding nine months, that is about £11,162,420 for a year. After tax and all other charges have been deducted, the net figure of £5,571,067 goes against an actual figure of £4,186,883, equivalent to £5,582,510 per annum. Dividends absorb a net sum of £661,551.

Maudslay Scholarship

Through the generosity of the Maudslay Society, the Junior Institution of Engineers is enabled to offer a scholarship of £150 for one year to young engineers for the purpose of assisting them in their technical education and practical training. Candidates must be not more than 25 years of age and must be an engineer or training to be an engineer wholly or mainly interested in mechanical engineering. The scholarship for 1952 was awarded to Mr. R. T. Collett, of Nuneaton.

Further particulars may be obtained from the secretary of the Junior Institution of Engineers, 39, Victoria Street, Westminster, London, S.W.1.

Industrial Damage Due to Floods

The London and South-Eastern Regional Board for Industry stated last week that the greatest damage to industry in London and the south-east by the recent floods was by injury to plant, fixtures, and stocks. Among the industries most affected were oil refining, engineering, electrical engineering, and cement. Nearly all firms are now more or less back to ordinary working.

Representatives of the Board of Trade are keeping in close touch with both local authorities and industrial concerns to make sure that they are receiving as much help as possible in the task of restoring industrial productivity.

British Blast Furnaces in the December Quarter, 1952

These tables are published through the courtesy of the British Iron and Steel Federation.

Derbyshire, Leicestershire, Notts, Northants, and Essex.

Name of firm.	In blast at end of the fourth quarter, 1952.					Weekly average in blast.	Total existing at end of quarter.
	Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.		
Clay Cross	—	—	1	—	1	1	2
Ford Motor	—	—	1	—	1	1	1
Holwell Iron	—	—	3	—	3	3	4
Kettering Iron & Coal	—	1	1	—	2	2	2
New Cransley Ionr & Steel	—	—	1	—	1	1	2
Renishaw Iron	—	—	2	—	2	1.3	2
Sheepbridge	—	—	2	—	2	1.2	2
Stanton Ironworks: Stanton-by-Dale	—	—	5	—	5	5	5
Staveley Iron & Chemical	—	—	4	—	4	3.3	4
Stewarts and Lloyds: Corby	—	4	—	—	4	4	4
Wellingboro' Iron	—	2	—	—	2	2	3
TOTAL	—	7	20	—	27	24.8	31

Lancashire (excl. N.-W. Coast), Denbighshire, Flintshire, and Cheshire.

Brymbo Steel	—	1	—	—	1	1	1
Darwen & Mostyn	—	—	—	1	1	1	1
Lancashire Steel Corp'n	—	2	—	1	3	2.5	3
TOTAL	—	3	—	2	5	4.5	5

North-West Coast.

Barrow Ironworks	2	—	—	—	2	2	3
Charcoal Iron	—	—	1	—	1	1	1
Millom & Askam	2	—	—	—	2	2	3
United Steel: Workington	2	—	—	1	3	3	3
TOTAL	6	—	1	1	8	8	10

Lincolnshire.

Appleby-Frodingham	—	7	—	—	7	7.4	8
Lysaght, J.: Scunthorpe	—	4	—	—	4	4	5
Thomas, R., & Baldwins: Redbourn	—	2	—	—	2	2	3
TOTAL	—	13	—	—	13	13.4	16

North-East Coast.

Cargo Fleet Iron	—	2	—	—	2	2	3
Consett Iron	1	2	—	—	3	3	8
Dorman, Long: Acklam	—	3	—	—	3	3	4
Redcar	—	2	—	—	2	2	2
Cleveland	—	3	—	—	3	3	4
Bessemer	—	2	—	—	2	2	3
South Bank	—	—	—	2	2	2	3
Gjers, Mills & Co.	2	—	—	—	2	2·2	5
Pease & Partners	2	—	—	—	2	2	3
Skinningrove Iron	—	2	—	—	1	2	3
South Durham Steel & Iron	—	2	—	—	2	2	2
TOTAL		18	—	2	25	25 2	35

Scotland

Bairds & Scottish Steel	1	1	1	—	3	3	5
Carron	—	—	1	—	1	1	4
Colvilles	—	3	—	—	3	3	3
Dixon's	—	1	1	—	2	2	6
TOTAL	1	5	3	—	9	9	18

South Wales and Monmouthshire.

Briton Ferry Works	—	1	—	—	1	1	1
Guest Keen Baldwins: Cardiff	1	2	—	—	3	3	4
Thomas, R., & Baldwins: Ebbw Vale	—	2	—	—	2	2	2
Steel Company of Wales: Margam	—	3	—	—	3	2.8	3
TOTAL	1	8	—	—	9	8 8	10

John Brown as Holding Company

Plans for converting John Brown & Company, Limited, the Clydebank shipbuilding firm, into a holding concern were announced this week by Lord Aberconway, chairman of the company. He said that it was so far impossible to make any definite statement of the board's policy regarding buying back nationalized steel assets because the denationalization conditions were not yet known.

The scheme is to transfer all the company's trading activities and assets to a new company to be called John Brown & Company (Clydebank), Limited. The changeover is to take effect from April 1. The new company will have an issued capital of £5,000,000 in £1 shares, which will be allotted to the holding company as consideration for the transfer. The businesses carried on by the new company will be those of shipbuilding and engineering now carried on at the Clydebank engineering and shipbuilding works, the construction of steam-generating plant, which will be carried on at the new Whitecrook Works at Clydebank, and the remaining trading activities of John Brown & Company, which are of comparatively minor importance.

Initially, the new company will be provided with adequate working capital amounting to approximately £1,500,000, of which just under £1,000,000 will be in Government stock at nominal value. A meeting has been called for March 27 to approve the proposal.

IT HAS BEEN STATED that Mr. A. D. Daysh has resigned from the board of Monsanto Chemicals Limited.

Development of Newfoundland

With the object of exploring and exploiting the natural resources of certain selected areas in Newfoundland and Labrador, the British Newfoundland Corporation, Limited, has been formed, with an authorized capital of 10,000,000 shares of no par value. This follows negotiations between the Newfoundland Government and a syndicate of British and Canadian interests.

British members of the syndicate include the English Electric Company, Limited, the British Metal Corporation, Limited, Imperial Chemical Industries Limited, and C. T. Bowring & Company, Limited, oil refiners, and exporters of iron, steel, tinplates, etc., to Newfoundland. Funds will be provided to permit the corporation to carry out the first stages of its undertaking to the Newfoundland Government.

British Blast Furnaces in the December Quarter, 1952—*continued*

Staffordshire, Shropshire, Worcestershire, and Warwickshire.

Name of firm.	In blast at end of the fourth quarter, 1952.					Weekly average in blast.	Total existing at end of quarter.
	Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.		
Goldendale Iron	—	—	1	—	1	1	2
Lilleshall	—	—	1	—	1	1	2
Round Oak Steel Works	—	—	1	—	1	1	2
Shelton Iron, Steel & Coal	—	3	—	—	3	3	3
Stewarts and Lloyds: Bilston	—	2	—	—	2	2	3
TOTAL	—	5	3	—	8	8	12
Sheffield.							
Park Gate Iron & Steel	—	2	—	—	2	2	2
GRAND TOTAL	13	61	27	5	106	103.7	139

Weekly Average Number of Furnaces in Blast during the December Quarter, 1952, and the Previous Four Quarters

District.	1951.	1952.			
	Dec.	March.	June.	Sept.	Dec.
Derby, Leics., Notts., Northants, and Essex	24.4	24.5	23.0	25.8	24.8
Lancs. (excl. N.-W. Coast), Denbigh, Flint, and Ches.	4	4	4	4	4.5
Lincolnshire	13.7	13.1	12.8	13.4	13.4
North-East Coast	24	24	24.3	25	25.2
Scotland	9	9	9	9	9
Staffs., Shrops., Worcs., and Warwicks.	8.5	8.4	8.7	8	8
S. Wales and Monmouth	7.7	7.8	8	9	8.8
Sheffield	2	2	2	2	2
North-West Coast	8	8	8	8	8
TOTAL	101.3	100.8	100.4	104.2	103.7

The following companies have furnaces in course of construction or rebuilding:—Barrow Ironworks; Darwen & Mostyn Iron; R. Thomas & Baldwins (Ebbw Vale); John Summers; Appleby-Frodingham Steel Co. (2).

United Steel's Results

An increase of nearly 29 per cent. in the rate of trading profits was achieved by the United Steel Companies, Limited, in the year ended September 27, 1952, the total being £7,316,725 compared with £7,071,242 for the 15 months ended September 29, 1951. With non-recurring profits of £230,488 (£86,495 after £285,048 to stock reserve) and investment income £311,501 (£391,126), the group's total profit is £7,858,714, against £7,548,863.

The year's outlay on replacement and extension of capital equipment amounted to £5,357,290. The directors report that it is expected that outgoings on capital account will be considerably higher than this figure in each of the next two years, owing to large payments for the blast-furnace extensions at the Appleby-Frodingham works. Group commitments amount to £9,980,000.

The new valuation of loose plant, tools and equipment has resulted in the transfer of a surplus to stock reserves. The estimated increase in working capital needed to finance the volume of stocks is £1,000,000. The stock reserve has been correspondingly increased and now amounts to £3,000,000.

ASSOCIATED LEAD MANUFACTURERS, LIMITED—Mr. W. K. Davey has retired from the board.

Index of Industrial Production

The index number of industrial production (1948 = 100) prepared by the Central Statistical Office is estimated provisionally at 111 for December compared with a revised figure of 122 for November. Figures for the corresponding months of 1951 were 113 for December and 123 for November. The provisional index for 1952 is 114 compared with 117 for 1951.

On the basis of information so far received the index for all industries for January is expected to be 117-118. The figures have been adjusted to show the average weekly rate of production in each month, but no correction has been made for annual or public holidays.

The greatest drop during December, which is subject to further revision, was in the mining and quarrying category, resulting chiefly from the decrease in coal production during the month. The figure was provisionally 103 compared with 116 in November. Christmas holidays have to be taken into account here, and also in the manufacturing industries, where the production figure, at 112, compared with 124 in November and 115 in December, 1951.

CROMPTON PARKINSON, LIMITED—Mr. J. V. Daniel has been appointed joint managing director, and Mr. D. E. Graham has been appointed an executive director.

Personal

MR. A. S. DUNCAN, B.Sc., assistant general manager of the Doncaster works of Crompton Parkinson, Limited, has been appointed general manager.

MR. C. H. FLURSCHEIM has been appointed assistant chief electrical engineer of the Metropolitan-Vickers Electrical Company, Limited, in addition to his present post as chief engineer of the switchgear department.

MR. R. J. V. WHEELER has been appointed secretary of Newton Chambers & Company, Limited, Thorncliffe Ironworks, Sheffield. He succeeds Mr. A. W. Grogan, who is retiring.

MR. C. O. BURGESS, the technical director of the Gray Iron Founders' Society of America, is spending a few weeks in this country. Amongst other business, he is to acquire a first-hand knowledge of the British foundry research organization.

MR. W. E. BARDGETT has been awarded the Iron and Steel Institute Robert Hadfield medal for 1953, in recognition of his contribution to the development of alloy steels, with particular reference to steels for service at elevated temperatures. Mr. Bardgett is research manager of the central research laboratories of the United Steel Companies, Limited.

MR. A. A. WADDELL, of Edinburgh, a partner in the firm of J. Cairns, of Saigon & Cholon, Indo-China, is going to Ceylon to instal a rice mill. The machinery was manufactured by Lewis C. Grant's Engineers, Dunnikier Foundry, Dysart, Fife. Mr. Waddell served his apprenticeship in the workshops of the North British Railway Company at Burntisland.

MR. FREDERICK HENRY HARRIS has been appointed group production adviser of Associated British Engineering, Limited. Until his present appointment he was works manager for B.S.A. Tools, Limited, in Birmingham. He began his engineering experience with an apprenticeship with the British Thomson-Houston Company, Limited, and subsequently served with that company before becoming production controller at Alfred Herbert, Limited.

AN OUTSTANDING DISTINCTION in amateur golfing circles was bestowed on MR. ALAN SOWDEN, of Ilkley, who was installed in London last week as president of the English Golf Union. Mr. Sowden is at present connected with George Hattersley & Sons, Limited, loom makers, Keighley. He is past-president of the Bradford and District Association of the Engineering and Allied Employers' National Federation, and an associate member of the Institution of Civil Engineers.

MR. W. L. HENDERSON, A.M.I.E.E., has resigned his position as assistant secretary to the Engineers' Guild, Limited, as from April 1, 1953, which post he has held since 1948, in order to take up a position in industry. The General Council of the Guild have appointed MR. J. G. ORR, M.A. (Cantab.), to succeed Mr. Henderson. Mr. Orr is a graduate of Cambridge and a barrister-at-law, and, until recently, held a responsible position with the British Motor Trade Association.

MR. M. H. DONALDSON, who was manager of the 1949 Scottish Industries Exhibition at Glasgow, is to manage the Scottish Industries & Trade Fair which is expected to attract many American and other world buyers to Glasgow next year. The exhibition, which is to be held in the Kelvin Hall in the autumn, is being promoted by the Scottish Council (Development and Industry). Mr. Donaldson also managed the Enterprise Scotland Exhibition in 1947 and was assistant manager of the 1938 Empire Exhibition at Glasgow.

MR. RICHARD MATHER truly merits the citation for the award by the Iron and Steel Institute of the Bessemer medal for 1953, for "his distinguished services to the Institute and to the industry." His services to the iron and steel industry have been varied and have extended beyond this country. A great deal of Mr. Mather's career was spent in India, where he served as technical adviser to the Indian Tariff Board in 1923-24, and again in 1926-27. From 1939-40 he acted as technical director of the Tata Iron & Steel Company. Early last year he went to Geneva with Mr. J. G. Summers, a director of John Summers & Sons, Limited, as employers' representative at the fourth session of the iron and steel committee, one of the industrial committees set up by the governing body of the International Labour Office to deal with conditions in certain major industries. Mr. Mather is chairman and managing director of the Skinningrove Iron Company, Limited, Saltburn-by-the-Sea. He was elected to the board in 1941. In 1942, he joined the board of Pease & Partners, Limited, Darlington. He was president of the Iron and Steel Institute for 1951-52.

Obituary

MR. JAMES B. MUIR, who was formerly foundry manager with the Carron Company, Carron, Falkirk, and later with David King & Sons, Limited, at Glasgow, has died at the age of 84.

MR. BENJAMIN BUTTERS, who died on March 6 at the age of 76, was managing director of Butters Bros. & Company, Limited, crane makers, of Glasgow, and chairman of the derrick crane section of the Association of Cranemakers.

THE DEATH occurred suddenly at his home in Walsall on Friday of MR. HORACE RAYMOND WILLIAMS, at the age of 59. Mr. Williams was for some years managing director of the Phœnix Foundry (Bloxwich), Limited, and was responsible for the modernization and mechanization which have taken place at the foundry in recent years.

THE DEATH has occurred at the age of 75, of MR. BERTRAM MORRIS MOORE, chairman and joint managing director of the family concern W. H. Moore & Sons, Limited, non-ferrous metals manufacturers of Bordesley, Birmingham. Mr. Moore was a grandson of the founder of the firm, and had been with the company for 60 years, being actively engaged until three weeks ago.

SIR VICTOR WARREN, formerly Lord Provost of Glasgow and Lord Lieutenant of the County of the City of Glasgow, died on March 3 at the age of 49. He was appointed regional manager for Scotland and Northern Ireland of Imperial Chemical Industries, Limited, in 1949, when he also became a member of the Clyde Navigation Trust. He was an associate of the Institution of Mining Engineers and of the Institute of Quarrying. He was knighted in 1951.

MR. ARTHUR EDMUND MAYO, who has died aged 74, was, until his retirement in 1937, governing director of the Coventry Eagle & Motor Cycle Company. His son, Mr. A. Douglas Mayo, is the present chairman and managing director. The firm was founded in 1890 under the name Hotchkiss, Mayo & Meek, and Mr. Arthur Mayo joined his father in it a year later. On the death of Mr. R. Hotchkiss in 1897, the firm was formed into a private limited company. Mr. Arthur Mayo became sole proprietor when his father retired in 1913.

News in Brief

THE MEEHANITE METAL CORPORATION of the United States has changed its address from Pershing Building to 714 North Avenue, New Rochelle, New York.

IT IS EXPECTED that the Schofield Building of Loughborough College on the Ashby Road Playing Fields, for students of the College of Technology, will be opened about September.

THE ST. JOHN X-RAY LABORATORY, Califon, New Jersey, U.S.A., has just published a bibliography on industrial radiology, 1950-52 (price $2.00), by Herbert R. Isenburger, which contains 70 references.

THE HIGH COMMISSIONER for India, Mr. B. G. Kher, addressed about one hundred Indian engineering students at the annual dinner of Loughborough College India Association, which was held at the Bull's Head Hotel, Loughborough.

AT PRESENT, in the United States, the largest forging press ever built is in course of construction. This and another of 35,000 tons capacity are primarily to increase air-frame production for the U.S. Air Force, particularly for new jet and turbo-jet planes.

THE ANNUAL two-day conference of the scientific, administrative and technical staff of the Colt Associated Companies (Colt Ventilation, Limited, and W. H. Colt (London), Limited) took place at the end of last month at the Ace of Spades' Club, Surbiton, Surrey.

A NORMAL FIVE-DAY WEEK has been resumed as from March 16 by 1,400 employees at the Manor Mills factory of the Hercules Cycle Company, Limited, Birmingham, who have been working short-time since the beginning of January. The management reports "a slightly better outlook" in the industry.

NORTHERN ALUMINIUM COMPANY, LIMITED (Banbury, Oxfordshire), recently opened their foundry and forge at Handsworth, Birmingham, for a visit by relatives and friends of employees, and rather more than 500 people made the tour of the works and saw the film and exhibition that had been arranged.

MR. JOHN WHITEHEAD, general manager of the David Brown tractor group, on March 12 performed the ceremony of laying the last sod to complete the new bowling green at Meltham Hall, a mansion in its own large grounds recently taken over by David Brown Tractors, Limited, to be used as a staff canteen and recreation centre.

THE INSTITUTE OF BRITISH FOUNDRYMEN announce that applications have been received for most of the vacancies available for the Foundry Foremen's Training Course, to be held at Ashorne Hill, near Leamington Spa, from Thursday, April 23, to Saturday, April 25. Only a few further applications can be entertained.

PRELIMINARY NOTICE is given by the British Iron and Steel Research Association, 11, Park Lane, London, W.1, of a conference on heat-treatment practice to be held from June 15 to 17, at Ashorne Hill, Leamington Spa. The conference is being organized by the metallurgy (general) division of B.I.S.R.A., and is expected to deal mainly with wrought steels and forgings.

SIR LINCOLN EVANS, general secretary of the Iron and Steel Trades Confederation, and chairman of the T.U.C. Economic Committee, addressing the Workers' Educational Association in Birmingham, condemned "some of the pointless strikes we hear about—things that could be settled quite easily through the negotiating processes and which seem to arise sometimes from sheer cussedness."

SPEAKING at the dinner of the Midland branch of the Institution of Mechanical Engineers in Birmingham on March 12, Colonel P. H. Jones, vice-chairman, said that West Germany was becoming more industrialized and Britain's trade position was not so easy as previously. He thought, as an industrialist, that it was a responsibility for employers to tell their workpeople the true position.

THE INSTITUTE OF PERSONNEL MANAGEMENT has issued details of a five-day residential study course on industrial relations to be held from April 13 to 18 at Skelmorlie Hydro Hotel, Skelmorlie, near Wemyss Bay, Ayrshire. The residential charge is £7 17s. 6d. and the course fee £10 10s. (members £9 9s.). Full particulars may be obtained from the secretary at Management House, 8, Hill Street, London, W.1.

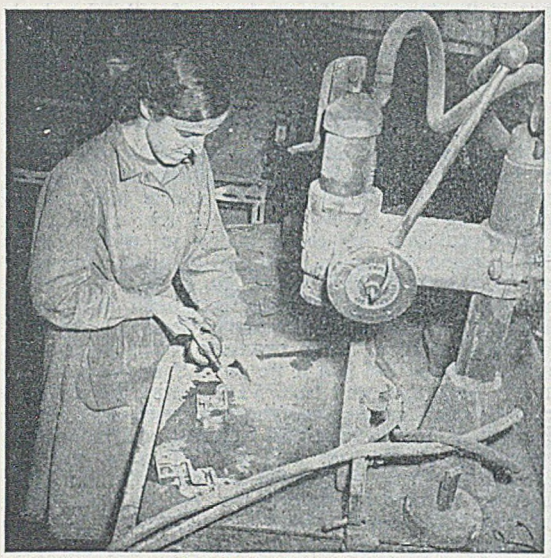
A FALLING-OFF in orders for iron castings brought about a strike last Friday of 30 workers at Moffat's Hazelbank Foundry, Cleland. The men, members of the Scottish Iron Moulders' Federation and the Foundrymen's Union, decided to take action after being told that 12 of their number were to be paid off as redundant. Mr. James Moffat, owner and general manager, said that there had been a reduction in demand and he could no longer afford to employ the redundant men.

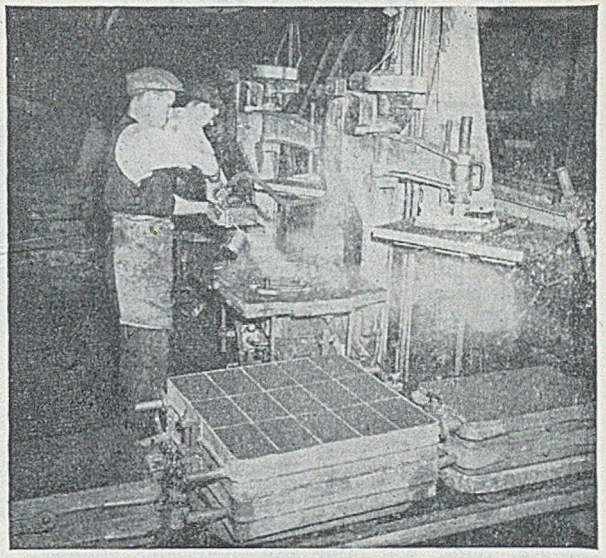
A SYMPOSIUM jointly organized under the auspices of the Society of Chemical Industry; the Corrosion Group of the Society of Chemical Industry; the Chemical Society; the Institute of Petroleum; and the Royal Institute of Chemistry, will be held in the chemistry lecture theatre, Manchester University, on Friday, March 27, entitled "Corrosion Inhibitors." Details may be obtained from the assistant secretary, Society of Chemical Industry, 56, Victoria Street, London, S.W.1.

THE SCOTTISH COUNCIL (DEVELOPMENT AND INDUSTRY) on March 11 reported "satisfactory progress" with the project for the expansion of the jig, tool, fixture, and gauge industry, and negotiations are to be opened with a number of firms who may be persuaded to participate. While the object is to establish in the first instance a large plant with adequate training facilities, it is intended to make provision for small firms capable of undertaking the manufacture of this kind of equipment.

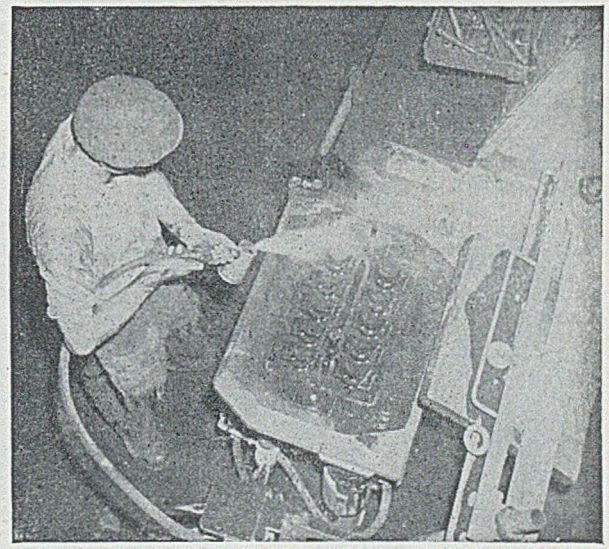
APPRENTICES were part of a firm's organization, part of its future, a product of its past, but, more important still, they were the backbone of the firm, Mr. Stanley J. Harley, chairman and managing director of the Coventry Gauge & Tool Company, Limited, Coventry, stated on March 12 at the firm's apprentices' annual dinner. The company had an intake of 30 apprentices a year, and there were 130 former apprentices employed in the firm's Coventry branch. This year, the firm celebrates its 40th anniversary and in the company's history more than 600 apprentices had served their time.

THREE ASPECTS of electricity's aid to industrial efficiency and productivity—electronic methods of control, industrial lighting, and canteen catering—will be featured on the stand of the British Electrical Development Association (No. 35) at the Factory Equipment Exhibition at the New Horticultural Hall, from March 23 to 25. Modern lighting in industry will be illustrated by means of enlarged photographs of industrial interiors and processes, accompanied by showcards giving particulars of the type of illuminant employed and the degree of illumination achieved. Also on view will be a selection of industrial canteen electrical equipment.





Illustrations of "PLP" in use by courtesy of Messrs. Henry Wallwork & Co. Ltd., Red Bank, Manchester.



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Raw Material Markets

Iron and Steel

When coal prices were advanced at the beginning of this month the Iron and Steel Corporation of Great Britain immediately asked the Minister of Supply to authorize an increase in maximum prices of iron and steel. Fuel prices play such an important part in the cost of producing ferrous materials that it was difficult to see how the request could be refused. The Minister has now made an Order authorizing increases in the maximum prices. It came into operation on March 14, and raises prices by an average of between 1 per cent. and 1½ per cent. In the case of foundry and forge pig-iron the increase is 10s. per ton.

Foundry owners fully realize that unless there are exceptional circumstances, any increase in the price of coal must eventually be passed on to the maker and consumer of pig-iron. Nevertheless, this latest increase, following so closely on the one which had to be borne last month, is disconcerting at a time when order-books for castings are difficult to fill.

Current business at the ironfoundries is at a moderate level, and there is nothing definite to portend that the near future will bring any appreciable improvement. The foundries are unable to obtain sufficient work to make good the deficiency of orders for castings resulting from the recession in export business, which, directly or indirectly, has affected most establishments. Castings for the defence programme assist to some extent, but the volume is not large enough to equalize the loss sustained in normal production. The motor and allied trades, the Diesel-engine, textile, and agricultural implement makers have all suffered a serious setback in trade and their indents for castings, as well as other components, have been reduced proportionately. Cisterns, heating and cooking apparatus, etc., also are being exported on a much reduced scale.

The demand for castings from home buyers is inadequate to keep plants fully operative, so that some foundries are not employing their full complement of labour, while others are on a reduced working week. The consumption of pig-iron has therefore declined, and, although many consumers have taken up their full allocated tonnages in expectation of an increase in business, this has not materialized and stocks have been enlarged. Some foundries have suspended deliveries of all raw materials until order-books show the need for additional tonnage.

Little difficulty is being experienced by the furnaces in meeting current demands from the foundries for supplies of pig-iron, apart from hematite iron, outputs of which have been curtailed by a reduction in the number of producing furnaces due to the change-over to basic pig-iron for steelmaking. Consignments of imported hematite and the increased use of refined irons relieve the position. Outputs of the low- and medium-phosphorus irons, while not excessive, are generally adequate, and plentiful supplies of high-phosphorus pig-iron are at the disposal of the foundries using this grade. Offers of all grades of pig-iron are received from oversea producers, whose prices are on a much reduced scale, but still well above United Kingdom figures and of little interest to buyers.

Outputs of basic pig-iron are fully absorbed by the steelworks, and with the larger number of furnaces engaged on this grade substantial tonnages are being supplied.

Output of steel continues on the upgrade and makers generally are concentrating upon the reduction of their existing commitments, including their backlogs from the previous period. The demand shows a slight decrease in the tonnage offering, but so far this has had no effect upon the rolling mills, whose order-books are filled for some months ahead.

Non-ferrous Metals

Both zinc and lead were active last week, the turnover during the last two days being particularly heavy, but sellers were inclined to show reserve and prices advanced sharply. It was a matter for regret that the backwardation in lead remains so wide. Lead certainly ought not to be short, for demand, although better than it was a few weeks ago, is still far from good. However, it rather looks as though both lead and zinc have now marked out their price course for the ensuing months. Zinc certainly found plenty of friends at around £76 and if we put £75 as the bottom, then the range may well be £75-£80 during the coming weeks. In the United States the zinc price is 11 cents and seems to be steady at that figure. Lead, however, advanced by ½ cent last week to 13½ cents, mainly in sympathy with the upward trend in the London market by which it appears to be a good deal influenced at present.

The copper situation remains uncertain and difficult to assess, for on the American market it was recently reported that no less than half-a-dozen different prices were being quoted, the highest of which was apparently 34 cents quoted by a Custom smelter, this figure being available for deliveries on the domestic market or for export.

With regard to Rhodesian sales to the United States, it seems pretty certain that the British Government has given permission for the sale of up to 15,000 tons, shipment of some part, at any rate, being made in April. Apart from this there has been a rumour that something really sensational was in contemplation, no less a figure than 75,000 to 100,000 tons being mentioned, but it is very hard to believe that our Government would agree to such a transfer of sterling copper. Apart from anything else, the outlook on the copperbelt is still rather unsettled.

Zinc official prices were as follow:—

March—March 12, £78 to £78 10s.; March 13, £79 to £79 2s. 6d.; March 16, £79 7s. 6d. to £79 12s. 6d.; March 17, £78 15s. to £79; March 18, £79 17s. 6d. to £80.

June—March 12, £78 7s. 6d. to £78 10s.; March 13, £79 5s. to £79 10s.; March 16, £79 10s. to £79 15s.; March 17, £79 to £79 5s.; March 18, £79 17s. 6d. to £80.

The following official tin prices were recorded:—

Cash—March 12, £955 to £956; March 13, £953 to £954; March 16, £951 to £952; March 17, £949 to £950; March 18, £947 to £948.

Three Months—March 12, £943 to £944; March 13, £941 to £942; March 16, £942 to £943; March 17, £941 to £942; March 18, £940 to £941.

Official prices of refined pig-lead:—

March—March 12, £89 to £89 5s.; March 13, £91 to £91 10s.; March 16, £91 10s. to £92; March 17, £89 to £89 5s.; March 18, £89 15s. to £90.

June—March 12, £86 15s. to £87; March 13, £88 10s. to £88 15s.; March 16, £88 15s. to £89; March 17, £87 to £87 5s.; March 18, £87 10s. to £87 15s.

THE POWER-GAS CORPORATION, LIMITED, Stockton-on-Tees, has opened a permanent exhibition at its works to give visitors a full knowledge of the firm's activities. There is a model of the company's proposed new works which will take about 20 years to complete.

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

(Delivered unless otherwise stated)

March 18, 1953

PIG-IRON

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

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

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

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

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

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

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

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered).

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

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

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

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

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

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

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

Cobalt.—98/99 per cent., 20s. per lb.

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

Ferro-manganese (blast-furnace). — 78 per cent., £48 12s. 11d.

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

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

SEMI-FINISHED STEEL

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

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

Sheet and Tinplate Bars.—£25 11s. 6d.

FINISHED STEEL

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

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £32 4s. 6d.; flats, 5 in. wide and under, £32 4s. 6d.; hoop and strip, £32 19s. 6d.; black sheets, 17/20 g., £41 6s.; galvanized corrugated sheets, 24 g., £51 7s. 6d.

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

Tinplates.—57s. 10d. per basis box.

NON-FERROUS METALS

Copper.—Electrolytic, £285; high-grade fire-refined, £284 10s.; fire-refined of not less than 99.7 per cent., £284; ditto, 99.2 per cent., £283 10s.; black hot-rolled wire rods, £294 12s. 6d.

Tin.—Cash, £947 to £948; three months, £940 to £941; settlement, £948.

Zinc.—March, £79 17s. 6d to £80; June, £79 17s. 6d. to £80.

Refined Pig-lead—March, £89 15s. to £90; June, £87 10s. to £87 15s.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £106 5s.; rolled zinc (boiler plates), all English destinations, £104 5s.; zinc oxide (Red Seal), d/d buyers' premises, £110.

Other Metals.—Aluminium, ingots, £166; magnesium, ingots, 2s. 10½d. per lb.; antimony, English, 99 per cent., £225; quicksilver, ex warehouse, £70 10s. to £71 (nom.); nickel, £483.

Brass.—Solid-drawn tubes, 26d. per lb.; rods, drawn, 34½d.; sheets to 10 w.g., 20s. per cwt.; wire, 32d.; rolled metal, 266s. 9d. per cwt.

Copper Tubes, etc.—Solid-drawn tubes, 32⅜d. per lb.; wire, 317s. 9d. per cwt. basis; 20 s.w.g., 346s. 3d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £200 to £218; BS. 1400—LG3—1 (86/7/5/2), £212 to £238; BS. 1400—G1—1 (88/10/2), £320 to £375; Admiralty GM (88/10/2), virgin quality, £325 to £380 per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £345 to £385; L.P.Bl, £248 to £275 per ton.

Phosphor Bronze.—Strip, 412s. 9d. per cwt.; sheets to 10 w.g. 434s. 6d. per cwt.; wire, 49⅝d. per lb.; rods, 44½d., tubes, 42¾d.; chill cast bars: solids 3s. 8d., cored 3s. 9d. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 2s. 8½d. per lb. (7 per cent.) to 3s. 11d. (30 per cent.); rolled metal, 3 in. to 9 in. wide × .056, 3s. 2½d. (7 per cent.) to 4s. 5d. (30 per cent.); to 12 in. wide × .056, 3s. 2¾d. to 4s. 5½d.; to 25 in. wide × .056, 3s. 4¾d. to 4s. 7½d. Spoon and fork metal, unsheared, 2s. 11½d. to 4s. 2d. Wire, 10 g., in coils, 3s. 9½d. (10 per cent.) to 4s. 11d. (30 per cent.). Special quality turning rod, 10 per cent., 3s. 8½d.; 15 per cent., 4s. 1¾d.; 18 per cent., 4s.6½d. All prices are net.

Forthcoming Events

MARCH 23.

Institute of Metals

Annual May Lecture :—"Present and Future Requirements of the Chemical Engineer," by Sir Christopher Hinton, M.A., 6 p.m., at the Royal Institution, Albemarle Street, London, W.1.

Purchasing Officers' Association

North London branch :—"Legal Aspects of Purchasing," by J. M. Grammer, 7.30 p.m., at the George Hotel, Enfield.

MARCH 24

Institution of Works Managers

Wolverhampton branch :—"The Place of the Foreman in the Management Structure," by J. Ayres, 7 p.m., at the Star and Garter Royal Hotel.

Sheffield Metallurgical Association

Discussion on "New B.S.I. Test Methods for Refractory Materials," 7 p.m., at the Grand Hotel.

Institution of Production Engineers

Wolverhampton graduate section :—Annual general meeting, followed by "Valid Incentives," by E. C. Gordon England, 7.30 p.m., at the Star and Garter Royal Hotel.

MARCH 24 TO 26

Institute of Metals

Annual General Meeting at the Park Lane Hotel, Piccadilly, London, S.W.1.

MARCH 25

Institute of British Foundrymen

Birmingham branch :—Symposium on Casting Defects, 7.15 p.m., at the James Watt Memorial Institute.
London branch :—"Matchplates," by D. H. Potts, 7.30 p.m., at the Waldorf Hotel, Aldwych, W.C.2.

MARCH 26

Royal Statistical Society

Sheffield group :—"Short-cut Methods in Statistical Analysis," by Prof. E. S. Pearson, 6.30 p.m., in the Cavendish Room, Grand Hotel.

Institute of Vitreous Enamellers

Midland section :—"Cast Iron for Enamelling," by C. J. Moore, at the Imperial Hotel, Birmingham.

Institution of Production Engineers

Cornwall section :—"A Broader Conception of Productivity and its Measurement," by F. G. S. English, 7.15 p.m., at the Camborne School of Mines.
London section :—Annual general meeting, followed by "Industrial Architecture," by H. V. Lobb, 6.45 p.m., at the Royal Empire Society, Northumberland Avenue, W.C.2.
South Wales section :—"Industrial Economics," by C. T. Tragen, 6.45 p.m., at the South Wales Institute of Engineers, Park Place, Cardiff.

MARCH 27

Institute of British Foundrymen

West Wales section :—"Recent Experiences with Basic- and Acid-electric Steel," by L. W. Sanders, 7 p.m., at Llanelly Technical College.

Institution of Mechanical Engineers

Annual general meeting, 5.30 p.m., at Storey's Gate, St. James's Park, London, S.W.1.

Manchester Association of Engineers

Annual general meeting :—"Friction between Solid Bodies," by Dr. R. Schnurmann, 6.45 p.m., in the Engineers' Club, Albert Square.

Institute of Industrial Supervisors

North-western section :—"The New Foremanship," by J. W. Ball, 8 p.m., at Unity Hall, Stockport.

MARCH 28

Institute of British Foundrymen

Bristol & West of England branch :—Annual general meeting, 3 p.m., at the Grand Hotel, Bristol.
Wales & Monmouth branch :—"Recent Experiences with Basic- and Acid-electric Steel," by L. W. Sanders, 6 p.m., at the Engineers' Institute, Cardiff.

THORN ELECTRICAL INDUSTRIES, LIMITED, whose South Wales factory has been damaged by fire, is transferring some of its production to its works at Spennymoor (Co. Durham).

NOTICE

Replies to Box Numbers to be addressed to "Foundry Trade Journal," 49, Wellington Street, London, W.C.2.

SITUATIONS WANTED

SENIOR EXECUTIVE, fully experienced in all grades of Malleable Castings production. Well known in the trade and a Member of National Committees. Accustomed to full control. Desires change to small/medium Midland Company. Could introduce proven staff if required.—Box 3312, FOUNDRY TRADE JOURNAL.

PLANT ENGINEER, managerial experience covering design and maintenance, wide variety foundry plant, seeks Executive post with foundry, plant manufacturers or agents, South preferred.—Box 3310, FOUNDRY TRADE JOURNAL.

FOUNDRY EXECUTIVE, grey iron Foundry Manager, desires change to similar position in Midlands area. Fully experienced in all ironfoundry processes. Buying, planning, estimating, rate-fixing, sales. Accustomed to full control. M.I.B.F., A.M.I.Prod.E. — Box 3334, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN / MANAGER (44), M.I.B.F., accustomed full charge, life experience trade, light and heavy castings to 8 tons, specialist repetition economic production, grey, high duty, malleable and non-ferrous experience, practical metallurgist, rigid metal, sand control, commercial and sales, desires join small foundry, Midland area.—Box 3335, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER (45), M.I.B.F., A.M.I.P.E., accustomed complete control and administration, sales, commercial, costs, etc., grey iron, whiteheart malleable, non-ferrous, metal, sand, technical control, specialist modern economic methods production, green, dry, mechanised, etc., available short notice, desires contact with small Midland foundry requiring organisation and increased results. Accustomed working on salary/results basis. Excellent connections trade.—Box 3336, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

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

WORKING FOREMAN required for small Jobbing Foundry in North-East country town. Excellent opportunities for advancement in view of current expansion programme.—Full details, salary, etc., to Box 3323, FOUNDRY TRADE JOURNAL.

FOUNDRY CHEMIST required, preferably with experience of malleable iron.—Please apply by letter, stating age, details of past experience, and salary required, to BAGSHAWE & CO., LTD., Dunstable Works, Dunstable.

SITUATIONS VACANT—*Contd.*

FOUNDRY ESTIMATOR required for Grey Iron and High Duty Mechanised and Jobbing Foundries. Must be fully experienced in Foundry production, wood and metal pattern work and competent to lay-out jobs from drawings. Permanent staff appointment, pension scheme in operation.—Box 3338, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER required for light alloy foundry near Bolton, Lancs. Applicant must be fully conversant with production of high strength aluminium alloys up to Class I aircraft standards. Some knowledge of magnesium alloys an advantage. Excellent and permanent prospects for suitable man. Write stating age, experience and salary required. Replies to Managing Director.—Box 3339, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER required for Ironfoundry producing 50/60 tons Light Castings per week. Full knowledge of Pattern Making, Metal, Labour and Sand Control. Floor, Bench and small Mechanisation methods employed. Canteen, Baths and Welfare facilities. Pension Scheme. State experience and salary required.—Box 3342, FOUNDRY TRADE JOURNAL.

PAKISTAN ORDNANCE FACTORIES.

THE Government of Pakistan invites applications for the following posts for their Ordnance Factories in Pakistan:—

CHIEF METALLURGIST.

Qualifications: Candidates should possess an honours degree of a University, the Fellowship of the Institution of Metallurgists or equivalent qualifications. Must have held a responsible industrial position, and experience should cover chemical (including spectroscopy) and physical testing method for ferrous and non-ferrous metals and alloys. Experience in radiography and other non-destructive testing methods would be advantageous. Must have had experience in process metallurgy, including the metallurgical control of steel foundries equipped with Arc melting furnaces, non-ferrous foundries and rolling mills, forging of ferrous materials, and cold drawing and pressing of non-ferrous alloys.

Rates of pay: Rupees 850×100—1,550 per month, plus an addition of £30 (sterling) overseas pay p.m. from date of embarkation, plus a technical staff allowance, as authorised, from date of arrival in Pakistan.

METALLURGICAL CHEMIST (ASSISTANT WORKS MANAGER).

Qualifications: Candidates should possess a degree of a University, the Associateship of the Institution of Metallurgists or equivalent qualification. They must have held a responsible industrial position. Experience should cover the complete chemical and mechanical testing of ferrous metals and alloys, and the metallurgical control of a steel foundry equipped with arc and high frequency melting furnaces. Experience in other process metallurgy and the non-destructive testing of metals would be advantageous.

Rates of pay: Rupees 600×50—1,000 per month, plus an addition of £25 (sterling) overseas pay p.m. from date of embarkation, plus a technical staff allowance, as authorised, from date of arrival in Pakistan.

Forms of application may be obtained upon application in writing to PAKISTAN ARMY TECHNICAL LIAISON OFFICER, No. 2, Palace Gate, London, W.8. Closing date for receipt of applications: 7th April, 1953.

SITUATIONS VACANT—*Contd.*

METALLURGIST AND CHEMIST required for Foundry Laboratory, familiar with Chemical analysis of Iron and Steel. Duties also include Furnace and Sand Control. Only those applicants with the above experience need apply.—Box 3340, FOUNDRY TRADE JOURNAL.

STEEL FOUNDRY FOREMAN required, for small Mechanised and Jobbing Foundry. Only those persons with Steel Foundry practice required.—Box 3341, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER required for large light casting foundry Australia. Salary £A1,500 p.a. First-class passages applicant and family.—Apply Box 3337, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER required for a new Foundry operating in Madras, India, specialising in Automobile castings. Good pay and prospects, with furnished bungalow. Applicants must be between 30 and 35 years of age, and preferably single men.—Write, giving full particulars of training and experience, stating age, Box 3308, FOUNDRY TRADE JOURNAL.

WEST YORKSHIRE FOUNDRIES, LTD., Sayner Lane, Leeds, 10, require ASSISTANT CHIEF METALLURGIST for technical control in their Grey Iron, Aluminium and High Frequency Steel Foundries. Qualification to A.I.M. standard or equivalent. Salary according to age, qualification and experience.—Apply in writing to CHIEF METALLURGIST.

YOUNG METALLURGIST & CHEMIST required for modern repetition Grey Iron Foundry in the Newport area. Duties include control of laboratory and of materials, metal and sand. Staff appointment. Superannuation Scheme. Apply, in writing, giving full particulars of experience, qualifications, education, age, whether married or single, and salary required to Box 3328, FOUNDRY TRADE JOURNAL.

INDUSTRIAL RADIOGRAPHER required for foundry work. Experience in steels preferred. Also DARK ROOM OPERATOR. State age and experience, and salary required.—Replies to EMPLOYMENT MANAGER, Brockworth Engineering Co., Hucclecote, Gloucester.

WANTED.—MOULDER, to introduce the manufacture of Rainwater Goods into our Grey Iron Foundry. Must be able to obtain production from hand-moulding methods. South Wales area.—Box 3331, FOUNDRY TRADE JOURNAL.

FOUNDRY METALLURGIST required, to control Laboratory of high-class Grey Ironfoundry in Birmingham. This vacancy offers a first-class opportunity to a man of 25/35 years of age, fully experienced in the chemical analysis of iron and steel, and in furnace and sand control. Applicants are invited to write, giving full particulars of experience and salary required.—Box 3332, FOUNDRY TRADE JOURNAL.

CHEMIST (aged 22 to 25 years) required, with knowledge of production of Synthetic Resins. Capable of controlling and installing plant and of supervising raw materials and general production of specialised foundry products. Adaptable, and willing to travel if necessary. Salary according to ability.—Box 3333, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

METALLURGIST required for Iron Foundry; must be energetic, able to take charge of laboratory. High Duty Irons, sand and cupolas. Write giving full details, age and experience.—HENRY BROWN & Co. (IRVINE), LTD., Irvine, Ayrshire.

FOUNDRY SUPERINTENDENT required for Steel Foundry in Manchester area; must be qualified Foundryman; fully experienced in the production of Heavy and Medium Castings; accustomed to full technical control, with some metallurgical experience, and knowledge of Open Hearth Melting Processes. Reply, giving details of education, qualifications, age, and salary expected to: Director of Personnel, THE DAVID BROWN COMPANIES, Meltham Mills, Meltham, Huddersfield, Yorks.

ASSISTANT CHEMIST required for Metallurgical Laboratory at Grey Iron Foundry in Wolverhampton. Please state age, experience and salary required. —Box 3326, FOUNDRY TRADE JOURNAL.

FOUNDRY CHIEF FOREMAN required by modern grey iron foundry in Midlands, producing general and repetition engineering castings. Applicant must have thorough experience of general and mechanised production and be able to supervise all works departments. Ability to introduce new business an advantage. State age, experience, and salary required. —Box 3327, FOUNDRY TRADE JOURNAL.

METALLURGICAL LABORATORY ASSISTANT required by well-known Engineering Firm in East Anglia. Applicants should be thoroughly knowledgeable regarding structure and analysis of cast iron and steel. Experience of one or more of following subjects would be advantageous: Non-ferrous analysis, metallography, foundry control, sand testing and heat treatment. Staff pension scheme. State age, salary required, and previous experience in full to personnel manager. —Box 3330, FOUNDRY TRADE JOURNAL.

AGENCIES

AGENCY—Sales agency required by small progressive iron foundry in the Midlands; exceptionally good commission payable on introduction of further business.—Box 3316, FOUNDRY TRADE JOURNAL.

AGENTS wanted, in all districts, by Midland Jobbing and Repetition Foundry, with own machine shops. Grey iron, aluminium, bronze, sand and gravity die castings. Commission basis only.—Box 3329, FOUNDRY TRADE JOURNAL.

FOUNDRY FOR SALE

WELL-EQUIPPED Jobbing Iron Foundry for Sale. Situated Newcastle-on-Tyne, with railway siding and adjacent main road. Building 8,000 sq. ft., total area approx. 14,000 sq. ft. Leasehold. Two 2 ton/hr. Cupolas, Mould and Core Stoves, Sand Mixers, Royer, Core Sand Drier, 2 Wheel Grinder and Exhaust, Electric Crane, etc. Output 40 tons per month. Price £8,000.—Box 3311, FOUNDRY TRADE JOURNAL.

FINANCIAL

ADVERTISER, interested in purchase of small Iron and Non-ferrous Foundry in Midlands, or would consider Partnership.—Write, giving full particulars, Box 3304, FOUNDRY TRADE JOURNAL.

MACHINERY WANTED

E.M.B. AIR PRESS No. 2510 or similar required.—Box 3325, FOUNDRY TRADE JOURNAL.

MACHINERY FOR SALE

PAN MILLS 4 ft. and 5 ft. dia. underdriven, stationary pans, self-discharging new, for delivery from stock.—W. & A. A. BREALEY (MACHINERY), LTD., Ecclesfield, Sheffield.

CORE OVEN, 5 ft. long, 36 in. wide, with conveyor hearth, gas fired. Complete with Thermocouples and Kent Temperature Recorders up to 500 degrees Centigrade. May be sold separately. Laboratory Equipment comprising:—Double Fume Chamber, Bench with Cupboards and Fittings and Sink Unit, unused.—H. B. BARNARD & SONS, LTD., Dudley Port, Tipton, Staffs.

RECONDITIONED 750 lbs. Pneulec Moulding Machines for disposal. Contact Works Engineering Department for details.—K. & L. STEELFOUNDERS & ENGINEERS, LTD., Letchworth, Herts. Telephone: Letchworth 1360.

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B. T.H. very powerful Dust Extractor-Blower. Motorised unit (unused), £15. One-third to-day's cost.—BELLANGER'S, 306, Holloway Road, London, N.7. North 4117.

PNEULEC Herman Jarr Rollover and Pattern Draw Moulding Machine, of 4,000 lbs. capacity, with 44 in. by 72 in. turnover plate. Complete with Pneumatic clamps, 5-ton capacity sand Storage Hopper, and 8 in. Belt and Bucket Elevator. Excellent condition.—A. C. BAMLETT, LTD., Thirsk.

FOR SALE.—One TITAN CORE BLOWING MACHINE, of 75 lbs. sand capacity to take coreboxes up to 18 in. long by 12 in. wide by 24 in. high. Sand chamber raised or lowered by means of compressed air in conjunction with an oil reservoir. The sand and air mixture fed towards the central blowing hole in the sand chamber baseplate by an agitator driven by ¾ h.p. totally enclosed geared unit wound for 400/440 volts, 50 cycles, 3-phase, complete with push-button starter. —Can be inspected at TWEEDALES & SMALLEY (1920), LTD., Castleton, Rochdale.

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SIZE 9 PADDLE BLADE, 450 c.f.m. 3 in. w.g., .75 h.p. motor, inlet 5⅜ in. dia., outlet 5⅜ by 4¼ in.
SIZE 12 PADDLE BLADE, 1,000 c.f.m. against 5 in. w.g., 2 b.h.p. s.c. motor, 8 in. dia. inlet, outlet 9 in. by 9¾ in.
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SIZE 17 PEERLESS EXHAUST FAN, capacity 6/7,000 c.f.m., 3 in. w.g., 10 h.p. s.c. motor, starter, slide rails, 17 in. inlet, outlet 12 in. by 15 in.

ROTARY BLOWERS:

No. 1 "EMPIRE" POSITIVE PRESSURE BLOWER, 23 c.f.m. against 5 lbs. p.s.i. pressure, 870 r.p.m., pulley 5 in. by 1¾ in. belt striking gear.
No. 3 "EMPIRE" POSITIVE PRESSURE BLOWER, 60 c.f.m., 5 lbs. p.s.i. pressure, 525 r.p.m., pulley 7 in. by 3 in.
HOLLAND MOTOR DRIVEN ROTARY BLOWER, comprising twin blowers giving combined displacement of 2,700 c.f.m., 60 in. w.g. mounted in tandem, 125 h.p. motor, 730 r.p.m. mounted between blowers.

PROPELLER BLADE FANS:

MOTOR DRIVEN PROPELLER BLADE VENTILATING FANS, 15 in. dia. blades; adjustable louvre outlet; air inlet filter, all mounted in self-contained sheet steel cabinet. s.c. motor, 230 volts, single phase, 50 cycles.

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KEITH BLACKMAN 15 in. MOTOR DRIVEN THREE BLADE PROPELLER FANS, with TOTALLY ENCLOSED S.C. MOTORS 440/3/50, 1,400 r.p.m., capacity 2,500 c.f.m.
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NOTICE TO ADVERTISERS AND AGENTS

It is greatly regretted that, owing to acute lack of space both at our offices and at our printer's works, it is not possible to retain in store indefinitely obsolete blocks used in past advertisements in the "*FOUNDRY TRADE JOURNAL.*"

NOTICE IS THEREFORE GIVEN that we shall be obliged to dispose of all advertisement blocks that have not appeared in the Journal since **December 31st, 1949**, if no application has been received for their return on or before **March 31st, 1953.**

March 5th, 1953

Foundry Trade Journal
49, Wellington St.,
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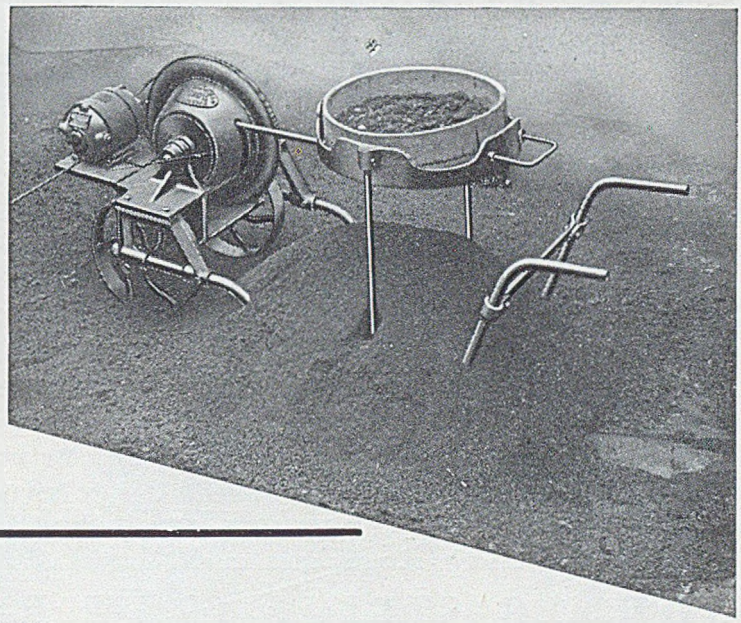

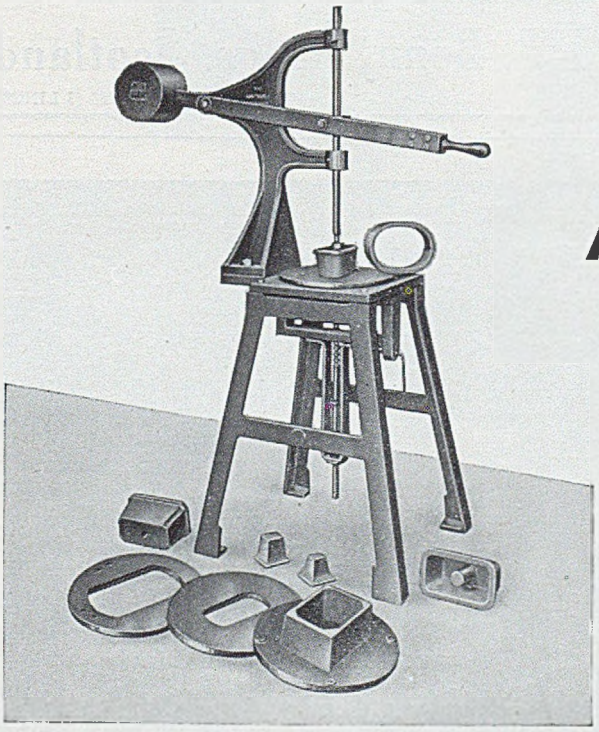

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