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Progress in Productivity

At the end of last month, the British Steel Founders' Association held their second productivity convention since their productivity team returned from the States. The convention was labelled "Progress Report,"* and was intended to show what individual foundries had done in the period of six months since the first productivity convention in November last. Twenty-three Papers were presented, dealing with various phases and operations in steel-foundry practice, and showed how concentrated effort by vigorous minds can achieve spectacular increase in industrial efficiency without in any way increasing the arduousness or physical effort of the foundryman. Indeed, rather the reverse, since most of the Papers covered advances which had been made by the application of mechanical aids—some simple, some more elaborate—to relieve the time-consuming and laborious tasks inconsistent with this mechanical age. Papers presented during the convention also showed the growing concentration of effort on improvement in working conditions, which have their effect upon recruitment of the right type of both men and boys, and undoubtedly lead of themselves to increased productivity.

This leading article has been generously contributed by Mr. Frank Rowe, B.Sc., president of the British Steel Founders' Association. Both in subject and associations it follows a precedent set last September by Mr. F. A. Martin, O.B.E., then B.S.F.A. president, who wrote for us on the general subject of steel founding productivity.

It was interesting to note that the session devoted to Papers on the improvement of working conditions was chaired by a member of the Executive of the Amalgamated Union of Foundry Workers, who added some vigorous remarks of his own. This participation of the leading Unions concerned with foundry workers, with many delegates there from the shop floor, was an important feature of the convention, and there is no doubt that the impact of views from every level in the steelfounding industry formed a most valuable feature. A body of men cannot live in one house for three days—mixing not only in the conference room but also in the dining halls and lounges—without a beneficial appreciation of each other's point of view. Too often, foundry conferences consist merely of technicians or of workers or of higher management executives, and their discussions and pronouncements are apt to reflect only their particularised viewpoint. A gathering of a complete cross-section of the industry in at atmosphere of complete informality, all with the common object of discussing higher industrial efficiency in all its phases and repercussions, has much to commend it.

Because of its small size, both in numbers of firms (less than 80) and numbers employed (less than 20,000) the industry does present opportunities for co-operative action and common viewpoint which would be difficult in a much larger industry with more diversified interests. The example the British Steel Founders' Association have set—not only in being the first to send a productivity team to the United States, but in vigorously and effectively following through the recommendations of its report—is one which should act as a stimulus to other sections of the foundry and engineering trades, as well as to other British production industries.

* See page 541 of this issue.

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Institute's Buxton Conference Fund

Second List

The second list of subscribers to the fund being raised in connection with the forthcoming conference of the Institute of British Foundrymen, is as follows:—

Birmid Industries, Limited, £100; Renishaw Iron Company, Limited, £52 10s.; Staveley Iron & Chemical Company, Limited, £50; Stone Wallwork, Limited, £26 5s; Brightside Foundry & Engineering Company, Limited, £25; Radiation, Limited, £25; Edgar Allen & Company, Limited, £25; I.C.I., Limited (Alkali Division), £25; David Brown Foundries Company, £25; Clay Cross, Company, Limited, £25; Newton Chambers & Company, Limited, £25; British Piston Ring Company, Limited, £20; John Harper & Company, Limited, £10 10s.; Samuel Osborn & Company, Limited, £10 10s.; Birlec, Limited, £10 10s.; National Gas & Oil Engine Company, Limited, £10 10s.; William Cumming & Company, Limited, £10 10s.; Ironfounders' National Confederation, £10 10s.; Morris Motors, Limited, £10 10s.; Barrow Hematite Steel Company, Limited, £10 10s.; E. W. Wynn (Ironfounders), Limited, £10 10s.; Bamfords, Limited, £10; Hadfields, Limited, £10; F. H. Lloyd & Company, Limited, £10; Thomas Blackburn & Sons, Limited, £10; Parkinson Stove Company, Limited, £5 5s.; Incandescent Heat Company, Limited, £5 5s.; Fletcher, Houston & Company, Limited, £5 5s.; Foundry Services, Limited, £5 5s.; Fodens, Limited, £5 5s.; Mr. F. H. Neal, £5 5s.; John Thompson Foundry Company, £5 5s.; James Hodgkinson (Salford), Limited, £5 5s.; W. & T. Avery, Limited, £5 5s.; Belliss & Morcom, Limited, £5 5s.; Midland Ironfounders' Association, £5 5s.; Humber, Limited, £5 5s.; Guest, Keen & Nettlefolds (Midlands), Limited, £5 5s.; Wm. Jacks & Company, Limited, £5 5s.; Castings, Limited, £5; A. H. Mould & Sons, Limited, £5; Modern Furnaces & Stoves, Limited, £3 3s.; Bradley & Turton, Limited, £2 2s.; Cast Nameplate Company, £2 2s.; Mr. S. B. Hole, £2 2s.; Pickford, Holland & Company, Limited, £2 2s.; Webster & Company (Sheffield), Limited, £2 2s.; Mr. B. S. Fletcher, £2 2s.; Mr. T. Watson, £2 2s.; White & Hancock, Limited, £2 2s.; Mr. J. Hogg, £2 2s.; Dr. J. G. Pearce, £2 2s.; Phosphor Bronze Company, Limited, £2 2s.; Mr. H. Buckley, £2 2s.; W. Woodcock, Sons & Company, Limited, £2 2s.; Mr. D. Macbeth, £2 2s.; Mr. E. N. Wright, £2 2s.; Mr. T. H. Weaver, £2; Mr. C. Swinglehurst, £1 1s.; Mr. E. C. Greaves & Mr. S. G. Throssell, £1 1s.; Joseph Boam, Limited, £1 1s.; Mr. S. Evans, £1 1s.; Mr. R. H. Buckland, £1 1s.; Mr. H. B. Farmer, £1 1s.; Mr. J. L. Francis, £1 1s.; Gilbert Gilkes & Gordon, Limited, £1 1s.; Mr. S. Hadfield, £1 1s.; Mr. E. Morgan, £1 1s.; Mr. J. Hill, £1 1s.; Mr. J. G. Bailes, £1 1s.; Mr. W. Frith, £1. Amount previously acknowledged, £434 2s. 6d. Grand total, £1,126 2s. 6d.

Death of Mr. C. Monseur

Last week, we briefly announced the death of Mr. Charles Monseur of Liège, who was known to hundreds of British foundrymen as Monty. His perfect command of the English language and his anglophile outlook were especially appreciated by visitors to Liège. His business established by his father was largely based on selling material and plant of British origin in Belgium and Spain. During the occupation, he escaped to Spain, where he was imprisoned, and later fled to the Belgian Congo. After many adventures, he found a temporary home in this country. He was a member of the Institute of British Foundrymen having joined in 1933 and often participated in its gatherings. His strenuous efforts to promote Anglo-Belgian co-operation will for long be an inspiration to others.

Leaders of the Industry

G. F. Mundell

Mr. George Ferguson Mundell, who was last month elected president of the Association of Bronze and Brass Founders, was born on August 30, 1898, and in September, 1912, entered the employment of the Knowsley Cast Metal Company, a family business founded by his father in 1896. He served a general apprenticeship in the patternshop, machine shops and foundry; he was also a constant attender at evening classes, studying accountancy, commercial law and economics, as well as metallurgy and kindred subjects, at the Manchester College of Technology.

MR. G. F. MUNDELL

With the exception of a short term with the Manchester Regiment in 1918, he continued to gain experience with the company, and in 1928 was promoted foundry manager and director, since when he has been solely responsible for the foundry and metal merchanting departments. As well as being a director of the Knowsley Cast Metal Company, Limited, Mr. Mundell is a director of Sydney Moorhouse & Company (1935), Limited; he is a member of the Institute of British Foundrymen and of the Institute of Metals. His company was a founder member of the Association of Bronze and Brass Founders, of which he was elected to the council in 1945 and as vice-president in 1949. He has represented the Association on the Manchester District Joint Foundry Recruitment and Training Committee since its inception.

Sheffield's New Coke Research Centre

The Midland Coke Research Station at Clarkehouse Road, Sheffield, was formally inaugurated by Lord Halifax on May 4. The opening was followed by a luncheon which was also attended by Sir Ben Lockspeiser, secretary of the Department of Scientific and Industrial research, Dr. W. Idris Jones, Director-General of Research for the National Coal Board, Mr. L. O'Connor, N.C.B. Director of Carbonisation, and Mr. F. Scopes, chairman of the British Coking Industry Association.

Speaking at the luncheon, Mr. Scopes said that 46 per cent. of the 15,000,000 tons of coke produced each year in Britain came from works still privately controlled, against 42 per cent. from N.C.B. coke ovens. The remaining 12 per cent. came from firms which could still be called independent, he added.

Non-ferrous Foundry Practice*

By J. Bamford, B.Sc.

An outline is given of the scope and range of the non-ferrous founding industry, and in a review of manufacturing practice the differences between ferrous and non-ferrous technique are considered. Melting methods, sand practice, running and feeding of castings, and mechanisation in the non-ferrous industry are dealt with in a lucid and straightforward manner. The Author is an instructor at the National Foundry College, Wolverhampton.

RELIABLE statistics concerning the non-ferrous foundry industry are difficult to obtain. It may, however, be said with confidence that although smaller than the ferrous branch of the industry, both as regards tonnage output and personnel employed, it is in no sense secondary in importance. Only to a limited extent are the two competitive, each having its own particular field, based upon the various properties and selling price of the castings produced. In general, non-ferrous castings are the more expensive, and hence ferrous alloys are usually chosen on financial grounds when specifications can be met. Non-ferrous castings are thus normally specified because of some definite property, or properties, of the alloy selected.

Range

The field covered by the non-ferrous foundry industry includes castings for the following applications:—

(*a*) *For Corrosion Resistance.*—Many alloys are available for corrosion-resisting application and customers usually have a choice of alloys suitable for service under particular conditions. Brass, bronze, the high-nickel alloys and aluminium alloys are all used for applications where corrosion resistance is required. The alloy chosen depends upon the particular corrosive medium considered in conjunction with the physical and mechanical properties required of the casting.

(*b*) *For High Thermal and Electrical Conductivity.*—Non-ferrous alloys usually possess a higher conductivity than ferrous materials. For applications where high thermal or electrical conductivity is required, high conductivity (or H.C.) copper castings are generally specified. Electrical conductivities of over 90 per cent. can be obtained.

(*c*) *For High Strength-to-weight Ratio.*—Alloys which possess a high strength-to-weight ratio are in great demand by the transport industries, particularly the automobile and aircraft industries. Table I details the strength-to-weight ratios for some ferrous and non-ferrous alloys. Non-ferrous alloys are italicised, and the figures are self-explanatory; the table, however, does not tell the whole story. The necessity for rigidity and the difficulty in producing very thin sections in the foundry are often the deciding factors when a casting is designed. The substitution of a light alloy for a ferrous alloy, therefore, does not always necessitate increasing the casting sections. Under such conditions, the relative weights of the two castings approach the relationship between their specific gravities.

(*d*) *For Decorative Applications.*—Bronze has been used for centuries for a large variety of ornamental castings and is the alloy usually chosen for statues, plaques and architectural work. Many other alloys, however, find applications in this field, according to the requirements of colour, corrosion resistance and mechanical properties and these include brasses, nickel-bearings alloys and aluminium alloys.

(*e*) *Where Special Methods of Production make Non-ferrous Castings Competitive.*—Examples where methods of production make non-ferrous castings competitive with ferrous materials are to be found when very large quantities of castings are required which can be produced in non-ferrous alloys by gravity or pressure die-casting methods. The reduced machining allowances possible and the ease with which many non-ferrous alloys can be machined may, in individual cases, so reduce the cost of the final component as to make it competitive with ferrous alloys. The field covered is thus very large. The size of castings is as varied as the field covered, ranging from castings weighing a fraction of an ounce up to marine propellers of thirty or more tons in weight.

TABLE I.—*Strength-to-weight Ratio U.T.S., Weight per Cub. In. (Minimum Values for All Materials).*

Alloy.	U.T.S.	Elongation, per cent.	Weight per cub. in.	Strength-to-weight ratio.	Remarks.
Elektron ..	13	4	0.0654	199	D.T.D.289.H.T.
Alloy steel ..	55	12	0.283	194	BSS.1459.H.T.
"Y" alloy ..	18	2	0.1025	176	BSS.703.H.T.
Al Mg alloy	16	7	0.092	174	D.T.D.300A. H.T.
Mang. bronze	50	15	0.3018	165	H.T.B. 3C. As cast.
Alloy steels ..	45	15	0.283	159	BSS.1458.H.T.
Alum. bronze	40	20	0.2725	147	As cast.
Mang. bronze ..	40	18	0.3018	133	H.T.B. 2C. As cast.
Monel	38	12	0.32	119	As cast.
AlSi alloy ..	11	5	0.094	117	As cast. (Alpax).
Mang. bronze ..	33	15	0.3018	109	BSS. 1400. As cast.
Carbon steel ..	29	20	0.283	102	Annealed.
Alloy iron ..	24	—	0.26	92	As cast. BSS. 1452-20.
W.H. malleable	20	4 to 12	0.2642	75	Annealed. BSS. 309-1.
B.H. malleable	18	6 to 14	0.264	68	Annealed. BSS. 310-1.
Gun metal ..	16	12	0.308	52	As cast. BSS. 1400.
Phos. bronze ..	16	10	0.315	50	As cast. BSS. 1400.
Common grey iron ..	11	—	0.26	42	As cast.

The above outlines give some idea of the scope of the industry; a list of typical castings would be very long and would serve little purpose here. It may, however, be emphasised that a very large proportion of the non-ferrous castings produced are manufactured to meet rigid specifications.

In dealing with the manufacturing practice itself it is proposed to cover the main differences between non-ferrous and ferrous practice. This procedure seems reasonable, as the ferrous and non-ferrous branches of

* A Paper read before the Birmingham branch of the Institute of British Foundrymen, Mr. H. G. Hall presiding.

Non-ferrous Foundry Practice

the industry have a common basis. Fundamental theories, mould materials, methods and procedures are common to both, and are modified only to accommodate the peculiarities of particular alloys.

Melting Methods

Copper- and Nickel-base Alloys

It is well-known that the majority of non-ferrous alloys are prone to gas unsoundness. This usually occurs due to the evolution of hydrogen as the molten metal cools down to and passes through the freezing range. The main exceptions are those alloys which contain high percentages of zinc, *e.g.*, the high-zinc brasses and the high-zinc nickel-silvers. The evolution of water-vapour, carbon monoxide and sulphur dioxide may also play a part in forming gas unsoundness in copper alloys. It would appear certain that the evolution of carbon monoxide is the main cause of gas unsoundness in nickel-silvers. Modern melting practice has been evolved in order to prevent the solution of harmful gases or to eliminate them before pouring. The two soluble gases which must be dealt with are hydrogen and oxygen—hydrogen forming gas unsoundness on its own, and oxygen by combining with another element in the melt, for example, with carbon, sulphur or hydrogen, to form an insoluble gas (carbon monoxide, water-vapour or sulphur dioxide) during the solidification of the alloy. When melting is carried out under oxidising conditions, oxygen is dissolved and hydrogen is kept to a minimum. Under reducing conditions, hydrogen goes into solution and oxygen pick-up is eliminated. The removal of hydrogen from a melt is difficult; de-gassing methods have been evolved, but are inconvenient and cumbersome. Oxygen can be removed by de-oxidation, usually a very simple process.

It thus should be possible, by melting under oxidising conditions, to keep the hydrogen content of the final melt to a minimum, thus preventing gas unsoundness due to hydrogen, and then, by de-oxidising, oxygen could be removed or converted to an inert oxide, and hence reaction gas unsoundness could be prevented. This, in fact, is the recommended modern practice. All nickel alloys and all copper alloys, with one exception, should be melted under oxidising atmospheres, ranging from slightly oxidising for phosphor bronze to strongly oxidising for high-nickel alloys. The de-oxidising operation should be carried out shortly before pouring. Phosphorus and aluminium are excellent de-oxidisers, and alloys containing either of these elements will not need the addition of a further de-oxidising agent. High-conductivity copper is the exception to the above procedure; authorities seem to be agreed that the procedure giving the best results for this alloy is to melt it under neutral or slightly-reducing conditions, followed by a de-oxidising treatment.

Phosphorus is the most popular de-oxidiser, and can be used successfully from the point of view of soundness for all copper alloys; including high-conductivity copper. Even small amounts of phosphorus, however, greatly reduce the conductivity of copper (0.1 per cent. phosphorus reduces the electrical conductivity of copper to below 50 per cent.), and for this reason phosphorus should not be selected as a de-oxidiser for castings required for high-conductivity applications. Lithium, calcium, boron, magnesium and silicon have all been successfully employed for these applications as their effect on conductivity is much less marked.

For nickel-silvers, Monel and nickel alloys generally, magnesium has been strongly recommended, either used alone or in conjunction with other de-oxidisers (for instance, manganese and phosphorus). Nickel alloys will dissolve sulphur in addition to oxygen, and magnesium is a powerful de-sulphuriser and de-oxidiser. This fact possibly explains why magnesium is so successful with nickel alloys.

Fluxes are not universally used for copper alloys. For high-zinc brasses they are not necessary and are seldom employed. A neutral cover may be used when melting tin bronze, silicon bronze, aluminium bronze or low-zinc brasses, a suitable one being a mixture of glass and borax. This cover will give some protection from the furnace atmosphere and will reduce the tendency for gas pick-up and zinc loss. However, if the furnace atmosphere be maintained oxidising, a covering flux is not necessary. Dry charcoal is recommended as a cover for high-conductivity copper by many foundrymen, its main function being to prevent the formation of any cuprous oxide, which later would have to be reduced by de-oxidation.

Aluminium Alloys

Aluminium alloys are very susceptible to hydrogen pick-up. Melting under oxidising conditions will, as with other non-ferrous alloys, limit the amount of hydrogen pick-up; it will not, however, reduce the hydrogen content by a reaction between hydrogen and the metallic oxide as aluminium oxide is inert. Hence the hydrogen content will tend to rise. As the oxygen is already in the form of an inert oxide, de-oxidation is not necessary, the removal of hydrogen is, however, generally essential. There are several methods available for the de-gassing of molten aluminium alloys:—

(1) Pre-solidification. (Archbutt);
(2) by bubbling dry chlorine through the melt;
(3) by bubbling dry nitrogen through the melt. (Hanson and Slater), and
(4) by submerging proprietary compounds which give off scavenging gases below the surface of the melt.

The furnace atmosphere is not the only source of gas, and when melting non-ferrous alloys, the following points must be observed:—

(1) Furnace linings, crucibles and ladles must be perfectly dry;
(2) all charge materials, including fluxes and de-oxidisers, must be clean and dry;
(3) all fuels should be dry (particularly coke and the combustion air in gas and oil-fired furnaces);
(4) the melting operation should be completed as rapidly as possible;
(5) the temperature of the molten metal should not be raised above that necessary to produce good castings, and
(6) the molten metal should be used as soon as it is up to the required temperature, and not be left in the furnace.

Melting Furnaces

From the earlier sections it should be readily understood that the essential characteristics of a suitable furnace for the melting of non-ferrous alloys are:—(1) Very rapid melting; (2) a controllable furnace atmosphere, and (3) flexibility. Practice has proved that the batch-type furnaces give the best results. The cupola has been used for the melting of some copper-base alloys, but owing to the inferior quality of the metal produced, the risk of contamination and the lack of flexibility, it has not found a permanent use in the non-ferrous foundry. All iron-foundrymen will have experienced difficulties due to contamination between one charge and the next, and will, in fact, usually agree that it is difficult to obtain a steady analysis, even when running on one mixture only. The majority of non-ferrous foundries require daily supplies of a large number of different alloys to close specifications, and it has been proved repeatedly that the best method of attaining this object is to use a number of small melting units rather than to attempt to obtain a higher over-all thermal efficiency by operating large furnaces. The number, type and size of the melting units installed will depend upon the type of foundry; the number and types of alloys to be melted and the amount of each required daily being the principal factors involved.

Crucible Furnaces

The crucible furnace is by far the most popular melting unit. The pit, or "lift-out" type, is still very common, particularly when small quantities of many different alloys are required. The possibility of reserving individual crucibles for each alloy prevents contamination between alloys and greatly increases flexibility. The tilting type of crucible furnace has many advantages, including greater thermal efficiency and crucible life, together with the marked improvement possible in the furnaceman's working conditions. However, flexibility is low due to the fact that the crucible remains in the furnace.

Coke, gas or oil may be the fuel used in both pit type and tilting crucible furnaces. When coke is the fuel used, forced draught will help towards rapid melting and furnace-atmosphere control. These objects can be achieved in gas- and oil-fired furnaces by manipulation of the separate air and fuel regulators. "Bale-out" furnaces, having steel or cast-iron pots, are used in aluminium die-casting foundries, usually as holding furnaces. The original melting is often carried out in other furnaces and the molten metal is transferred to the "bale-out" furnaces to provide a continuous supply of molten alloy throughout the working day.

Reverbatory Furnaces

In reverbatory furnace units the products of combustion come into direct contact with the molten metal during melting; it is therefore extremely important to be able closely to control furnace atmosphere. Covers for the molten metal or fluxes may be used to reduce the amount of contamination and to reduce melting losses. Good results can be obtained when melting brasses and bronzes. These furnaces are usually of larger capacity than crucible furnaces and are commonly used when large quantities of a particular alloy are required. Thermal efficiency is higher than for crucible furnaces, metal losses, however, are also higher. The smaller installations are usually oil-fired, while coal is the fuel used for the larger types. It is in this latter coal-fired type that the metal for large marine propellers is melted.

Electric Furnaces

Several types of electric furnaces are available and have found a permanent place in the non-ferrous foundry. All types have the advantages of rapid melting, the absence of products of combustion, low metal loss and a high degree of cleanliness. Electric furnaces are employed on a larger scale in the United States than in this country, although they appear to be increasing in popularity here. The indirect-arc furnace and the high-frequency induction furnace would appear to be particularly suited to the non-ferrous foundry. Both types are flexible in application, particularly the lift-coil high-frequency furnace which uses the pouring crucible as the metal receptacle in which the melting is done.

For the melting of aluminium alloys, several resistance-type furnaces are available, all of which are capable of melting the charge under ideal conditions. The low-frequency induction furnaces are ideal for melting many non-ferrous alloys including aluminium where one alloy composition is continuously demanded. This type is not flexible and is used mainly in melting for billet manufacture. The high initial cost of electric furnaces is probably their main disadvantage.

Non-ferrous Foundry Moulding Sands

The properties required in moulding sands for non-ferrous castings differ only in degree from those of sands suitable for the ferrous foundry. The range of casting temperatures for commonly used non-ferrous alloys is very wide and is shown in Table II to lie between 680 and 1,550 deg. C.

TABLE II.—*Pouring Temperature Ranges for Non-ferrous Alloys.*

Type of alloy.	Pouring temperature range.
	Deg. C.
Magnesium alloys	680 to 760
Aluminium alloys	680 to 780
Manganese bronze	980 to 1,050
Brass, 65/35	1,000 to 1,100
Brass, 70/30	1,020 to 1,110
Phos. bronze	1,030 to 1,130
Tin bronze	1,040 to 1,140
Gunmetal	1,120 to 1,200
Alum. bronze	1,120 to 1,300
Copper H.C.	1,120 to 1,200
Nickel silver	1,210 to 1,270
Cupro nickel, 90/4	1,220 to 1,270
Monel	1,450 to 1,550

The refractoriness of sand for the high-nickel alloys is very important and should approximate to values considered to be satisfactory for steel castings. Copper-base alloys are poured at lower temperatures than those used in the ironfoundry, and hence sand refractoriness for these alloys is not a limiting feature. The light alloys, having the lowest pouring temperatures, do not require sands with high refractory values.

Permeability

The permeability of any moulding sand must be sufficiently high to permit the easy escape of the gases generated during and immediately following the pouring operation. If the gas pressure in the sand rises to a higher value than the adjacent metal pressure in the mould cavity, mould gas will be forced into the molten metal, possibly forming blowholes, scabs or other casting defects. The mould-gas pressure must, therefore, be less than the adjacent metal pressure. The mould-gas pressure generated will depend upon many factors, including the following:—

(1) The moisture content of the sand;
(2) the presence of other materials which generate gas on being heated;
(3) the pouring temperature of the alloy used;
(4) the permeability of the sand;
(5) the degree of ramming of the mould; and
(6) the speed of gas evolution.

Reductions in (1), (2), (3), (5) and (6) will reduce gas pressure; an increase in (4)—sand permeability—will reduce gas pressure. The metal pressure is proportional to the product of the head of metal and the specific gravity of the alloy concerned. As the metal head would be appreciably the same, irrespective of the alloy, it follows that, in a particular case, the metal pressure will be proportional to the specific gravity of the alloy used. The permissible gas pressure, therefore, depends upon the specific gravity of the alloy. Thus it is very important to keep mould-gas pressure down when using low-specific-gravity

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alloys. Table III gives ranges of specific gravities for various groups of alloys.

TABLE III.—*Range of Specific Gravities for Various Groups of Alloys*

		Sp. gr.
Light alloys	Magnesium alloys	1.8–1.86
	Aluminium alloys	2.65–3.0
Copper alloys	Brasses	8.2·8.5
	Bronzes	8.5–8.75
Nickel alloys	Nickel bronze	8.4–8.9
	Monel	8.5–8.8
Ferrous alloys	Cast iron	7.2–7.5
	Steel	7.8–8.0

Fortunately, the alloys having the lowest specific gravities also have the lowest pouring temperatures, which fact partially offsets the effects of low specific gravity by reducing the total quantity and the speed of gas evolution. The low specific gravity enables the sand to be rammed more lightly than is the case with moulds for the heavier metals, thereby further reducing the mould-gas pressure. The copper-base alloys have a higher specific gravity than cast iron and are poured at lower temperatures, the former increasing the permissible metal pressure and the latter reducing the mould gas pressure. High permeability is, therefore, not as important in sands for these alloys as it is in those for cast iron. Nickel-base alloys have a higher specific gravity than cast iron but are poured at higher temperatures with the overall result that these alloys require moulds with higher permeabilities than are necessary for iron castings.

Grain Size of Sands

The finer grain-size sands are chosen for non-ferrous foundries. The fine finish required on the castings, coupled with the fact that the alloys, generally (and phosphor-bronze and the high-lead alloys, in particular) have a great tendency to penetrate between the sand grains, supplies the reason. The sand used for green-sand moulds for iron castings invariably contains additions of coal dust in order to improve the casting skin. Coal dust does not prove so effective in the non-ferrous foundry, due to the lower pouring temperature of the alloys used. Sands of the Mansfield and Erith types give good results. Coal dust is used in sand for the alloys of higher casting temperature and the necessity for fine-grain sand does not arise in these cases.

Mould dressings are used on dry-sand moulds and it is this facing which imparts the necessary finish to the castings. Thus, for dry-sand moulds it is considered good practice to use one of the coarser and often cheaper grades of sands. If this is done, care must be taken when casting with one of the alloys which render it necessary to guard against metal penetration.

Mould Strength

The required green strength of a sand is not a function of the particular alloy but of the pattern being moulded, and the method of manufacture of the mould. It therefore will be essentially of the same order as for ferrous founding. Dry strength should be fairly low when casting with a hot-short alloy (many of the aluminium alloys are hot short).

Moisture

The moisture content of the sand for green-sand work should be that which gives the best combination of permeability and green strength. It should be remembered that increasing moisture increases mould-gas pressure and, therefore, sand for the light alloys should be rather drier than would be satisfactory for cast iron. As in the ferrous foundry, the moisture content in sand for dry-sand moulds is higher than that used for green-sand mouldings, as increased moisture gives increased dry strength.

Additions to Non-ferrous Moulding Sands

As mentioned earlier, coal dust is used in green-sand moulds for high-nickel alloys. Its function is exactly the same as in green-sand moulds for cast iron. Additions of about 5 per cent. are usually sufficient.

Sawdust, chaff, etc., are widely used for dry-sand and loam moulds. Their functions, as in the ironfoundry, are to increase permeability and to reduce dry strength. Incidentally, they also reduce green strength, hot strength and expansion. Great care must be taken to prevent metal penetration if phosphor bronze is the alloy being cast.

Flour. Two to 3 per cent. of flour may be added to green-sand mixtures for brasses, gun metals and tin bronzes to improve casting finish. It also increases green strength but reduces permeability.

Plumbago. Plumbago is often added to dry-sand mixtures to prevent metal penetration of phosphor bronze. Between four and six per cent. is a normal addition. As well as reducing permeability, it reduces green and dry strength, expansion and hot strenth.

Clay and *cereal binders* may be added to improve green- and dry-strength of the sand. Addition of these materials permits a reduction to be made in the new-sand additions.

Inhibitors. Moulding and core sand for alloys containing magnesium must contain some inhibiting agent, such as boric acid or fluorides. Sulphur or sulphur dioxides may be present in order to reduce metallic oxidation.

Sand Mixtures

Deterioration of sand in the non-ferrous foundry is slow and the quality of the floor sand is usually maintained by the new sand additions to the facing sand. Only small additions are required as the casting temperatures are low. The actual amount of these new-sand additions will obviously vary according to the type of new sand used, and the average section of the castings produced. An average figure of 10 to 12 per cent. sand in the facing sand would represent British practice. With separate clay additions, this figure can be reduced until the new-sand additions just compensate for sand loss.

Core Sands

Oil-sand, dry-sand and green-sand cores are used in non-ferrous foundry practice. The sands used for the dry-sand and green-sand cores are the same as the facing sand for moulds.

The base for oil-sand mixtures is silica sand (usually sea sand, although sand from inland sources is satisfactory provided that it has a fine even grain size and a high silica content—over 90 per cent.). The normal binding agents used in the ferrous foundries are satisfactory for the making of oil-sand cores for non-ferrous alloys. The mixtures invariably contain a percentage of a naturally bonded sand to guard against metal penetration. Percentages ranging from 10 to 30 per cent. are common.

Mould Facings

As in the ironfoundry, dry-sand moulds are invariably coated with a facing material to improve the casting finish and to reduce cleaning costs. The same materials are in general use and typical blackings contain one or more (usually a mixture) of the following—

plumbago, coke dust, coal dust, retort carbon, lamp-black, soapstone, and silica flour. The best blackings contain the higher proportions of plumbago and these should be used for the high-nickel alloys and for phosphor bronze. The wash should contain a binding agent, and when mixed should have a specific gravity of about 1.2 to 1.35 according to the method of application to the mould or core surface.

Facings for Green-sand Moulds

Dry facings may be dusted on to the mould surface. The materials used include most of those used in wet blackings, and plumbago is probably the best. Either plumbago or a good-quality commercial "blacking" should be used for heavy-section castings and for phosphor-bronze and other "searching" alloys. Gunmetals, brasses and bronzes do not demand the best facing unless the castings are large. Soapstone, talc-flour or pease-meal are amongst the materials in common use. The main object of these facings is the same as facings for dry-sand moulds, *i.e.*, to present to the metal a smooth, impervious surface and hence to impart a good skin to the casting.

"Flared" dressings are being used to an increasing extent. These can have a similar base to the ordinary wet facings, but the water is replaced by commercial methylated spirits or similar inflammable liquid. After applying this dressing to the green mould, the spirit is ignited and burnt off, leaving a dry refractory layer on the surface of the mould which itself may be dried to a small depth by the combustion of the spirit. When this type of facing is used, the moulds are of course not stove dried.

Casting

Running and feeding castings is one of the most important aspects of casting production. The principles involved are common to all metals whether ferrous or non-ferrous. The application of these principles will, however, vary from alloy to alloy and the method chosen in a specific case will depend upon the relative importance of the various points considered in conjunction with the particular alloy concerned.

Thus, the runner system, *i.e.* the system of channels through which the metal is conducted from the runner basin to the mould cavity, should be such that when the molten alloy (at the correct pouring temperature) is poured the following conditions shall be fulfilled:—

(1) The mould cavity must be completely filled;
(2) a correct temperature gradient should be promoted to assist feeding;
(3) impingement of metal stream on mould or core, which is severe enough to produce sand erosion or other defects, should be avoided;
(4) the metal entry into the mould cavity should be non-turbulent, and
(5) clean metal only should be allowed to enter the mould cavity.

The above points are not necessarily in order of importance as this will depend upon the particular alloy being considered.

Conditions which a correct feeder system will fulfil are:—

(1) The feeder head, or heads, should contain a minimum of liquid metal after the whole of the casting has set;
(2) the head(s) should promote directional solidification;
(3) no section of the casting should solidify before the section(s) it is to feed;
(4) sections which cannot be fed adequately should be chilled, and
(5) size and position of feeders should be decided upon, bearing in mind the necessity for their removal.

The runner and feeder systems are so interdependent that it would be more correct to consider the runners and feeders as one system—the runner and feeder system. In order to produce a sound casting, it is necessary to supply liquid metal to all parts as cooling proceeds. It is obvious that a section will not be adequately fed if another section between it and the feeder head solidifies first. Hence, freezing must proceed progressively towards the head. Under these conditions, each section will be sound, provided that sufficient pressure exists to force the liquid metal into the casting as shrinkage proceeds.

Temperature Gradients

The runner and feeder system should be designed to promote these conditions by setting up a correct temperature gradient. The ingates should supply the hottest metal to the head and the coldest to the further parts of the mould cavity. Whilst doing this, the sand in the vicinity of the head usually becomes heated to a greater extent than elsewhere in the mould. Once this correct temperature gradient has been established, the feeder, by virtue of its bulk, will maintain it.

Probably, the best method of pouring (from a feeding point of view) is top pouring with the feeder also at the top. This method gives a correct temperature gradient as the first metal—and hence the coldest—to enter the mould comes to rest at the bottom, while the last to enter goes into the feeder head. It also enables both atmospheric pressure and gravity to act together in forcing molten metal from the head downwards into the casting to compensate for the shrinkage that occurs during the cooling of the metal. Some alloys may be poured by this method, provided that the casting design is suitable. Cast iron, steel, tin and phosphor bronzes, gun metal and copper nickel alloys can be top poured and fed successfully.

Top pouring is very severe on mould and core surfaces when impingement occurs, and for this reason its application is limited even when using suitable alloys. In deep moulds, the stream or streams of metal should not touch the sides of mould or core but drop straight to the bottom of the mould cavity. Impact on the mould surface (which can be reinforced) is thereby of short duration as molten metal will quickly cover the bottom surface and metal thereafter will drop into metal. Where the mould is too deep or too intricate to permit top pouring, step gating may be resorted to as the best alternative.

Non-turbulent Methods of Pouring

Many non-ferrous alloys cannot always be successfully top poured because of the effects of turbulence. Manganese- and aluminium-bronze and the light alloys are the main examples. Each of these alloys when molten forms a tenacious oxide film immediately on contact with air. This film protects the metal beneath it from further oxidation. Should, however, this oxide skin be disturbed further oxide immediately forms on the newly-exposed metal surface, and when the disturbed film becomes entrapped in the metal it cannot easily be removed. Turbulence in the mould cavity breaks the protective film and allows oxidation to proceed. The oxide so formed will tend to rise to the surface and lodge against the first portion of mould or core with which it comes into contact, or it may become entrapped within the metal, thus breaking up the continuity of the metal section and greatly reducing strength and pressure tightness of the casting. It is impossible to obtain satisfactory castings in these

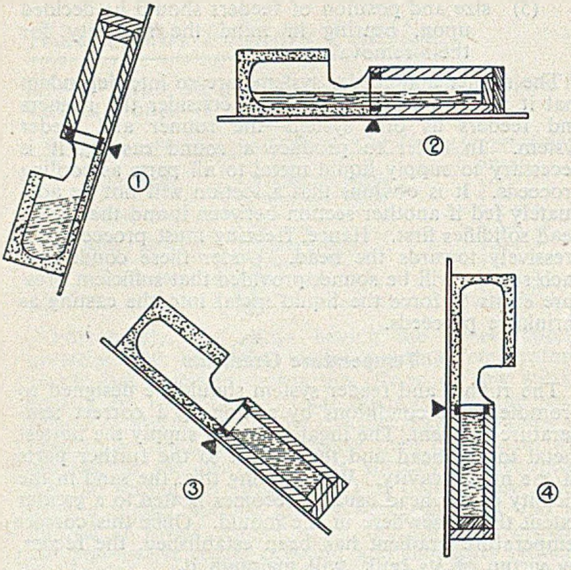


FIG. 1.—STAGES IN THE DURVILLE METHOD OF CASTING.

alloys by methods of pouring which produce turbulence. The first essential, therefore, is to use runner systems which will allow the metal to enter the mould cavity in a quiet manner. Efficient feeding is also essential with these alloys, and the runner/feeder system must be designed with both objects in view. Possible methods include:—

(1) The Durville method;
(2) the total-reversal method;
(3) the partial-reversal method;
(4) the use of chills and heavy feeders;
(5) feeding by the use of blind risers; and
(6) the top filling of feeders.

Durville Method

The Durville method of casting was developed for the production of billets, in which field it has proved highly satisfactory. Fig. 1 shows diagrammatically four stages in the casting of a billet by this method. Castings of complicated shapes can be produced; the billet mould being replaced by the sand mould of the casting to be produced. In this process, the mould is filled without breaking the oxide film at all. Complicated mould shapes will, however, cause some disturbance, but it can be expected to be at the minimum; fettling costs may be high.

Total-reversal Method

The total-reversal method will give very good results if the metal enters the heads (at the bottom) and pouring is slow, because slow pouring from the bottom gives a very pronounced temperature gradient. After the mould is turned through 180 deg., the relatively-cool sections at the bottom in contact with the coolest portions of the mould will solidify long before the hot metal in the head or heads in contact with the hottest portions of the mould. This method, while successful for many designs of castings, is particularly useful for castings of uniform cross-section, *e.g.*, hollow, cylindrical castings cast on end.

Partial-reversal Method

Fig. 2 shows this method diagrammatically illustrated; the metal enters the lowest part of the mould cavity, which must be the feeder head, and rises quietly in the mould. After pouring is complete, the feeder end of the moulding box is raised, thus bringing the head which contains the hottest metal to a higher level than the rest of the casting. In this position, feeding continues under the influence both of gravity and atmospheric pressure. This method can be used on a large variety of casting designs, although reversal methods may not be convenient for quantity production.

Stationary Moulds

When moulds are made which are to remain stationary, non-turbulent pouring is still essential for the alloys quoted previously, and feeding must receive adequate attention. Bottom-pouring sets up a temperature gradient in the wrong direction. Fast pouring minimises this effect, and castings which are bottom-run and top-fed should always be run as fast as is practicable, bearing in mind the necessity to avoid disturbance and to allow only clean metal into the mould. The feeder head, if of the correct size, will help to correct the temperature gradient, as also will correctly-placed chills. In positions where feeding is not possible, chills used in mould or core will often produce the desired result. Chills are used to a much greater extent in the non-ferrous than in the ferrous foundry.

A hot-spot usually occurs where metal enters a mould, and if the section thickness is not much less at this point than the remaining sections of the casting, shrinkage cavities will occur due to the delayed solidification. Chilling usually cannot be employed and blind risers or shrink-bobs should be incorporated in the ingate. This ensures that metal to feed shrinkage in the hot-spot is drawn from the runner and not vice versa.

In order to get the hottest metal in the feeder head, pouring may be stopped as soon as metal enters the head and the head then may be filled direct from the ladles. This method greatly improves the temperature gradient and increases the efficiency of the feeder head. Two points, however, call for comment. (1) When filling the head, care must be taken to prevent oxide being forced into the casting itself; and (2) if there is more than one feeder on the casting, all should be

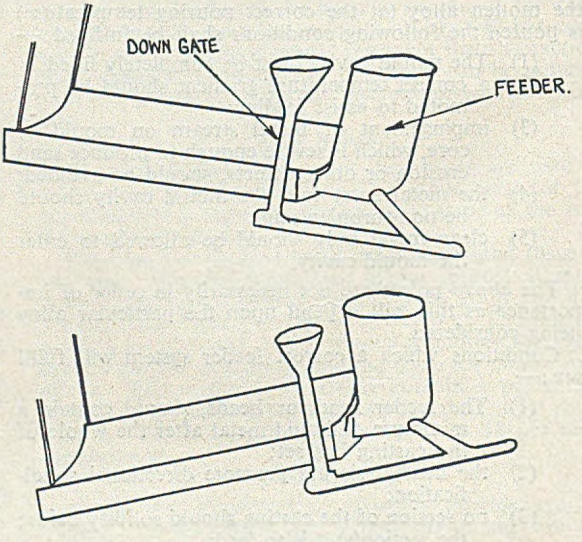


FIG. 2.—POURING AND FEEDING POSITIONS IN THE PARTIAL-REVERSAL CASTING METHOD.

filled simultaneously. If all the new metal is poured in one head the others will receive cool metal from the casting and the casting will receive approximately an equal amount of hot metal from the one head.

A few methods of bottom pouring are illustrated in Figs. 3 to 6. All ingates should increase in cross-secional area as they approach the casting. This will reduce the velocity of the metal stream as it enters the mould. A choke in the runner system should be before the ingates.

Methods of Production

Moulds and cores are produced in the non-ferrous foundry by all the methods used in the ferrous foundry. These include:—

Moulds

(1) By hand methods, using loose patterns or strickles, in green-sand, dry-sand or loam;
(2) By hand methods, using pattern plates or odd-sides, in green-sand or dry-sand; and
(3) By machine, hand- or power-operated, using pattern plates, in green-sand or dry-sand.

Cores

(1) By hand methods, using ordinary core-boxes or strickles, in green-sand, dry-sand, loam or oil-sand;
(2) By machine, hand- or power-operated (including core-blowing machines), in green-sand or oil-sand.

There is, therefore, little difference in the actual mould or core manufacture between the two branches of the industry, it being understood that the positions and sizes of gates and feeders will vary not only between ferrous and non-ferrous castings, but also from one non-ferrous casting to another.

Moulding machines are used for mould production when the quantity of castings ordered warrants the expense of pattern plates. In the ironfoundry the use of a unit sand is common. The need to resist metal penetration in some, but not all, non-ferrous alloys, together with the difficulty of completely separating the non-magnetic particles from large quantities of sand, make the use of facing sands desirable if not essential for non-ferrous casting production. It is common in both types of foundry for moulds made on machines to be placed on the floor, or on roller conveyors, and

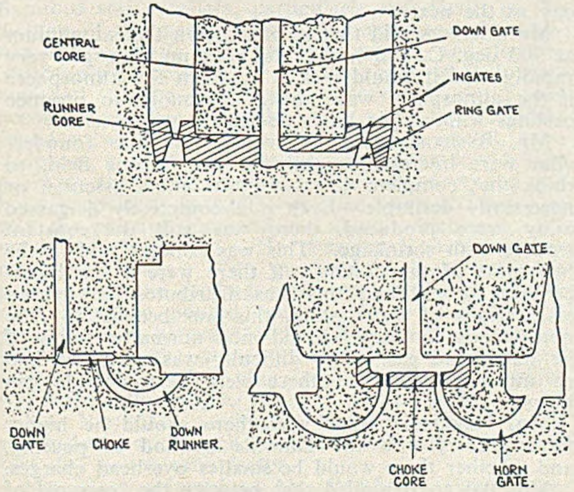


Fig. 3.—Bottom Pouring of Cylindrical Castings, showing the use of Horn Gates.

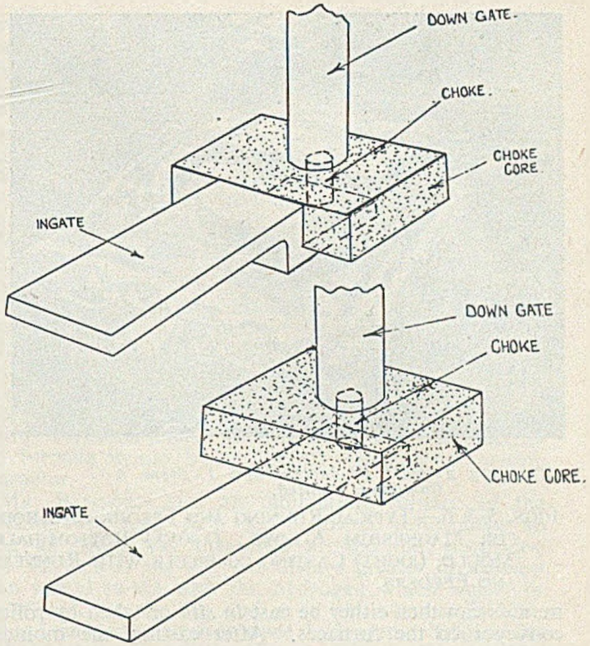


Fig 4.—Runner Systems suitable for Manganese Bronze, etc.

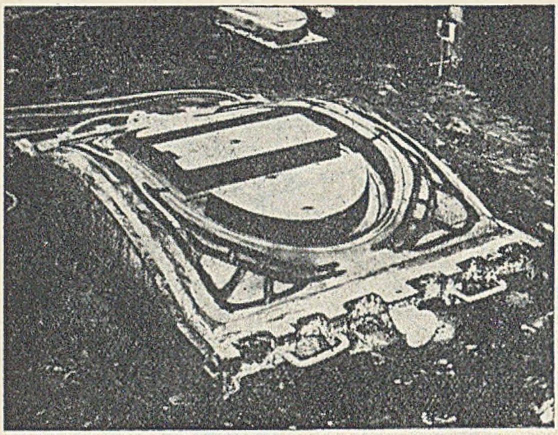
for the molten metal to be brought from the furnaces in ladles to the moulder's site.

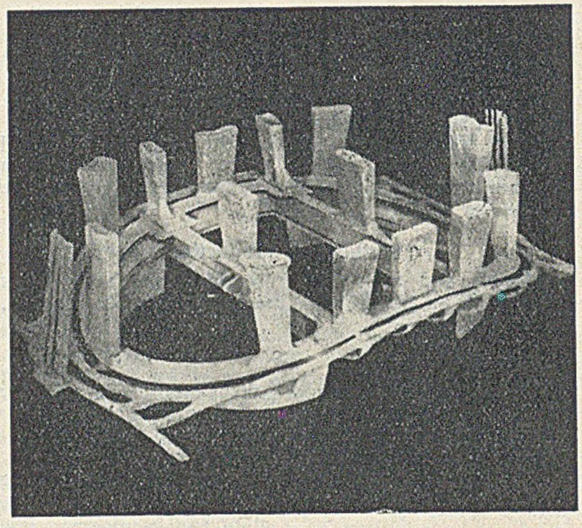
Mechanisation

Mechanisation in the ironfoundry has proceeded further than in the majority of non-ferrous foundries by mechanically conveying the moulds to a pouring point and, after casting, to a knock-out and then returning the empty moulding boxes to the moulding machines. This further advance in the ironfoundry has been possible because of two main points:—(1) One metal composition is commonly used for all castings produced at any one time; and (2) there is a continuous supply of molten metal. Neither of these points, generally speaking, can be satisfied in a non-ferrous foundry.

Where machine moulding has been adopted, the further mechanisation has many advantages, some of which are listed below:—(1) Increased production is possible from the machines: (*a*) by reduction of the time involved in carrying the moulds to the floor; and (*b*) by the return of moulding boxes to the machines; and (2) there is an improvement in shop conditions and atmosphere: (*a*) by separating the pouring operation; and (*b*) by concentrating the knock-out at one or two points.

Although the non-ferrous foundry may not be capable of being mechanised in exactly the same way as the ferrous foundry, some solution which will attain the desired objectives is possible. The main difficulties are due to the incidence of smaller runs, the varied cooling times necessary before knock-out and the large number of alloys to be catered for. Some advancement has been made by individual foundries by using roller conveyors which give much more flexibility in working than a mechanised conveyor. Moulds made on a particular machine, or machines, can be stored on roller conveyors adjacent to the machines until the particular metal required is ready. These





[Courtesy Aircraft Production and J. Stone & Company, Limited.

FIGS. 5 & 6.—TYPICAL RUNNING AND FEEDING METHODS FOR MAGNESIUM ALLOYS; (ABOVE) BOTTOM-HALF MOULD, (RIGHT) CASTING COMPLETE WITH RUNNERS AND FEEDERS.

moulds can then either be cast *in situ* or taken by roller conveyor to the furnaces. After casting, the moulds could proceed to a knock-out and the empty boxes be returned, again by roller conveyor, to the moulding machines. Such a scheme is possible but not necessarily practicable in all circumstances. The production of large quantities of non-ferrous castings, particularly in the light alloys, is catered for by gravity and pressure die-casting methods.

DISCUSSION

MR. FRANCIS, in proposing a vote of thanks, said Mr. Bamford had mentioned that with high-zinc alloys it was not really necessary to provide a covering flux. Mr. Francis thought that was perfectly true, but he thought a covering flux was of value in that it did suppress zinc fumes to a very great degree. The use of coal dust was a controversial point, particularly with the gunmetal range of alloys. Atmospheric-pressure feeding was a very valuable feature, and should be used wherever possible, particularly with non-ferrous castings where sometimes the shrinkage was very considerable.

MR. MARSH, in seconding the vote of thanks, said Mr. Bamford had mentioned the possibility of melting aluminium under oxidising conditions. He would have thought that under these conditions there would have been quite a heavy metal loss. On the question of de-gassing aluminium with chlorine, could Mr. Bamford tell them whether the grain size of the aluminium would be increased?

MR. BAMFORD, in reply, said the lecture, covering as it did such a wide field, had had to be much curtailed in detail, as any one of the headings in the lecture could form a lecture in itself. However, his title was non-ferrous founding, and he had tried to bring in as many aspects as possible. He agreed with Mr. Francis that fluxes would reduce zinc loss by preventing oxidation. Melting aluminium under oxidising conditions would reduce the amount of hydrogen pick up, and many aluminium alloys could be cast without de-gassing if they were melted under oxidising conditions. He did not know whether chlorine would increase grain size. Some reports stated that it did, and some that it did not. If it did increase grain size, he thought it should be very slight.

MR. H. G. HALL, branch president, referred to the point made regarding the necessity for dry air with regard to non-ferrous melting practice. How was this obtained; was it necessary in this country, and was it common here?

MR. BAMFORD said it depended on how the air was obtained, but if traps were used, relatively dry air could be obtained. It was a very definite point to watch because water vapour was more detrimental in melting than anything else and caused most of the troubles. He had tried to stress the importance of keeping everything dry, and if the air could be kept dry too, it was a help in the right direction.

MR. HALL asked whether he meant that the normal atmospheric conditions were not worth worrying about.

MR. BAMFORD said that we did get variation in humidity in this country, but not so much as, say, America. There was quite a variation in humidity on the driest and the wettest day here, and that alone would give a variation of gas pick-up and would prevent working conditions being the same on one day as the next.

MR. FRANCIS said that it was known that aluminium at 700 deg. C. and higher did pick up hydrogen very rapidly, and it would pick it up from the atmosphere if the atmosphere was moist. Normally, to produce castings without pin holes de-gassing was essential.

MR. BAMFORD said he would not like founders who were interested mainly in the ferrous field, to think that complete de-gassing was either essential or necessarily desirable. Even if a completely de-gassed alloy were produced, there was still the constant trouble with shrinkage. This was concentrated in the hot spots of the casting. If there were a small percentage of gas, and this was distributed throughout all sections of the casting, this was beneficial. The non-ferrous foundryman did not normally worry if he had some gas. The difficulty was when he had so much present that there were very definite pin holes.

MR. HARRISON asked why there should be higher fettling costs with the Durville method of pouring, and whether there would be smaller overhead charges.

MR. BAMFORD replied that between the reservoir of metal and the casting, there had to be a large area. In the Durville method there was still the presence of the feeder; it did not obviate the necessity for those at all; and in order to do this, there had to be very much bigger downgates, ingates, etc., than was normal.

MR. EVANS, referring to facings and dressings, said that some people sprayed a mould with paraffin as a dressing. Could Mr. Bamford say what was the action of the paraffin?

MR. BAMFORD said he could not be authoritative on this point. It had been used for a long time for aluminium castings and it did impart a very good skin. Why it did so was because of a gas cushion, probably after the manner of coal dust in moulding sands for cast iron. Certainly, it would give an increased gas pressure; this would tend to prevent any metal penetrating between the sand grains.

MR. DAVIS asked whether magnesium could be used for de-oxidising nickel silver, and in what manner.

MR. BAMFORD said that it could be used successfully, added after the metal had been taken from the furnace, and before pouring. Varying quantities were added depending upon the particular foundry, connected with the amount of oxygen to be neutralised. One to two oz. per 100 lb. of metal was normal. It was added by fastening a piece of magnesium, preferably in stick form, of about 1 to 1¼ in. dia., on to the recommended iron bar, and plunging it to the bottom of the crucible. If iron was detrimental, then a nickel bar ¾ in. dia. was used; the magnesium was tied on by string, not wire, as the former did not melt so quickly.

MR. LLOYD said he was interested in the remarks made about the oxidising and neutral method of melting; how was this applied to a 400-lb. Morgan oil-fired crucible furnace?

MR. BAMFORD explained that an oxidising atmosphere could be changed into a reducing atmosphere by increasing the fuel supply, or decreasing the air. There were two possibilities, particularly with a reducing atmosphere. Hydrogen being present, this penetrated to the crucible quicker than any other gas, and there was possibly some penetration through the crucible itself. The main source, however, was in the gas flow which always occurred up the side of the crucible between the cover and the crucible, from whence gas escaped through and into the crucible.

Shrinkage, Gas Holes and Turbulence

MR. CALLAGHAN thought the lecture given by Mr. Bamford was excellent, particularly the details of the melting of the metal. Every sentence was well qualified. The details given of the pouring and feeding could only be regarded as a guide, because each casting had to be considered individually, and fed accordingly. He thought the two big troubles founders were up against, say, in gun metal, were shrinkage cavities and gas holes, and he found that probably the most important factor in preventing gas holes, provided de-oxidisation had been carried out, was the pouring temperature, about which not very much had been said. He considered that this was most important. With gun metals, there was one point about the feeding which was probably missed; they must be poured with as little turbulence as possible. He, himself, found it very useful to bottom pour some of the deeper jobs until near the top, and then remove another plug from the downgate which was sufficiently large to feed the whole casting.

MR. BAMFORD, confirming Mr. Callaghan's recommendations, said much had been left out of the lecture due to the time factor.

MR. HALL referred to Mr. Bamford's remarks regarding the possibility of competition between ferrous and non-ferrous foundries. He was not quite clear as to why there were peculiar difficulties in the non-ferrous foundry especially, in connection with the mass production of castings.

MR. BAMFORD said the problem would be solved if the non-ferrous foundries only dealt with one particular metal, the trouble being that the orders generally speaking were for relatively small numbers, and for various types of metals.

MR. DALLOW asked what Mr. Bamford thought would be the best method of removing hydrogen in connection with gun metals.

MR. BAMFORD said possibly the best method was to oxidise it. If melted under reducing conditions, hydrogen would undoubtedly be picked up. That could be removed by putting cuprous oxide into the melt. This was an active oxide forming steam, and it would oxidise the melt. This tended to take out any hydrogen already in the melt, so that by de-gassing, one was in effect, doing afterwards, what oxidising atmospheres did during the melt.

MR. TWIGGER asked whether an indirect-arc electric-arc furnace would be sufficiently oxdising in melting character.

MR. BAMFORD said an indirect-arc furnace of the Rocking-Arc type gave an oxidising atmosphere so long as there was clearance around the electrodes. The oxygen in the air was always greater in amount than would re-act with the hydrogen which would be absorbed from the air, and so it was not usually considered necessary to introduce hydrogen. Trial melts had been made by introducing inert gases to give neutral conditions.

MR. FORD said that Mr. Bamford mentioned something about glass as a covering flux. What effect did this have on the crucible?

MR. BAMFORD said the effect was very drastic. It did reduce contamination and also metal loss, but it had the disadvantage of reducing the life of the crucible. It was difficult to remove some of the flux, and he thought it was a question which the particular foundryman had to solve for himself, weighing advantages against disadvantages. If operating with the type of furnace which could not be controlled, fluxes were invaluable. If, on the other hand, the furnace was of a type which could be controlled, then the general concensus of opinion was that fluxes were not really necessary.

International Mechanical Engineering Congress

The Third International Mechanical Engineering Congress will take place in Brussels from September 18-23. The Congress will concentrate attention on the various elements which contribute to the improvement of quality in the field of mechanical engineering production. About a dozen papers will be read with subsequent discussions and will be supplemented during the week by visits to factories. Accordingly, the Congress will concern itself with such subjects as: The roles of design and manufacturing processes; the selection of raw materials; control at various stages of manufacture; influencing customers' requirements; the part played by the human factor including the educative influence of trade associations and governments in matters of quality.

The Congress is being organised by the mechanical engineering trade associations of Belgium, Denmark, Finland, France, Great Britain, Holland, Italy, Norway, Sweden and Switzerland, and a large number of industrialists and technologists are expected to attend. Further particulars and detailed programmes may be obtained from Mr. A. W. Berry, the British Engineers' Association, 32, Victoria Street, London, S.W.1.

Foundry Apprentices*

By J. C. Hallamore

For many years, foundrymen have been bemoaning the lack of boys taking up foundry work as a career, and the prospect is still poor. A discussion on what foundries propose to do in the future to rectify this serious shortage should be of general advantage.

Every year, the number of old skilled moulders dwindles and matters become serious if a skilled man has to be replaced. The scarcity of skilled moulders is emphasised in FOUNDRY TRADE JOURNAL advertisements, where it would appear that from a monetary angle they can expect a higher wage than other men taking executive positions in the foundry. In this age of high production by mechanical methods, the shortage of skilled moulders is not so serious, as they can, to a certain extent, be replaced by semi-skilled labour. Ironically, many of these men receive a bigger wage than a skilled moulder working on the floor. Bad conditions, dirt, and no facilities for washing, etc., used to be blamed for lack of boys attracted to the foundry but many shops have now been brought up to a high standard and the trade as a whole will have to follow if boys are to be encouraged. It is felt that conditions in the foundry in the future have a very big bearing on the problem.

From the educational side, the Institute has done much to encourage the training of foundry apprentices and most technical colleges include a foundry course in the curriculum; all this is a step in the right direction, but foundrymen must do their share in the foundry itself to make it more attractive. Looking back on the days when boys were put to work with the moulders, they had a fair chance of picking up the general principles of moulding, but beyond this, opportunities for a wider range of training in the core shop, pattern shop and laboratory were not so good; furthermore this method was open to abuse, as the boys were partly dependent on the moulder for their week's wages.

This is a mechanised age . . . what of the future? Are moulders becoming just robots? The industry must have a sound policy for the future training of apprentices, if boys are to become interested in the foundry, and their parents to feel that the work shows good prospects for their children. The raising of the school-leaving age may be a help, if the extra time is used in special subjects pertaining to the foundry, also in visits to various shops to encourage practical interest.

The critical period is at the actual entry into the foundry, which even now cannot, by the very nature of things, be as "spick and span" as a machine shop; it is the creative instinct of the boys that must be aroused. Part of the foundry should be set aside for their exclusive use, giving them the opportunity of productive work under actual foundry conditions. It should be a full-time job for at least one man to look after these boys. Making things for oneself is always an attractive pastime (no doubt most foundrymen have made many an ornament on the quiet) so why not encourage this side, among apprentices, it is good moulding experience and gives an added interest to the boys.

After a period in the foundry, some time must be spent in other departments to secure a full knowledge of the operations. The old way of youths becoming errand boys for the shops should be rigorously discouraged. The actual time to be spent in the various sections is a debatable point, as not all those being trained will wish to remain in one specified department. The foundry should be predominant, but it may be the least popular. The future of the boys can only be determined by their abilities; those not making the grade would possibly join the ranks of the semi-skilled.

This is a very vast subject, and as this is a "short paper" the whole aspect of the problem cannot be covered, if the seed of doubt as to the future has been sown then the object of the Paper has been attained.

* An entry from a short paper competition organised by the Lincoln branch of the Institute of British Foundrymen.

Crucible Care

The Association of Bronze and Brass Founders has prepared the following list of Do's and Don'ts *for crucible users. It is printed on a card suitable for wall mounting, and is being supplied free to members and is available to non-members at a cost of 2s. on writing to the Secretaries of the Association at 25, Bennetts Hill, Birmingham, 2.*

DO

DO use crucibles carefully.
DO keep in dry storage, dry out and warm before use.
DO, when starting from cold, heat evenly, increase heat steadily—avoid hot spots.
DO, if possible, use *continuously*—minimise cold starts.
DO *place* ingot or heavy metal in crucible, avoid wedging.
DO use tongs that fit—have them adjusted.
DO make sure carrying buels (shanks) fit crucible properly.
DO empty crucible completely—scrape clean after each melt.
DO use a rasp if spout must be cut.
DO see crucible stands level and central in furnace.
DO leave room for expansion when fitting crucibles to tilting furnaces.
DO add flux at right time and in right quantity.
DO use a stand for crucible in all furnaces.
DO maintain linings in good repair.

DON'T

DON'T damage glaze.
DON'T rest hot crucible on cold floor.
DON'T overheat, soak or stew metal.
DON'T wedge metal across crucible.
DON'T drop ingot and lumps of metal into crucible.
DON'T use ill fitting buels (shanks) or pack space between buel and crucible with skimmer iron.
DON'T knock down ring in securing or releasing crucibles.
DON'T lever crucible from or near top edge.
DON'T use a chisel to cut spout.
DON'T allow furnaces to choke with clinker or carbon.
DON'T let clinker build up or crucible stick to stand.
DON'T let guide bricks grip crucible.
DON'T allow crucible to rest on fire bars.

Institute of British Foundrymen *London Branch*

Future of the Founding Industry*

Discussion of Mr. F. W. Rowe's Paper

The branch president, MR. F. ARNOLD WILSON, introducing Mr. Rowe, said the title of his Paper was probably the most ambitious of all those comprising the programme of Papers for the current session; and the programme committee of the branch was to be congratulated on having selected the ideal man to deal with the subject. He had known Mr. Frank Rowe for many years; they were brother Liverymen of the Worshipful Company of Founders. Mr. Rowe had started his career in the foundry industry at the works of Metropolitan-Vickers, and had studied at Manchester University; he had been through the works and had been in charge of nearly every sort of job in the industry. He had travelled a great deal on the Continent; and those who had been privileged to visit the K. & L. works at Letchworth had been impressed by the enormous care that was taken of the workers, by the hygiene, the regular X-ray service for moulders, and so on, all of it being done in a very modern and far-sighted way.

Utilisation of Amenities

MR. A. A. MATTHEWS asked what proportion of the workers in Mr. Rowe's foundry used the washing facilities provided.

MR. ROWE was unable to answer because the new washing facilities that were being provided were not then completed; they would be complete twenty weeks hence. The matter had been somewhat neglected in the past, but the company were installing facilities which he believed would compare with the best in the country. One of the finest amenities blocks that he had seen among foundries was at a works in Switzerland, and he was assured that 100 per cent. of the men employed there were using the facilities provided. The washing block, with cloakrooms, drawers, etc., was so situated that the men could not get into or out of the foundry without passing through it. He had verified for himself that there was 100 per cent. usage.

MR. C. D. POLLARD said that his organisation had installed washing and cloakroom facilities at one of their foundries at Derby. Those facilities were used and appreciated, so much so that the men in the other foundries complained because they had not equivalent facilities.

MR. B. LEVY, whilst he would not say that he disagreed with Mr. Rowe's optimism in regard to the future of the foundry industry, pointed out that the industry had to face very severe competition from welded fabrications, the plastics industries, and so forth. In view of that, and the fact that certain weapons of war, for example, were likely to be required in less abundance than formerly, he asked on what basis Mr. Rowe considered that the demands for castings were likely to expand.

MR. ROWE replied that all the graphs, both in this country and in the United States, showed a constantly rising demand for castings. He would not say that the rise in the curve showing the total tonnage of castings used was as steep as that relating to fabrications; but it should be remembered that welded fabrication was a relatively new industry. He had often wondered how many people who had turned over to fabrications would have done so had the foundry industry really done the job as it should have done. He felt that those in the foundry industry were apt to be complacent, a little old-fashioned; and there were good reasons for that, as he had explained in the Paper. It was debatable how much of the change-over was due to the foundry industry not having sufficient men of the right calibre, that in turn being due to not having made conditions in the industry as attractive as they should have been to boys. If the industry did not recruit its workers as boys, it would never get them as men; that was why he pinned his whole faith for the future on really getting down to making conditions as good as they should be.

MR. S. CLARKE commented that he was brought up in a foundry in the North, and at the age of 20 years he was discharged. He suggested that the foundry industry to-day was suffering in respect of recruitment because men of his age, having had that sort of experience, would not put their boys into the foundries.

Improved Remuneration

MR. ROWE said that one must take some cognisance of the law of supply and demand. He had remarked to the branch president that evening that it was time that we began to express the earnings of foundrymen, not in terms of £'s per week, but of £'s hundreds per year. The remuneration of skilled craftsmen to-day would stand very strict comparison with that of clerical and junior professional men; there were many young schoolmasters, for instance, who would be very glad to draw the wages of a really skilled loose pattern moulder, and he was sure also that there were many bank clerks less well paid. The foundry industry to-day was having to pay for the arduous and dirty conditions in foundries in the past, for the delay in putting its house in order and thus failing to attract the cream of the youth.

MR. J. FALLOWS suggested that, although the reconditioning of washing facilities, ventilation systems, and so on, was important, it had been somewhat over-emphasised in the Paper. The matter that concerned him most was the reference by Mr. Rowe to the craftsmanship which he had witnessed in foundries abroad and to the absence of it in this country to-day. Surely the interest in the finer arts of founding, which was so important a factor, was rapidly dying! He could not remember any period in his short experience in the foundry which was so uninteresting as the first twelve months he had spent there; at that time there was very little that had meant anything to him, but when he really began to learn something about the job he had found his interest and could see that there was something more in the business than just ramming and other mundane jobs. That was a very important problem, and one we were not solving to any degree to-day, in spite of the existence of foundry colleges, etc.; we were only just scratching the surface of that really important problem. If we could really arouse interest by teaching

* Paper printed in the JOURNAL, May 4, 1950.

Discussion—Future of the Industry

the man and the boy on the floor what things really meant, the industry would progress. The provision of washing and other facilities would develop alongside, and those facilities would be used; but he urged that interest was the biggest feature in attracting anyone to any job, whether it be founding or anything else.

Effect of Mechanisation

Mr. Rowe emphasised that a good deal more was being done at present in the way of providing facilities for education and training than was the case 10 or 20 years ago, but he agreed that the problem of craftsmanship was a difficult one. Mechanisation in any phase of industry tended to destroy the need for craftsmanship to some extent, and the opportunities for applying learning were thereby considerably reduced; the industry had lost something in its attractiveness because of that. Mr. Fallows had rightly said that in the past the fascination of foundry work, because of the greater opportunities then offered for the exercise of real craftsmanship, had overcome a man's dislike of dirt and dust and of the fact that he would go home as black as a crow. But, inasmuch, as we had lost, to some extent at any rate, the attractions of craftsmanship, it was necessary to remove the disadvantageous feature of poor working conditions. It was of no use merely harking back nostalgically for the craftsmanship of the past, for much of it would never come again; nor was it needed. Even with all the de-valuation and the wars which had taken place during the last 50 years, castings were cheaper to-day than they were 50 years ago; and that was due to mechanisation. By all means, the boys of to-day should be shown how to make all the things that boys in the foundry were allowed to make in the past; even so, the spirit of the past would not be recaptured in these days of mechanisation.

Position of the Smaller Foundries

Mr. A. Curtis, commented that as large foundries were compelled to instal ultra-modern lighting and heating and so on, what was likely to happen to the small shops in the country, employing only about half-a-dozen hands, or to the young men who hoped to open their own shops in the near future?

Mr. Clarke suggested we were approaching the stage at which the jobbing founder, making only two or three off each job, would have to close down his business.

Mr. Rowe replied that there never was any progress, of course, which did not bring some disadvantage in its wake. He was not suggesting that all the amenities he had mentioned in the Paper should be made compulsory by law; far from it. It was better that the effort should be voluntary, that the improvement that could be effected should appeal to the good founder. There would always be room for the small jobbing founder, and he would probably be able to attract sufficient men to keep him going. But the fact remained that the industry was not attracting the best of the youth or even its fair proportion of the best of the youth, and it had got to remedy that state of affairs, for otherwise there would be no future for it.

Mr. V. Delport (past branch president) pointed out that in every country there were trades and industries which found it more difficult to attract workers than did others. The foundry industry was one such industry, and he supposed the coal-mining industry was another. The problem was the same in the United States.

The remedy must be sought in other directions as well as in the provision of amenities such as had been so ably, and rightly, stressed in the Paper. He emphasised the importance of propaganda to attract young people into the foundries, by convincing them that the foundry industry could offer them good jobs with a good future. It was only during the last few years that a start had been made in that direction by showing films, giving lectures, and so on. That was the only way, after having improved the conditions in the foundries, in which to attract young people. If then they entered the trade and found that it offered what had been promised, they would stay.

Impact of Military Training

Mr. J. Hale suggested that the percentage of young people who were interested in the foundry industry nowadays was less than it had been at any time during the last 30 years. By all means, he said, let there be ideal conditions; but in his experience a more important factor than conditions was the lack of a sense of security. Complicating factors were the raising of the school-leaving age to 15 years and the Military Service Act; young people had not the interest in their jobs between the ages of 15 and 18 years when they were faced with military service on attaining the latter age.

Mr. Rowe agreed that the prospect of having to underake military training at the age of 18 years was not helpful. However, compulsory military service was relatively new to this country; we had known it for only four years in peace time. He felt we must condition our views by the experience of numerous other countries where military service had been compulsory for generations before the last war; such countries had not found then that it was a serious deterrent to a boy taking up foundry work. It was true that it did not help the foundry industry in this country, especially in combination with all the other difficulties and bearing in mind the many opportunities offered in industry generally to boys leaving school nowadays. He personally would prefer to see military service deferred to a later date, if possible; it would be very nice if that could be so, but he did not feel it was right to say that we alone of all the countries in Europe should be the one to be excused from compulsory military service.

Mr. Delport added that the argument against military service applied as much to other trades as to the foundry trade.

Mr. E. C. James pointed out that *bona fide* apprentices were not called up for military service at the age of 18 years, but were deferred until they had completed their apprenticeship. He knew of a works at which 33 per cent. out of the total number of applicants for apprenticeship had been persuaded to try the foundry, and where 12 per cent. of the total number of entrants had taken up apprenticeship. One of the greatest problems was the great lack of knowledge of the foundry trade on the part of the parents of potential apprentices. From experience of 80-90 interviews during the previous year with teachers and with boys and their parents it seemed that they regarded a job in the foundry as a cross between a chimney sweep's job and that of a navvy. They had not the faintest idea what a mould was; there was appalling ignorance among laymen.

Mr. E. Harwood Browne expressed great interest in the arguments put forward in the Paper and in the discussion concerning amenities in the foundries, and particularly when Mr. Delport had stressed that the problem applied, not only in this country, but on the Continent and elsewhere. As one who had roamed about a good deal on the Continent, and had even worked on the foundry floor there 25 years ago, he had gained the impression that the average young fellow on the Continent took a lot more personal interest in himself than did the young fellow here, even in Continental foundries where facilities were not provided as in this country. It was quite general in a small foundry—and there were hundreds in France, probably more than here—to find that about five minutes before knocking-off time the young men would get buckets of water and wash themselves. It was his impression that that did not apply so much here.

Attractions of the Foundry Craft

He felt that the greatest reason for the lack of entrants into the foundries at present was that the industry had not sufficiently publicised its work and its attractions, that it had failed to acquaint the public of just what was entailed in the glorious craft of the founder. He personally had entered the foundry industry just because there happened to be a vacancy in the foundry and not in the engineering shop at the time he had made application. Because he had come under the tuition of men who possessed real craftsmanship, he had never wanted to leave the craft. It was that which had kept him tied very much to the foundry; and he urged that if similar facilities were given to-day, a bigger proportion of boys would act in the same way.

MR. W. TAIT expressed surprise that so far no mention had been made of the pattern shop. He felt there must be a change of outlook in the industry from that which had obtained in the past. In his opinion, if the industry wanted to attract apprentices, it would have to do it from the pattern shop and not through the foundry. None of his generation, as boys, had really liked working in the foundry, it was simply looked on as a means to an end. From his observations, he felt, with the foundries of the future, that the work would be planned in the pattern shop and so arranged that when it came into the foundry, the maximum benefit could be obtained from the equipment installed.

MR. B. LEVY said that in the modern pattern shop everything was planned to give quick production, with the expenditure of the minimum amount of labour. More and more patternmakers were faced with problems of converting a hitherto loose-pattern job into a plate-pattern job on a machine, the production of pattern equipment by repetition methods. There had been in pattern shops the introduction of milling machinery, duplicating machinery and the production of pressure castings. As a result, the moulders had a very simple job, so much so that on mass-produced castings moulders were hardly needed, the pattern and equipment was merely put on to machines, and the castings could be produced by girls or any unskilled labour.

Opportunities for Advancement

MR. E. DAYBELL, commenting that it seemed as though the meeting was a patternmakers' meeting, said there was more in foundry work than just the making of the patterns. If the castings were made as soon as the pattern was made, what a lot of headaches would be avoided! Surely there would always be room for craftsmanship in the foundry, though perhaps at a different level than formerly. Supervisors would always be needed, people who could plan manufacturing, and so on, and the ability to do such work could come only from craftsmanship. A job must be studied from its inception in order to be able to put into practice those methods which were necessary to the production of a good casting; no-one would ever be able to walk into a foundry and decide, just by reading from a book, what should be done. There must always be a certain amount of craftsmanship in the foundry, but instead of it being on the foundry floor it was now required at a higher level, *i.e.*, in the supervisory grades; there would always be room for boys to learn craftsmanship, even though they would apply it as supervisors instead of doing the hard work on the floor.

On the importance of the development of human relationships, Mr. Daybell said that, as a result of years of free education, whereby young people were taught to think more than was the case formerly, there must be a different approach from the managerial side, in order to retain the interest of the boys so that they would apply their talents to the benefit of the industry and to their own satisfaction, instead of always being led.

MR. J. WARREN, as one who had been in the foundry industry for 24 years, said that his biggest headache in the past had been the fear of meeting friends when returning home in a dirty condition after a day's work. He had even stripped off in the foundry and had bathed with the aid of a bucket, to the amusement of the men who were working there; and it was rather embarrassing. One could not avoid getting dirty in the foundry, and it would be of great help in the future to give the foundry workers the opportunity to clean up before returning home.

Film Shows

MR. A. C. LESTER, taking up the point concerning the publicising of the industry by means of cinematograph films, said that after he had seen a film dealing with the foundry he had tried to arrange to have it shown in boys' clubs, etc. But on three occasions when clubs had written to ask for the film to be loaned to them they had been asked to pay four guineas, plus the cost of the insurance premium on the film; it was impossible for the clubs to find that money. He wondered, therefore, whether the Institute's executive could use its influence with those concerned with a view to reducing the cost.

MR. W. G. MOCHRIE (branch honorary secretary and treasurer) asked that Mr. Lester would see him after the meeting with a view to arranging for the loan of a film.

MR. A. A. MATTHEWS commented that we were living in an era of clean hands, collars and ties. That was why we had not the young blood in the foundry industry.

MR. ROWE endorsed, from his personal experience, the remarks of Mr. Warren concerning the importance of being able to return home in a clean condition. He could well remember that when his father had put him into the foundry it had caused him considerable heartburn. He remembered having walked home in the evenings by back ways, lest he should meet people who knew him in what he considered to be much better circumstances.

Small Foundries Fully Competitive

MR. D. E. B. BARNARD, speaking as the owner of a jobbing steel foundry, accustomed to the production from patterns for two's and three's off, said he was endeavouring to brighten up his foundry in every way that Mr. Rowe had mentioned, and also to obtain mechanical aids as far as possible. He felt that jobbing foundries had no reason to fear dropping out of business under modern conditions; they could just as well modernise as could the big foundries.

MR. W. G. MOCHRIE recalled that Mr. Rowe had mentioned the future markets for castings, and Mr. Levy had rather pessimistically taken up this question, but discussion on the point had not materialised further. It had been suggested that founders might lose some of their business to the fabricators and the engineers. No

Discussion—Future of the Industry

doubt, many had had experience of cases in which castings had had to give way to fabrications, but had it occurred to them that the foundries might well produce as castings some articles which now were fabricated?

Entry to New Markets

In that connection, he mentioned a very pleasant experience of four or five years ago, when he had seen a foundry producing as castings some articles which previously were fabricated. Again, about two months ago he had had a similar experience in another foundry. The article being produced was of the everyday type; and the founder concerned, having conceived the idea of producing it as a casting, had gained a very good customer. Those instances were in no way connected. Therefore, Mr. Mochrie threw down the challenge—how many founders, he asked, were content to wait for the customer to give them the pattern for the production of castings? How many, on the other hand, had had the ingenuity to re-design and produce as a casting anything from the unlimited choice of everyday objects which had never before been made as castings?

Mr. Rowe, who endorsed heartily Mr. Mochrie's remarks, said that founders did not generally seek to take business from the fabricators, whereas the fabricators were always seeking to take business from the founders. Too often the founders sat down and waited for the customer to send them drawings and an enquiry for castings. If they went out to a potential customer, who might say that he had no castings to order, they would conclude that nothing could be done, whereas if they used their ingenuity and push they would gain business. It should be remembered that the potentiality for the development of castings was far greater than the potentiality for forgings or welded structures; he was confident that the field for castings could be widened. The number of castings required from the foundry industry was going to be, and had been in the near past—though not in all cases—limited by the amount of suitable labour available to produce them; but increased numbers could be produced, and their price reduced, by obtaining more intelligent labour and more mechanical aids.

Mr. Levy, enlarging upon Mr. Rowe's remarks, said there were four main factors entering into the problem—(*a*) competition; (*b*) equipment; (*c*) mechanical aids; and (*d*) price. Recalling a job which had been lost by a foundry to welded fabrication, he said it was a large base for an injection moulding machine. The casting was very heavy, but no foundry could quote a price that was competitive with that at which the customer could obtain a welded fabricated base of similar design, and which would serve the purpose better—not merely as well, because it was stronger, and could be delivered more quickly. The ironfoundry which had originally cast the base for that particular machine could have installed, if it had been sufficiently enterprising, a large moulding machine. Instead, it had made the job with loose patterns; but by using the machine the casting could have been produced much more competitively than the welded fabrication. The casting might possibly have been less strong, when made of iron, whereas the welded job was of steel; but high-duty iron could have been used. The point was that, in view of the labour cost and the manner in which the job was being tackled, the ironfoundry had lost the job to the welder. Obviously, if the foundry had used a large moulding machine and had really got down to the job, it could have got down to the price.

Vote of Thanks

Mr. G. C. Pierce (past branch president), proposing the thanks of the meeting to Mr. Rowe for the splendid manner in which he had presented the Paper, said he had given much food for thought, and apparently plenty of room for wishful thinking. The references made to the "inevitable" shortage of skilled workers in the industry, or the reduced demand for skilled workers, had impressed Mr. Pierce, but he could not quite follow the argument. From time to time in the past he had said that those who believed mechanisation would do away with the skilled moulder were wrong. Forty years ago, there were about 21,000 skilled moulders in England and Scotland combined, but there were more skilled moulders in the industry to-day than at that time. The need for them was greater; mechanisation brought in its train the need for more skilled moulders, and indeed, they were needed to make the machines. The trouble was that the industry needed more skilled moulders, but was not getting them.

One of the most pungent remarks made during the discussion was that concerning the problem of arousing the interest of boys and maintaining it when they were in the foundry; admittedly it was difficult, but if it could be done good moulders would be the result. In that connection, Mr. Pierce recalled that in his youth he was sent to the pattern-shop to learn patternmaking and had spent nine or twelve months there; then he had found that the foundry paid 2s. more per week than did the pattern shop, and he went after it. There was a moral in that which could be applied in connection with attracting boys to the foundries.

On the question of washing facilities, he urged that they should be provided and that the men should be given a chance to use them, before it was claimed that they would not use them. Expressing the view that military service was not a big factor in preventing boys from entering foundries, he said that four years ago it did not apply, yet the difficulty was the same then as now. Indeed, military service was useful in that it taught the boys and young men a little discipline, which was helpful when they were being trained for the foundry; he was not an advocate of compulsory military service, but such results were beneficial.

A factor of importance in attracting young people was that of keeping buildings as clean as possible. There were many old buildings still existing; but was there ever a time when they could not be kept clean? They could be kept clean, even though it probably cost more to do so than in the case of a new building. In that connection, he recalled that in his school days he was accustomed to pass a particular foundry and he had felt then that it must be an awful place to work in. Only a week ago he had been taken into it, had been dismayed to find it appeared the walls had not been cleaned for a very long time. The way in which to attract young people was to make the conditions attractive, to give them attention, pay them right; then they would make moulders. The technical training that was available was very good, but it was not making moulders; it was making foreman, rate-fixers, and so on, men who would not work with their tools. Propaganda was all right; sometimes it was successful.

(The vote of thanks was seconded by Mr. W. Tait, and heartily accorded. Mr. Rowe briefly responded and voiced his appreciation of a most stimulating discussion).

Crompton Parkinson, Limited, the electrical manufacturers, have announced the development of a new range of AC motors, initially between one and 20 h.p., based on American and Canadian standards.

B.C.I.R.A. Scottish Laboratories

Early this month, the new premises housing the Scottish laboratories of the British Cast Iron Research Association were officially opened at Blantyre, near Glasgow, by the Rt. Hon. the Lord Bilsland, chairman of Scottish Industrial Estates, Limited, and a director of Colvilles, Limited, in the presence of a large gathering from Scottish foundries. In 1925 the Association took over the laboratories known as the Foundry Technical Institute in Meeks Road, Falkirk, and in so doing made acknowledgment of the special and regional needs of the Scottish ironfounding industry. The Foundry Technical Institute, the first co-operative laboratory premises in Scotland, had been inaugurated in 1918 by the British Ironfounders' Association (then known as the National Light Castings Association) with the object of furthering the study of cast iron and the application of technical control to foundry practice. The laboratories included equipment for carrying out chemical analysis and the physical and mechanical testing of cast iron. In 1944 the laboratories were entirely re-modelled, without, however, any addition to the area of 1,350 sq. ft. previously covered. The introduction of the Joint Iron Council's scheme in 1948 led to a further increase in Scottish B.C.I.R.A. membership, and it was evident that new premises must be sought to accommodate the growing demands made upon the laboratories; as a consequence the laboratories were transferred to a recently-erected unit covering 5,000 sq. ft. at the Blantyre Industrial Estate, near Glasgow.

The party was welcomed at Blantyre by Mr. P. H. Wilson, O.B.E., president of the Association, and by the director, Dr. J. G. Pearce, O.B.E., and Lord Bilsland was presented with a key with which to open the premises and suitably inscribed as a memento of the occasion. After a tour of inspection the party returned to luncheon at the Central Hotel, Glasgow. At the luncheon, following the loyal toast, Mr. P. H. Wilson, who acted as chairman, called upon Lord Bilsland to propose the toast of the Scottish ironfounding industry. Introducing Lord Bilsland, Mr. Wilson said that the Scottish laboratories of the Association, which had now been in existence for some twenty-five years, were an excellent example in practice of the principle of decentralisation which appeared to find favour in many quarters in Scotland to-day.

FIG. 1.—LORD BILSLAND (LEFT) ACCEPTS THE KEY FROM MR. P. H. WILSON AT THE OPENING CEREMONY.

Apart from the principle of establishing regional laboratories there was no doubt that the foundry industry in this country was moving increasingly towards higher technical control, and the general shortage of metallurgists and other technicians made it difficult to exercise this control in more than a few centres. Equipment similar to that which had been seen at Blantyre, which gave speedy results, involved high capital expenditure which was beyond the reach of some of the smaller foundries. There was thus a strong case for considering regional laboratories, and he hoped that Scottish ironfounders would take full advantage of the facilities provided at Blantyre.

One of the matters to which the Council of the Association was devoting a good deal of consideration, Mr. Wilson continued, was the extent to which regional laboratories could fill a want in other parts of the country, away from headquarters, and here, the experience of the Scottish laboratories would prove invaluable. The Association's counterpart in France, *Centre Technique des Industries de la Fonderie*, though younger than the Association, had not only established headquarters laboratories and administrative offices and library in Paris, but also in not less than nine regional laboratories, four of which were regarded as important and five as subsidiary. Their field was roughly equivalent to that of the Scottish laboratories: chemical analysis, microscopic examination, mechanical testing and sand testing. The financial support given by the French industry to its technical centre was, of course, on a much higher scale than that afforded to the Association.

Scottish Ironfounding Industry

Lord Bilsland, proposing the toast of the Scottish ironfounding industry, expressed admiration of the new laboratories and referred to their importance in the future of Scottish ironfounding. For two hundred years the Scottish ironfounding industry had made a great contribution to Scottish economy and had helped in no small measure to foster and sustain the reputation of Scottish industry for craftsmanship, enterprise and quality. In earlier days, cast iron was virtually the only engineering material available; but, in spite of the evolution of important new materials, it was still, and would remain, an essential material with a range of use and value which had not yet reached its limit.

It was true to say, said Lord Bilsland, that Britain gave a lead to the world in the art of ironfounding, and he paid tribute to the work of the men who through those past two hundred years had developed that art, the practical production of iron castings, and the moulding and core-making techniques required in it which

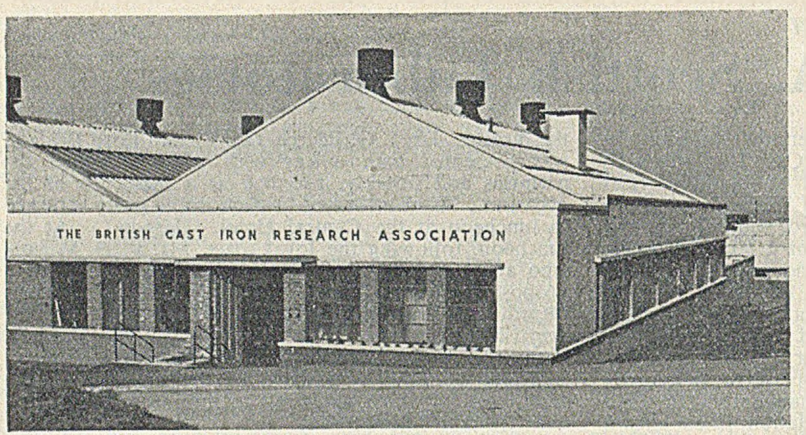


FIG. 2.—EXTERNAL VIEW OF THE SCOTTISH LABORATORIES.

was very largely a British and particularly a Scottish development.

The Scottish ironfounding industry, continued Lord Bilsland, was a major Scottish industry, and Scotland possessed about one-tenth of the foundries in the United Kingdom, just at it possessed about one-tenth of the population. Emphasising that iron founding was one of the many industries in Scotland, whose productive capacity was considerably in excess of the requirements of the home market, Lord Bilsland added that about 75 per cent. of the output was sold outside Scotland. The Scottish foundry output represented about one-eighth of the total output for the United Kingdom, and both the light castings side of the industry centred in Falkirk, and the engineering castings section centred in the Glasgow area were well represented. Nevertheless, though there existed an efficient and active research association which any foundry could join without paying a subscription, only 60 per cent. of Scottish foundries were members, slightly less than the proportion in England which was some 68 per cent. Lord Bilsland said that we lived in a scientific age in which the fundamental work of the scientist was ever opening up opportunities of trade and progress, and Scotland had to be alive to this movement and to its meaning. The new laboratories would perform an invaluable service in improving the technique and efficiency of the products of the industry and in dealing with problems of materials, processes and production.

Vital as these matters were to-day there were always the pressing problems of to-morrow and these brought us into the field of research. Industry was very fortunate in having a most efficient and active research association, and it had to be realised that the industry was passing from the era of craft to one of technical control, in which the skill of the moulder and coremaker was reinforced by the knowledge of the metallurgist.

Replying to the toast, Mr. A. D. MacKenzie, O.B.E., for the Scottish Ironfounders' Association, said that the foundry worker now had facilities and amenities unknown in earlier days. It was an axiom of industrial management that firms wanted to make their employees glad to work in their premises.

The toast of the B.C.I.R.A. and its Scottish

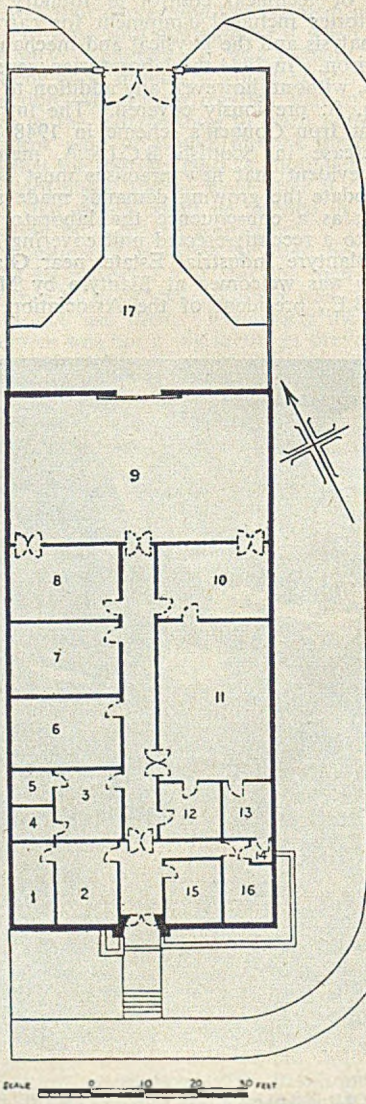


FIG. 3.—(RIGHT) PLAN OF THE BLANTYRE LABORATORIES.

(1) Superintendent. (2) General Office. (3) Metallographic Laboratory. (4) and (5) Dark Rooms. (6) Stores. (7) Sands Laboratory. (8) Mechanical Testing Laboratory. (9) Development Laboratories. (10) Machine Shop. (11) Chemical Laboratory. (12) Balance and Furnace Room. (13) Spekker Laboratory. (14) Automatic Telephone Exchange. (15) Ladies' Cloak Room. (16) Men's Cloak Room. (17) Yard and Rear Entrance.

laboratories was proposed by Mr. William Rennie, J.P., chairman of Federated Foundries, Limited, who expressed a hope that in moving its laboratories from Falkirk to Blantyre the Association would enrol many new members in the Glasgow district.

Progress in Scottish Ironfounding

In replying, the director, Dr. J. G. Pearce, O.B.E., said that the Association had a larger Scottish staff than ever before. The cost of arranging and equipping the new building had, under prevailing conditions, been considerable. The Association owed to Scotland its first President, Lord Weir (who was unhappily prevented on medical advice from attending on that day), and about six vice-Presidents. Scotland was represented on the Council and the main committees of the Association and had about thirty representatives on various sub-committees, notably the Light Castings Sub-Committee and the Enamelling Panel, and some of the sub-committee meetings were held north of the Tweed. Dr. Pearce said he could not forbear to mention the names of a number of gentlemen in the Scottish industry who in the early days had given the Association their loyal support and warm encouragement to him personally, among them Mr. John Arnott, Mr. John Cameron, Mr. D. M. Semple, Mr. A. W. Steven, and the late Mr. G. Lawrie Anderson, Mr. Jeffrey Smith and the late Mr. G. A. Ure.

Mr. W. Barr, A.R.T.C., F.I.M., executive director of Colvilles, Limited, proposd a vote of thanks to those concerned with the inauguration of the new laboratories. In particular, he thanked the panel of the Scottish Committee, under the chairmanship of Mr. Robert Dickson, J.P., who had given very great assistance during the whole of the negotiations.

Layout of the New Premises

The new premises at Blantyre comprises a unit in one of the standard estate blocks which has been structually modified in the interior and exterior to suit the special purpose of the laboratories. A view of the exterior is shown in Fig. 2, and Fig. 3 shows a plan view with a key to the individual sections. There is the usual supervisory, clerical and records office accommodation, chemical, metallographic, mechanical testing, sands and refractories laboratories, and a section is set aside for development work.

A feature of the chemical laboratory is the positioning of the fume cupboard (housing hot-plates, muffle furnaces, gas-generator, etc., in its sections) in an "island" with wall benches and one central bench around. In the balance room there is also located the apparatus for carbon and sulphur estimations; separate, too, is an absorptiometer laboratory. Equipment for the metallographic section includes a Vickers projection microscope and the usual dark-room features. The machine shop is adequately provided for preparing test pieces for the various operations, and the mechanical test house has a 25-ton Amsler Universal machine, a 3,000-lb. Denison machine for strip and wire, an Izod machine and three hardness-testing machines. The sands and refractories laboratory contains all the usual equipment for routine testing, with, in addition, an elutriation apparatus and a "Synex" vibrator for grading tests. In this section, too, is a Mahler bomb calorimeter for obtaining calorific values of fuels. The whole is served by adequate storage accommodation. Mr. A. N. Sumner, A.I.M. (previously hon. secretary of the East Anglian section of the London branch of the Institute of British Foundrymen) is superintendent of the laboratories.

Pattern Construction to Prevent Warping

By "Chip"

To ensure that wood patterns retain their true form over a period of years, it is necessary for the patternmaker to exercise discretion in their manufacture so as to ensure that the natural tendency of the timber to distort is counteracted by the type of construction used. Especially is this true when some of the timber available to the patternmaker is insufficiently seasoned and shrinkage and warping of the resultant pattern is inevitable unless precautions be taken.

The use of deep cleats on large flat surfaces is advisable to retain a true face, and often it is wise to screw these to the back of a built-up plate which is of considerable width, before commencing truing operations. Then, when one face is true, the cleats may be reversed and the plate brought to thickness. Iron bars are sometimes let into flat surfaces for a similar reason, but the use of timber running the opposite way of the grain is often to be preferred.

Fig. 1(*a*) shows a scrap view of a portion of a pattern which gave trouble in the foundry due to the wrong method of pattern construction being used, A being the main pattern and B, one of two lugs let in with the grain as shown. Invariably, under the changing atmospheric conditions of the foundry, the pattern buckled and twisted. A better construction is shown in Fig. 1(*b*) in which the portion forming the lugs is checked into the main portion and extends the whole width of the pattern thereby helping to keep it rigid.

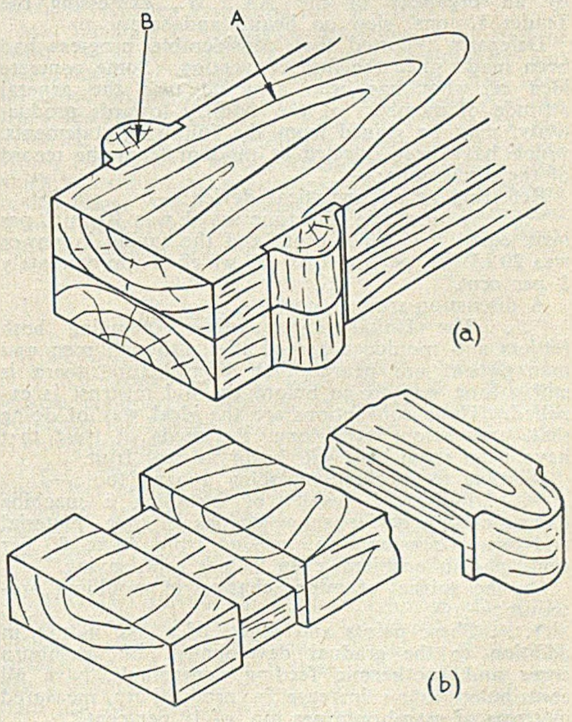


FIG. 1.—PATTERN WITH SIDE PROJECTIONS; (*a*) USE OF SMALL INSERTS FOR THE LUGS PERMITS WARPING, (*b*) LUGS CONNECTED BY A BAR REINFORCE THE PATTERN.

Progress Report

Second B.S.F.A. Productivity Convention *

The first productivity team to visit America under the auspices of the Anglo-American Council on Productivity was that representing the steel-founding industry. In the following September, the team's report was published, and received widespread publicity. To discuss ways and means of implementing the recommendations contained in that report, the British Steel Founders' Association held a "Productivity Convention" at Ashorne Hill, Leamington Spa, in November, 1949. Arising from the discussions was the decision to appoint a productivity committee to stimulate and guide the work which had to be done. Mr. F. A. Martin, O.B.E., who led the productivity team, accepted the chairmanship of the committee. Representatives from all levels of the industry pledged themselves in a formal resolution to strive unreservedly to increase the productivity and efficiency of the industry. Now, about six months later, a second Productivity Convention has been held for the purpose of reporting progress and comparing notes. In all, 116 delegates were present and, as at the previous convention, the practice was followed of splitting up the audience into small groups by room number for discussing the individual Papers and then presenting a summary of their deliberations to the assembly.

At this second convention the Trades Unions were represented, and the chair at the session which was devoted to "Working Conditions in Steel Foundries" was taken by Mr. R. W. Casasola, a member of the executive of the Amalgamated Union of Foundry Workers. In this same session a Paper was presented by an organiser of the A.U.F.W., expressing the Trades Unions' view on health and safety.

Delegates reported that considerable progress had been made since the first convention. Some concrete idea of what has been achieved, and the general attitude of members of the industry towards productivity, may be gained from the following statements, which have been selected at random from the record of the discussions:—

Referring to an analytical device:—

". . . In our case, the time saved was 10 min. per heat, equal to 7.5 per cent., and the saving in power was 20 kW-hr. per ton of steel, which is approximately 3 per cent."

A discussion-group report:—

". . . The Union representatives, including both fettlers and moulders, agreed that although men and management are nearer than ever before, there is still a long way to go before the old mistrust is expelled. These conventions are the ideal way of doing that, and before very long, the seeds of trust that have been sown here will begin to bear fruit."

Relating to machine replacing a hand tool:—

". . . Individual results of installing a machine oxygen-cutting device show savings in time, material and power consumption, varying from 40 to 80 per cent., and in one item even 95 per cent. saving."

On the subject of minor changes in moulding procedure:—

". . . These points and others of a like nature, in addition to the gradual development of Washburn cores and exothermic feeding compounds, have all contributed to an increase in productivity, measured in terms of man-hours per ton, of 10 per cent."

A mechanisation project:—

". . . Requirements for the new layout were that the section should be self-contained and independent of the overhead cranes and that the total man-hours per ton should be reduced by 50 per cent. . . . at the present moment the section has been running on a day-work basis for a fortnight and has achieved about 75 per cent. of its final target."

The steel foundry industry is quite a small industry, comprising less than 80 firms, of which 62 are members of the B.S.F.A. Its total employees number less than 20,000. Members of the B.S.F.A. vary in size between foundries producing from some 10 tons to upwards of 300 tons per week, varying with their geographical location, their equipment and technique, and the markets which they serve. As a result of long personal contact between leading members of the industry, there has grown up a fine co-operative spirit which, while in no way interfering with the essentially competitive nature of the industry, ensures that the benefits of technical improvements achieved by one member are immediately and unreservedly made available to all. It is this spirit which is enabling the B.S.F.A. to give so clear-cut a lead to other British industries towards increased productivity. The work and usefulness of the Convention was praised by all who were present, and there was universal support for the holding of another Productivity Convention in due course.

* Programme printed in the JOURNAL, May 4.

New Catalogues

Axial Flow Fans. A new catalogue covering "Aeroto" fans has just been issued by Davidson & Company, Limited, of Sirocco Engineering Works, Belfast, N. Ireland. Externally it resembles the format used by many of the monthly technical journals. The catalogue, which is excellently illustrated, is divided into three sections, the first of which covers industrial applications. Herein are data, illustrations and letterpress sufficient to give an appreciation of the size of the field to be covered and the systematic way this has been accomplished. The next section is purely for the marine engineer, whilst the last is a mass of labour-saving data to help the customer to co-operate in the solution of problems. It makes a really worthwhile contribution to solution of ventilating problems.

Cemented Carbide Tools. William Jessop & Sons, Limited, of Brightside Works, conjointly with J. J. Saville & Company, Limited, Triumph Steel Works, both of Sheffield, have just issued a 56-page well-illustrated catalogue covering the "Cutanit" brand of cemented carbide. The stock list and prices printed came into force on April 1. This catalogue represents an attempt to reduce the number of standardised parts, and it is inferred, and rightly so, that better service can thereby be given to the customer. The publishers have chosen green as the predominant colour for the catalogue, and this makes a pleasant change from the hackneyed blue-print type of illustration. In general, the tabular matter is clearly presented, though here and there a more generous spacing would make for increased clarity.

Tin Content Indicator for Solder. A photograph illustrating a piece of apparatus for indicating the tin content of solder accompanied by a leaflet has been sent to us by the Wheelco Instruments Company, of 847, W. Harrison Street, Chicago, 7, Ill., U.S.A. At first glance the instrument was mistaken for a new model of a pyrometer. Actually, it works like a pyrometer, but on plunging the "business" end into molten solder, instead of temperature being read on a clear scale, the tin content is indicated. It appears to be a very useful piece of apparatus for those handling considerable quantities of liquid solder.

April Steel Output

Steel output last month was at the highest rate ever achieved in the month of April. Production was at an annual rate of 16,822,000 tons, compared with 15,854,000 tons in April, 1949. Both months were affected by Easter holidays.

April pig-iron output was at an annual rate of 9,677,000 tons, which compares with 9,324,000 tons a year ago.

The latest steel and pig-iron production figures (in tons) compare as follow with earlier returns:—

	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
1950—January ..	187,400	9,742,000	305,300	15,873,000
February ..	184,400	9,588,000	325,000	16,898,000
March ..	186,500	9,696,000	329,800	17,147,000
1st qtr. ..	186,100	9,677,000	320,700	16,679,000
April	182,500	9,492,000	323,500	16,822,000
1949—January ..	178,100	9,262,000	288,500	15,002,000
February ..	181,200	9,422,000	311,100	16,176,000
March ..	178,800	9,295,000	312,900	16,269,000
1st qtr. ..	179,300	9,324,000	304,800	15,850,000
April	178,600	9,288,000	304,900	15,854,000

Heating Efficiency of Fires

Replying to critics of solid-fuel-fired heating appliances, Mr. W. Rennie, managing director of Federated Foundries, Limited, declared in Glasgow recently that to say open fires gave only five per cent. efficiency was quite absurd. Scientific tests in the firm's laboratories in Possilpark, Glasgow, had shown that the efficiency of open-type coal fires was far greater than was obtained from electric fires. Mr. Rennie gave his reply when a Press party visited the firm's research laboratories to see something of the work being done to perfect solid-fuel-burning appliances.

Dr. R. S. Silver, head of the department, and inventor of a new type of continuous-burning open fire, illustrated by tests that solid-fuel open fires are three times more efficient than electric fires. It has been said that old types of fires are wasteful and send 80 per cent. of their heat up the chimneys. What was not realised generally was that the electric fire was much less efficient, for only 20 per cent. of the heat generated in a power station using coal firing reached the consumer. In electricity, Dr. Silver claimed that 10 per cent. of the heat was lost "up the chimney" while 70 per cent. was lost in the cooling waters.

Engineering Industries' Association Scottish Office

Scottish engineering firms will in future have the assistance of the Glasgow office of the Engineering Industries Association, which on May 2 formally opened its Scottish regional office at Crescent House, 36, Elmbank Street, Glasgow. Sir Hector McNeill, former Lord Provost of Glasgow, who performed the opening ceremony at the new premises, particularly welcomed the assistance the Association could give to smaller firms, saying that such firms would be advised to accept all the help they could receive in making their way. Mr. H. A. M'Queen, chairman of the Scottish regional committee of the Association, explained the increased activities which the new premises had made possible. Groups had already been formed in Glasgow, Edinburgh, and Aberdeen, and it was hoped soon to form another in Dundee.

Personal

Mr. Charles Ramage, secretary and cost accountant with R. Y. Pickering & Company, Limited, ironfounders, etc., of Wishaw (Lanark), has retired after 52 years' service with the company.

Mr. Allan J. Marr, managing director of Sir James Laing & Sons, Limited, shipbuilders and repairers, etc., of Sunderland, has been elected president of Sunderland Chamber of Commerce.

Mr. J. Varney and Mr. H. Jow, foremen with Edgar Allen & Company, Limited, steelmakers, etc., of Sheffield, have received presentations in recognition of over 50 years' service with the company.

Mr. R. W. Stuart Mitchell, formerly with the Brush Electrical Engineering Company, Limited, Loughborough, has been appointed chief development engineer in the Diesel-engine division of the English Electric Company, Limited, Rugby.

Mr. John O. Crabtree, managing director of R. Hoe & Company, Limited, Borough Road, London, S.E.1, and a director of R. W. Crabtree & Sons, Limited, Leeds, has been elected chairman of the Association of British Manufacturers of Printers' Machinery.

Mr. B. A. Williams, founder, chairman, and managing director of Williams & Williams, Limited, metal window and door manufacturers, of Chester, has received a presentation from his employees to commemorate the 40th anniversary of the founding of the firm.

Mr. R. E. J. Moore, director of the British Industries Fair, is due to retire next year, and the current Fair is thus the last for which he will be responsible as director. He has been in the service of the Board of Trade for 30 years, during 25 of which he has been associated with the B.I.F.

Mr. William E. Goodrich, who joined the staff of Edgar Allen & Company, Limited, steelmakers and foundrymen, of Sheffield, last December, has been appointed an assistant to Dr. Edwin Gregory in the firm's research laboratory. From 1921 to 1925 Mr. Goodrich was senior metallurgical investigator for the British Non-ferrous Metals Research Association, after which he held several appointments in industry. Before joining Edgar Allen & Company he was superintendent of metallurgical research and development for the Guest, Keen & Nettlefolds group.

Board Changes

Workington Iron & Steel Company, Limited—Mr. T. S. Kilpatrick, who has been appointed a director, became commercial manager at Workington in 1948. He joined the United Steel Companies, Limited, under its university apprenticeship scheme in 1934.

Ford Motor Company, Limited—Sir Rowland Smith has been elected chairman. In 1928 he was appointed general manager of the company, subsequently becoming a director, managing director, deputy chairman. Sir Rowland is also chairman of the Kelsey-Hayes Wheel Company, Limited.

Associated British Oil Engines, Limited—Dr. J. W. Bondi, an overseas director of Associated British Oil Engines (Export), Limited, and a director of British Oil Engines S.A., A.B.O.E.'s Belgian sales company, has been appointed to the board. Also appointed to the board are Mr. Bosworth E. Monck, sales director of Henry Meadows, Limited, Wolverhampton, and Mr. J. T. Rymer, general manager and a director of Mirrlees, Bickerton & Day, Limited, Stockport, and a director of Associated British Oil Engines (Export), Limited, and of Associated British Oil Engines (Marine), Limited.

News in Brief

STOTHART & PITT, LIMITED, are having a foundry annex erected at Victoria Works, Bath.

THE ADDRESS of the National Office of the American Foundrymen's Society is now 616, South Michigan Avenue, Chicago 5, Illinois, U.S.A.

A FACTORY for the production of motor-car parts is to be built at Sydney, N.S.W., by the Lockheed Hydraulic Brake Company, Limited, Leamington Spa.

STEELS ENGINEERING PRODUCTS, LIMITED, of Sunderland, are assembling 80 of their sales delegates from 36 different countries to a conference at Harrogate from May 15 to 25.

THE BRITISH OXYGEN COMPANY, LIMITED, are to build a factory at Mount Vernon, on the outskirts of Glasgow. Employment will be found for 400 people at the new works.

BLYTHE COLOUR WORKS, LIMITED, enamel manufacturers, of Cresswell, Stoke-on-Trent, have appointed Grundy, MacGowan & Browne, Finsbury Circus, London, E.C.2, as their registrars.

THE RAILWAY EXECUTIVE announces that Mr. F. J. Wymer, C.B.E., general assistant to the chief regional officer, Southern Region, has been appointed assistant chief regional officer, Southern Region, Waterloo.

HARLAND & WOLFF, LIMITED, Govan, Glasgow, have received an order for an oil tanker of 16,500 tons dw. from Hunting & Son, Limited, Newcastle-upon-Tyne. There has been an empty berth in the Govan shipyard since March 2, when the British Consul was launched.

IT IS UNDERSTOOD that I.C.I., Limited, are prepared to spend up to £17,000,000 on a development scheme for the expansion of output at two of the combine's soda-ash producing factories in mid-Cheshire. The scheme, which is in progress, will, when completed, at least double the output of the factories.

A NEW WORKS for W. Canning & Company, Limited, electro-platers' engineers, of Great Hampton Street, Birmingham, 18, was opened recently by Lady Canning. The works, which cost about £120,000, will facilitate a reorganisation plan estimated to increase total output by over 25 per cent.

A NEW BRITISH STANDARD for ball and roller bearing plummer blocks (general purpose series) (B.S.1642: 1950) lays down the leading dimensions which are essential to ensure satisfactory installation and interchangeability of a series of ball and roller bearing plummer blocks for shafts ranging in diameter from ¾ to 3 in.

THE CENTENARY of the death of Joseph Louis Gay-Lussac, the French scientist, was on May 9. Gay-Lussac was one of the founders of modern physical chemistry. In the early years of the 19th century, he was the outstanding chemist in France, equalled only by his contemporary and rival, Davy, in England.

THE SCIENTIFIC FILM ASSOCIATION will give two further shows of scientific films in the theatre of the Science Museum, South Kensington, London, S.W.7, as follow:—May 20: "Steam Turbine," "The Cornish Engine," and "An English Oilfield"; June 17: "Atomisation" and "Job 99—Pluto." Programmes commence at 10.45 a.m. A programme of French scientific films will be given at the *Institut Français*, Queensbury Way, London, S.W.7, on June 9, at 7.45 p.m. Admission will be by ticket only—applications should be sent to The Scientific Film Association, 4, Great Russell Street, London, W.C.1.

BECAUSE of an unprecedented spate of orders from all over the world, following devaluation, the Consolidated Pneumatic Tool Company, Limited, Fraserburgh (Aberdeenshire), have found it necessary to build a 40,000 sq. ft. extension to their existing works. The Government has approved the plans, and work on the extension can now commence. The additional factory space will mean employment for another 150 men.

ORDERS TO BUILD two motor tankers of about 16,500 tons dw. each, for Hunting & Son, Limited, Newcastle-upon-Tyne, have been received by William Doxford & Sons, Limited, Pallion, Sunderland. These vessels will be the largest yet to be built by the firm, although they will not be as long as two tankers of 15,600 tons dw. each launched by the Pallion yard in 1914, which have hitherto been the largest ships yet built in the yard.

THE IRON AND STEEL INDUSTRY was short of younger men of the right calibre, said Mr. H. Boot, a director and general manager of the Consett Iron Company, Limited, Consett (Co. Durham), when presenting evening-class awards to apprentices of the firm. Referring to two apprentices who have been selected to study in France and Sweden, Mr. Boot said that the company, if encouraged to do so, would send more apprentices overseas to study.

SHORT INTENSIVE COURSES in metallurgy for teachers with general scientific qualifications but with no training in metallurgy have been suggested by Mr. Harry Reoch, principal of Dundee Trades College. He told a meeting of Dundee and District Regional Advisory Council for Technical Education that teachers were having to teach themselves the subject as they prepared students for examinations. Prof. W. T. Marshall said there was no organised course in this subject at Edinburgh or Dundee, Glasgow being the centre in Scotland.

Parliamentary

Industrial Use of Scientific Resources

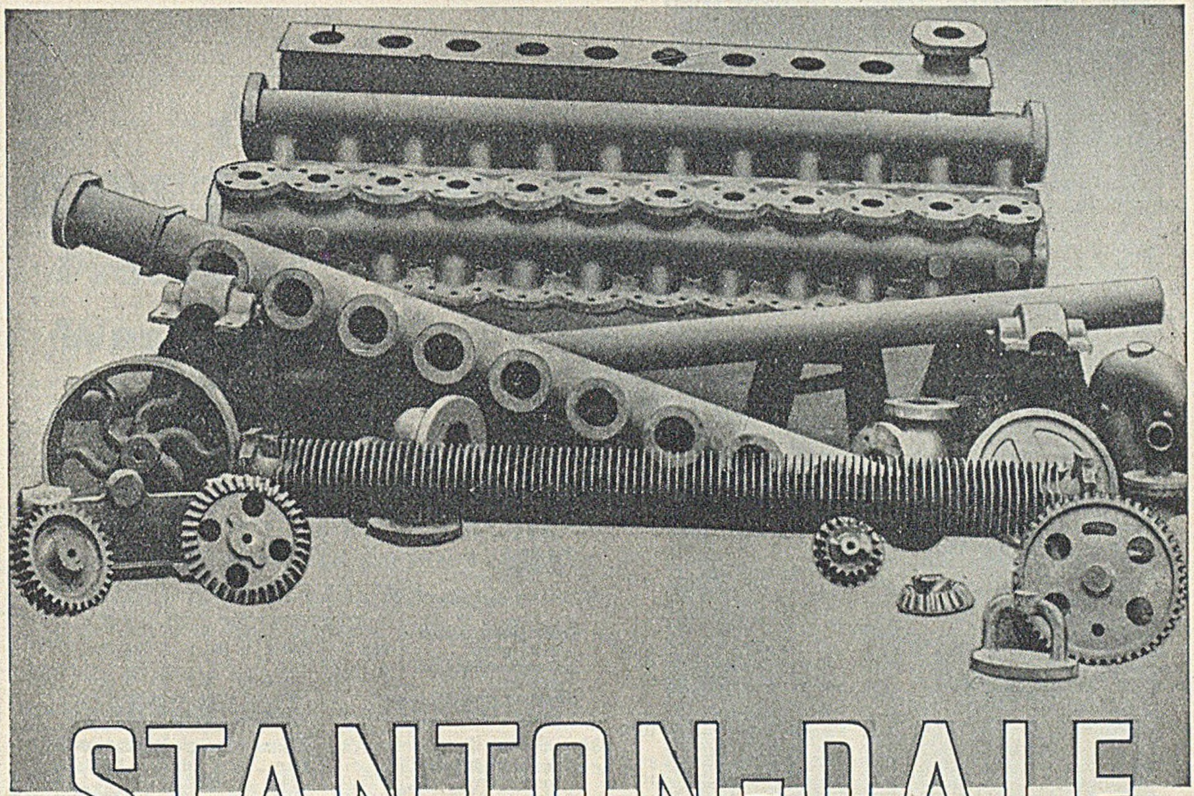
Inadequate utilisation by industry of the scientific resources of the nation was alleged by MR. M. P. PRICE, when the House discussed the Private Members' Motion on the subject. The Motion, being of a non-party character, was carried. It called for the fullest development and utilisation of Britain's exceptional resources and man-power, with a view to ensuring effective progress in the development of industry, agriculture, and the Colonies, and material improvement in Britain's economic position in the world. Mr. Price argued that there was a possibility of science being inadequately used in peacetime. There should be a greater application of science to home needs.

MR. HERBERT MORRISON, Lord President of the Council, said that, so far as the Treasury was concerned, it was an established principle that expenditure of scientific research and scientific work in relation to industry was the subject of special favourable consideration. Many progressive industrialists were great supporters of the research associations, and were making full use of the results achieved. But there were many industries which were not applying those discoveries as quickly as they might.

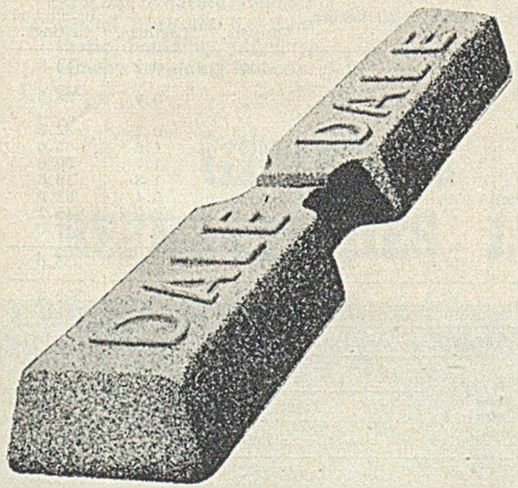
SIR RONALD CROSS complained that high taxation was preventing many firms, notably in the newer industries, from accumulating the necessary reserves. If this continued, we would be falling behind in the race for industrial efficiency, he declared.

Future of Steel Distribution Scheme

Asked whether in view of the fact that there was no longer any shortage of steel, except for sheets and tinplates, he would now abolish or modify the steel distribution scheme, MR. JOHN FREEMAN, Parliamentary Secretary to the Ministry of Supply, said the steel distribution scheme was at present under consideration.



STANTON-DALE



REFINED PIG IRON

Designed to meet the demands of high quality castings, which are, strength, machineability and resistance to wear.

All these can be secured by using Stanton-Dale Refined Pig Iron in your cupolas.

The above illustration shows a group of castings made from this iron by a well known economiser maker.

PROMPT DELIVERY

THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

Pig-iron and Steel Production in Great Britain

Summary of February Statistics

The following particulars of pig-iron and steel production in Great Britain have been extracted from the Statistical Bulletin for March, issued by the British Iron and Steel Federation. Table I gives the production of pig-iron and ferro-alloys in February, with the number of furnaces in blast; Table II, production of steel ingots and castings in February, and Table III, deliveries of finished steel. Table IV summarises activities during the six months ended February.

TABLE I.—*Weekly Average Production of Pig-iron and Ferro-alloys during February. (Thousands of Tons.)*

District.	Furnaces in blast 25.2.50	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants, and Essex	26	—	17.4	23.5	1.4	—	42.3
Lancs. (excl. N.W. Coast) Denbigh, Flints. and Cheshire .. Yorkshire (incl. Sheffield, excl. N.E. Coast) ..	7	—	7.5	—	—	1.4	8.9
Lincolnshire ..	14	—	24.0	—	—	—	24.0
North-East Coast	23	7.6	36.9	0.4	—	1.3	46.2
Scotland	7	0.9	9.0	2.6	—	—	12.5
Staffs., Shrops., Worcs., and Warwick ..	9	—	8.9	1.6	—	—	10.5
S. Wales and Monmouthshire	8	4.2	19.1	—	—	—	23.3
North-West Coast	7	16.5	—	0.2	—	—	16.7
Total ..	101	29.2	122.8	28.3	1.4	2.7	184.4
January, 1950 ..	100	29.0	124.5	29.3	1.7	2.9	187.4
February, 1949 ..	101	28.0	117.1	31.5	1.6	2.9	181.2†

† Incl. 100 tons of direct castings.

TABLE III.—*Weekly Average Deliveries of Non-alloy and Alloy Finished Steel. (Thousands of Tons.)*

Product.	1948.	1949.	1949. Feb.	1950. Jan.	1950. Feb.
Non-alloy Steel :—					
Heavy rails and sleepers	8.9	9.8	10.4	9.8	12.7
Heavy and medium plates	36.1	39.2	40.3	39.0	42.4
Other heavy prod.	34.7	36.1	38.9	35.1	40.1
Light rolled prod.§	59.7	46.4	49.3	46.7	48.5
Hot-rolled strip ..		17.1	16.0	17.5	19.2
Cold-rolled strip ..	4.8	4.9	4.9	5.2	5.1
Bright steel bars ..	6.1	5.8	6.2	5.9r	6.0
Sheets, coated and uncoated	26.3	27.6	29.1	31.0	30.1
Tin, terne and black-plate	13.5	13.7	14.3	15.1	13.9
Tubes, pipes and fittings	15.1	18.5	17.8	19.3	20.2
Wire	12.8	15.0	15.6	15.3	15.3
Tyres, wheels and axles	3.9	4.1	4.0	3.6	3.6
Forgings	6.0	6.3	6.8	6.4	7.0
Castings	3.5	3.6	3.9	3.5	3.7
Total	231.4	248.1	257.5	253.4r	267.8
Alloy Steel† :—					
Tubes and pipes ..	0.4	0.6	0.4	0.7	0.9
Bars, plates, sheets, strip and wire ..	4.7	4.7	5.9	4.4	4.6
Forgings	2.5	2.7	3.0	3.0	3.3
Castings	0.7	0.	0.8	0.8	0.8
Total	8.3	8.7	10.1	8.9	9.6
Total deliveries from U.K. prod.‡ ..	239.7	256.8	267.6	262.3r	277.4
Add from other U.K. sources	5.7	5.8r	4.7	5.0r	7.2
Imported finished steel	3.4	7.7	3.9	4.1	4.0
	248·8	270·3r	276·2	272·3	288·6
Less intra-industry conversion ..	35.0	39.1	39.9	37.9	42.4
Total deliveries of finished steel ..	213.8	231.2r	236.3	234.4	246.2

† Excludes high-speed steel. ‡ Includes finished steel produced in the U.K. from imported ingots and semi-finished steel. *r* Revised.
§ Excl. wire rods and alloy-steel bars, but incl. ferro-concrete bars.

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in February. (Thousands of Tons.)*

District.	Open-hearth. Acid.	Open-hearth. Basic.	Bessemer.	Electric.	All other.	Total. Ingots.	Total. Castings.	Total ingots and castings.
Derby, Leics., Notts., Northants and Essex ..	—	0.7	11.1(basic)	1.2	0.2	12.7	0.5	13.2
Lancs. (excl. N.W. Coast), Denbigh, Flints., and Cheshire .. .. Yorkshire (excl. N.E. Coast and Sheffield) ..	1.6	23.2	—	1.2	0.4	25.6	0.9	26.5
Lincolnshire	—	32.4	—	—	0.1	32.3	0.2	32.5
North-East Coast	1.6	62.7	—	0.8	0.5	64.0	1.6	65.6
Scotland	4.4	43.9	—	1.6	0.7	48.9	1.7	50.6
Staffs., Shrops., Worcs. and Warwick	—	15.1	—	0.8	0.7	15.3	1.3	16.6
S. Wales and Monmouthshire	11.4	49.2	5.7 (basic)	0.8	0.1	66.8	0.4	67.2
Sheffield (incl. small quantity in Manchester) ..	9.1	27.5	—	7.9	0.7	43.2	2.0	45.2
North-West Coast	0.6	2.3	4.6 (acid)	—	0.1	7.4	0.2	7.6
Total	28.7	257.1	21.4	14.3	3.5	316.2	8.8	325.0
January, 1950	25.2	240.8	22.7	13.3	3.3	296.9	8.4	305.3
February, 1949	29.0	242.3	20.5	15.7	3.6	302.3	8.8	311.1

TABLE IV.—*General Summary of Pig-iron and Steel Production. (Weekly Average in Thousands of Tons.)*

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy). Imports.†	Steel (incl. alloy). Output of ingots and castings.	Steel (incl. alloy). Deliveries of finished steel.	Steel (incl. alloy). Stocks.‡
1938	228	89	—	130	118	16	200	—	—
1948	252	172	200	178	174	8	286	214	1,028
1949	258	169	199	183	188	17	299	231	1,275
1949—September ..	266	177	199	185	194	19	306	239	1,331
October	237	178	196	184	194	12	307	242	1,296
November* ..	249	180	199	187	200	8	315	245	1,246
December	249	170	197	186	181	12	291	231	1,275
1950—January	260	175	198	187	189	11	305	234	1,263
February	250	170	194	184	206	8	325	246	1,257

* Five weeks. † Weekly average of calendar month. ‡ Stocks at end of years and months shown.

Raw Material Markets

Iron and Steel

The steelmakers have decided not to increase the prices of steel products because of the higher transport charges, but foundries and other users of pig-iron will have to pay higher prices. Under the Iron and Steel Prices Order, 1950, which came into force on Monday, new maximum prices are set out for pig-iron, cast-iron pipes and fittings, and rainwater and soil goods. The price of basic pig-iron, which was raised a few weeks ago, has been increased again, this time by 6s. to £10 11s. 6d. per ton delivered station or siding. The increase in foundry pig-iron is 5s. in the Midlands and 6s. 3d. in Middlesbrough. Hematite is also dearer, the increase ranging from 4s. to 7s. per ton, according to district. The new prices are set out on page 26.

The controlled maximum delivered prices of iron and steel scrap also are raised as the result of the increased rail and road transport costs. For most classes of foundry iron and steel scrap, the increase is 2s. 9d. per ton.

The engineering foundries continue to constitute the busiest section of the foundry trade. They are working on good contracts for the motor-car, tractor, agricultural-implement, and other departments of the engineering industry, and also have substantial commitments for the export market. They are unable to secure all the low- and medium-phosphorus iron they need, and hematite and refined irons are, therefore, being specified in larger quantities. Although the higher prices of these irons result in increased costs of production, the foundries have no alternative if they are to continue production at present levels.

Other foundries are finding business rather slow. The jobbing establishments are experiencing difficulty in obtaining sufficient orders to obtain maximum outputs. The light foundries also are in search of work, and are hoping that an easing of the restrictions on building activities will shortly bring them more orders for castings. They are able to obtain all the high-phosphorus pig-iron they need for current use, and most of them have good working stocks.

The steel industry, on the whole, shows very little change. The prices of galvanised sheets and other galvanised products have been raised because of the recent increases in the cost of zinc. Mild-steel wire is also dearer, but other steel products are unchanged in price.

Non-ferrous Metals

Apart from a rise to 18 cents on the commodity market, no change occurred in the American copper price last week and producers continued to sell at 19.50 cents, delivered Valley. Both lead and zinc were strong, however, and, in consequence, the Ministry of Supply raised its prices in London—lead to £96 per ton and zinc to £103 10s.

Tin, too, was quite firm and ended the week with a gain of about £5. The price, however, is still below £600 and there has been no news of any selling by the Government broker. Tin is talked higher in some quarters, but it is difficult to see how the market can go much beyond £600, unless, of course, the Ministry of Supply has altered its ideas.

Metal Exchange tin quotations were as follow:—

Cash—Thursday, £595 5s. to £595 15s.; Friday, £596 5s. to £596 15s.; Monday, £591 10s. to £592; Tuesday, £595 5s. to £595 10s.; Wednesday, £595 10s. to £596.

Three Months—Thursday, £596 15s. to £597; Friday, £597 to £597 10s.; Monday, £592 10s. to £593 10s.; Tuesday, £596 to £596 10s.; Wednesday, £596 10s. to £597.

Brass and copper scrap were both firm last week in sympathy with the strength in virgin metals. A moderate business was done, mostly for early dates.

The monthly copper statistics have been released by the Copper Institute in New York. Output of crude or blister copper in April was 84,186 short tons, compared with 90,335 tons in March. The March figure has been revised since it was first published. Production of refined copper in April was 103,293 tons, against 113,440 tons in the previous month. Deliveries to domestic consumers were sharply down in comparison with March, when the exceptionally high figure of 123,030 tons was returned. In April the total was 101,729 tons, the reduction, it is thought, being due not so much to any falling-off in business as to the fact that the producers were unable to supply more than the tonnage shown. Stocks of refined copper in producers' hands were again reduced, this time by only about 3,200 tons to 57,028 tons. Although deliveries were lower, it must be admitted that the figures suggest a continuation of activity in the US metal industry, and so long as stocks stay at around 60,000 tons or less (equal to about a fortnight's consumption), it is obvious that the position is precarious and the price level in danger.

English Electric's Canadian Interest

A controlling interest in the John Inglis Company, Limited, Toronto, of which the English Electric Company of Canada, Limited, is a wholly owned subsidiary, has been bought by the English Electric Company, Limited, Kingsway, London, W.C.2. The sum involved is in the region of £750,000. The John Inglis Company manufactures heavy engineering products and consumer appliances. The existing president, Major J. E. Hahn, has agreed to remain president of the John Inglis Company, and will continue to administer the activities of that group.

A statement issued in London says that the linking of the resources in research and engineering in the United Kingdom to manufacturing facilities in the Dominion under Canadian management will play an important part in Canadian development. Both companies believe that it will contribute to the revival and expansion of reciprocal Anglo-Canadian trade.

The English Electric Company, Limited, has five main factories in the United Kingdom. The group already has factories in South Africa and Australia.

New Mills to Roll Stainless Steel

About £2 million is to be spent on new plant to be operated by Shepcote Lane Rolling Mills, Limited, a new company registered last week. The controlling interest will be held by Firth Vickers Stainless Steels, Limited, who will contribute two-thirds of the £2 million. The remainder of the finance will be found by Samuel Fox & Company, Limited, a subsidiary of the United Steel Companies, Limited, whose interest in the new company will accordingly be one-third.

The plant, now in course of construction on a site provided by Firth Vickers Stainless Steels at Shepcote Lane, Tinsley, Sheffield, will comprise hot- and cold-rolling mills for the continuous handling of stainless-steel strip up to approximately 40 in. in width.

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

(Delivered, unless otherwise stated)

May 17, 1950

PIG-IRON

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

Low-phosphorus Iron.—Over 0 10 to 0.75 per cent. P, £12 1s. 6d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si)—North Zone, £12 10s.; South Zone, £12 12s. 6d.

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

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

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

Cold Blast.—South Staffs, £16 3s. 3d.

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

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

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

FERRO-ALLOYS

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

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

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

Ferro-molybdenum.—70/75 per cent., carbon-free, 8s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £109 per ton.

Ferro-tungsten.—80/85 per cent., 7s. 3d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 8s. 3d. per lb. of W.

Ferro-chrome.—4/8 per cent. C, £60; max. 2 per cent. C, 1s. 5½d. lb.; max. 1 per cent. C, 1s. 6d. lb.; max. 0.15 per cent. C, 1s. 6¾d. lb.; max. 0·10 per cent. C, 1s. 7d. lb.

Cobalt.—98/99 per cent., 13s. 6d. per lb.

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

Ferro-manganese (blast-furnace). — 78 per cent., £28 3s. 3d.

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

SEMI-FINISHED STEEL

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

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

Sheet and Tinplate Bars.—£16 16s. 6d.

FINISHED STEEL

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

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

Alloy Steel Bars.—1-in. dia. and up: Nickel, £36 8s.; nickel-chrome, £52 16s. 6d.; nickel-chrome-molybdenum, £59 9s. 6d.

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

NON-FERROUS METALS

Copper.—Electrolytic, £162; high-grade fire-refined, £161 10s.; fire-refined of not less than 99.7 per cent., £161; ditto, 99.2 per cent., £160 10s.; black hot-rolled wire rods, £171 12s. 6d.

Tin.—Cash, £595 10s. to £596; three months, £596 10s. to £597; settlement, £596.

Zinc.—G.O.B. (foreign) (duty paid), £103 10s.; ditto (domestic), £103 10s.; "Prime Western," £103 10s.; electrolytic, £104 5s.; not less than 99.99 per cent., £105 15s.

Lead.—Good soft pig-lead (foreign) (duty paid), £96; ditto (Empire and domestic), £96; "English," £97 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, all English destinations, £119 10s.; rolled zinc (boiler plates), all English destinations, £117 10s.; zinc oxide (Red Seal), d/d buyers' premises, £98.

Other Metals.—Aluminium, ingots, £112; antimony, English, 99 per cent., £160; quicksilver, ex warehouse, £17 7s. 6d. to £17 10s.; nickel, £321 10s.

Brass.—Solid-drawn tubes, 16¾d. per lb.; rods, drawn, 23¼d.; sheets to 10 w.g., 21⅛d.; wire, 21⅝d.; rolled metal, 19⅞d.

Copper Tubes, etc.—Solid-drawn tubes, 18¾d. per lb.; wire, 182s. 6d. per cwt. basis; 20 s.w.g., 209s. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £101 to £115; BS. 1400—L.G.3—1 (86/7/5/2), £110 to £123; BS. 1400—G1—1 (88/10/2), £158 to £200; Admiralty GM. (88/10/2), virgin quality, £185 to £208, per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £162-£216; L.P.Bl, £120-£132 per ton.

Phosphor Bronze.—Strip, 28¾d. per lb.; sheets to 10 w.g., 30⅝d.; wire, 30⅜d.; rods, 28¼d.; tubes, 33½d.; chill cast bars: solids, 28½d., cored, 29½d. (C. Clifford & Son, Limited.)

Nickel Silver, etc.—Ingots for raising, 1s. 10½d. per lb. (7%) to 2s. 8½d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 2s. 4½d. (7%) to 3s. 2½d. (30%); to 12 in. wide, × .056, 2s. 4¾d. to 3s. 2¾d.; to 25 in. wide × .056, 2s. 6¾d. to 3s. 4¾d. Spoon and fork metal, unsheared, 2s. 3d. to 3s. 1d. Wire, 10g., in coils, 2s. 9¾d. (10%) to 3s. 8d.; (30%). Special quality turning rod, 10% 2s. 8¾d.; 15%, 3s. 1¼d.; 18%, 3s. 5½d.

Obituary

DR. HERMAN SHAW

Director of the Science Museum, South Kensington, London, S.W.7, Dr. Herman Shaw, who died suddenly on May 4, had a distinguished reputation as a physicist and administrator. His work in the field of applied geophysics was well known, and he was largely responsible for the development of prospecting methods using the Eötvös balance, on which instrument he was an authority.

After serving in the R.N.V.R. and R.N.A.S. during the 1914-18 war as a commissioned officer, Dr. Shaw entered the Science Museum in 1920 and served under the guidance of Sir Henry Lyons, F.R.S. In due course he became Deputy Keeper of the Department of Physics and Geophysics and in 1935 was promoted Keeper. In 1940 he was made Acting Director, and in 1945 became Director.

Dr. Shaw, who was 58 years of age, was president of the Museums Association, a trustee of the Imperial War Museum, a governor of the Imperial College of Science and Technology, and a manager of the Royal Institution. He was also a Fellow of the Institute of Physics, a Fellow and hon. treasurer of the Physical Society, a member of the Board of Studies of London University, and a member of the general committee of the British Association for the Advancement of Science.

MR. ALEXANDER MACARTHUR, late of Maclean & Macarthur, marine engineers, of Johnstone (Renfrewshire), died recently, He was 79.

MR. FRED THORNTON, late of Mather & Platt, Limited, electrical and textile engineers, etc., of Newton Heath, Manchester, 10, died suddenly on May 3. He was 55.

DR. HUGO ALEXANDER DICKIE, general manager of research and technical development at Stewarts and Lloyds, Limited, Corby, died in hospital last Friday. Dr. Dickie, who was one of Britain's leading metallurgists, served on a number of committees of the British Iron & Steel Federation and was a member of the British Iron and Steel Research Association. He was 54.

MR. WILLIAM HAROLD MASON, formerly a director of Mason & Binns, Limited, ironfounders, of Walsall, died last week at the age of 56. A son of the founder of the business, Mr. Mason had been active in the management of the foundry for many years and had been a director until it was converted from a private to a public company. He had been in failing health for some time.

MR. E. J. DUFF, who has died at the age of 87, studied Physics at Glasgow University under the late Lord Kelvin and became one of the leading engineers in the country. He was chief engineer and later works manager of the Steel Company of Scotland during the period when the company produced all the steel used in the Forth Bridge and several Cunard liners. He was a director of the Gas Power & By-Products Company, Limited, Glasgow, and a vice-president of Glasgow Royal Technical College Chemical & Metallurgical Society, and of West of Scotland Iron & Steel Institute.

Wills

PEARSON, JONAS, of Bradford, ironfounder £1,102

MARTINSCROFT, J. P., staff engineer of the British Aluminium Company, Limited, Bank Quay, Warrington (Lancs) £1,914

AITON, SIR J., A., of Duffield (Derbyshire), late governing director of Aiton & Company, Limited, pipework specialists and ironfounders, of Derby £83,157

HOGARTH, S. C., of Cardross (Dunbartonshire), a director of Tharsis Sulphur & Copper Company, Limited, and other companies £206,818

CLASSIFIED ADVERTISEMENTS

SITUATIONS WANTED

COREBSHOP FOREMAN, age 51 years, 11 years' supervision experience, use to coreblowing and mass production.—Box 510, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN desires post, Midland Foundry; not afraid of hard work, long hours, etc.; control all departments tnd take responsibility; age 45; M.I.B.F.; commence immediately.—Box 468, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER (45); practical and technical; 12 years' managerial; vast experience light and heavy; mechanical production; 3 years' abroad consultant.—Box 502, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER (age 44) open re-engagement owing termination of contract, life experience light castings, specialist economic repetition production, good commercial knowledge and contacts, able to obtain substantial business, can train labour and get results, would like join small Midland Foundry.—Box 466, FOUNDRY TRADE JOURNAL.

IRONFOUNDRY FOREMAN (aged 42 years) requires similar position; experienced in hand, board and machine moulding, green and dry sand work of wide range, including high strength irons; price setting and estimating, and able to train labour; post preferred in south.—Box 452, FOUNDRY TRADE JOURNAL.

PRACTICAL FOUNDRY MANAGER desires change; 13 years' supervisory experience; general engineering, including textile, in general and mechanised foundries; age 45.—Box 450, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

EXPERIENCED FOUNDRY SUPERINTENDENT required, to control the Steel and Iron Foundry of The Union Steel Corporation (of South Africa), Ltd., at Vereeniging, Transvaal. Annual production 4,500 tons of steel and 2,500 tons of iron castings.

Applicants must have practical and technical knowledge of the manufacture of castings in plain carbon, alloy and manganese steels up to 20 tons in weight, be fully conversant with estimating from customers' drawings, and also job costing methods. Previous positions held should be stated, also age and marital state.

Commencing salary £1,000 per annum, on an initial 3 years' contract, plus "cost-of-living" allowance, at present £171 per annum for a married person. It is obligatory for the successful applicant to join the Corporation's pension, recreation and medical benefit funds.

Fare to South Africa for successful applicant and family will be paid by the Corporation.

Applications in writing should be forwarded to the LONDON REPRESENTATIVE, Union Steel Corporation (of South Africa), Ltd., 535-546, The Adelphi, London, W.C.2.

FIRST-CLASS CUPOLA ATTENDANT wanted, to take complete control, also experienced ASSISTANT; melting 3 to 5 tons per day; state experience; all correspondence treated with strict confidence; single man preferred; West Country foundry.—Box 490, FOUNDRY TRADE JOURNAL.

MOULDERS required, first-class men only. Vacancies occur in iron and non-ferrous departments for floor and bench moulders. Piece work with time rates guaranteed.—MOYLE, Kingston-on-Thames.

SITUATIONS VACANT—*Contd.*

ENGINEER'S Pattern Maker required. —Apply C. F. DOYLE, LTD., Weston Works, Faversham.

FOUNDRY FOREMAN required for Grey Iron Foundry, West of England; general engineering castings, 20-25 tons per week; high class jobbing work, with small machine moulding section; knowledge of cupola control and machine practice necessary; good prospects for the right man; house provided.—Applicants, who should be between 35 and 45, should state qualifications, experience, and salary required, Box 494, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN will shortly be required for Steel Foundry in Clyde area; applicant must be experienced in green and oil sand practice and good organiser; state age, experience, and salary expected.—Box 506, FOUNDRY TRADE JOURNAL.

FOUNDRY TECHNICIAN required for Modern Progressive Foundry, situated near London; must have good experience in non-ferrous and foundry processes, including melting sand control, running and feeding practice; state standard of education, experience, and salary required.—Write Box M.715, WILLINGS, 362, Grays Inn Road, London, W.C.1.

METALLURGIST required to organise and develop Phosphor Bronze Chill Bar Foundry, including Continuous Casting Machine; state age, experience, and salary expected.—Box 508, FOUNDRY TRADE JOURNAL.

REQUIRED.—Experienced and energetic FOUNDRY FOREMAN, for West Riding Foundry, producing High Class Machine Tool and Engineering Castings, with an optimum output of 2,500 tons per annum; applicants must be capable of efficiently supervising Moulders in green and dry sand and loam, coremaking, and final dressing, and fully conversant with modern methods of production by hand or machine and accustomed to piecework; a strict disciplinarian and used to control; applications are invited only from persons who have satisfactorily held a similar post and who are requiring a permanent position; an adequate salary will be paid to a first-class applicant; house available.—Apply, stating age and previous experience, to Box 486, FOUNDRY TRADE JOURNAL.

WORKS MANAGER required for small Foundry with Machine Shop near Nottingham; light to medium work by machine and loose pattern; must be good organiser and disciplinarian; excellent prospects for right man; give full details of experience, age, and salary required.—Box 504, FOUNDRY TRADE JOURNAL.

WANTED FOR INDIA.—An experienced FOUNDRY FOREMAN for a large Steel Foundry in Calcutta producing a large variety of Steel Castings from a few lbs. up to 5 tons in weight, chiefly Railway Rolling Stock Components; candidates must have had at least 10 years' experience in such a foundry, 5 years in sole charge; experience in the working of a fully mechanised foundry is desirable; appointment is for 3 years, with free passage out and home; salary at the rate of Rs. 1,300 per month (rupee = 1s. 6d.), with free furnished quarters.—Applications, with full details of experience and copies of recent testimonials, to Box 498, FOUNDRY TRADE JOURNAL.

PATTERNMAKERS required. Foundry 40 miles from London. Housing difficult, accommodation easy; single men preferred.—VICTORIA FOUNDRIES (ALTON), LTD., Alton, Hants.

PARTNERSHIP WANTED

FOUNDRY Manager wants Partnership or Directorship small Foundry (Midlands); sound practical and commercial knowledge; can influence substantial business; would reorganise neglected or run down foundry; invest up to £2,000.—Box 470, FOUNDRY TRADE JOURNAL.

BUSINESS OPPORTUNITIES

A UNIQUE AND ORIGINAL system of repetition moulding of light castings (1 oz. to 28 lbs.) in any metal has been perfected and proved. Utilising unskilled/semi-skilled labour a daily unlimited number of moulds can be made without appreciable capital outlay or expenditure, and several different types of castings made at same time. Only qualifications from labour is limit of willingness to work, and excellent earnings are the incentive.

This system is only available to small foundries of limited capital 50 miles radius Midlands.

Our organisation is now arranging rota to give full explanations, plan, demonstrate, and supply all components if required. Also prove and train unskilled labour over initial period of any difficulty or snags. Initial expenses and royalty basis are only required.

Contacts are wanted solely from principals, no curiosity seekers, and must be held as strictly confidential.

Box 464, FOUNDRY TRADE JOURNAL.

FOUNDRY CONSULTANT AND DESIGNER wishes to contact progressive Company of Foundry Equipment Manufacturers; prepared to act in an advisory capacity on the design and development of new equipment, plant and/or installations; own general and drawing office facilities available in central area; replies treated in strictest confidence.—Apply Box 496, FOUNDRY TRADE JOURNAL.

BUSINESSES WANTED

FOUNDRY EXECUTIVE, with outstanding experience in High Duty Irons, wishes to acquire an interest in a Foundry in the Midlands; the advertiser has an assured large volume of lucrative business in specialised castings available immediately; must be permitted to take complete control; evidence of ability and integrity available to genuine enquirers; all replies will be treated in strictest confidence.—Box 484, FOUNDRY TRADE JOURNAL.

IRONFOUNDERS require to purchase or lease small Foundry, Manchester district, preferably with small machine-shop attached; not necessarily going concern.—State particulars, Box 426, FOUNDRY TRADE JOURNAL.

WANTED.—To Lease, Rent or Purchase, small Ironfoundry, Midlands, Black Country preferred, or Buildings suitable; going or not immaterial; consider taking up interest in existing business.—Box 472, FOUNDRY TRADE JOURNAL.

BUSINESS FOR SALE

FOR IMMEDIATE SALE.—Old-established going concern, Private Limited Company, owners retiring; Stove Grate Manufacturers and Ironfounders, situate in busy Yorkshire town; capital required £25,000, inclusive of freehold.—Apply in first instance to DAVIDSON, COLLINS & VERITY, Accountants, 38, Boar Lane, Leeds, 1.

MACHINERY FOR SALE—*Contd.*

FOR SALE

"MOLYNEUX," X1 type, shockless jolt squeeze, long draw Moulding Machine; perfect condition; 6 months' use only since new; £165, or offer.

IMPERIAL MACHINE CO.,
Edgware Road, Cricklewood, London., N.W.

FOR SALE

D. & L. Fettling Bench, with built-in Dust Collector, 3/50/400 volts.
D. & L. Swarf Extractors; steel body, 6 ft. by 6 ft., on legs, with gauze mesh trays, and fitted two 4 h.p., 3/50/400 volts, Extraction Fans.
Combination Cyclone and Dust Box; 4 ft. 3 in. dia. by 7 ft. 6 in. high.
Other Dust Collectors in stock.

S. C. BILSBY, A.M.I.C.E., A.M.I.E.E.,
Crosswells Engineering Works, Langley Green, near Birmingham. Broadwell 1359

MISCELLANEOUS.

SHOT-BLASTING PLANTS; Room, Cabinet, Barrel Types. Can be supplied with Air Compressor, Air Receiver. Dust Extraction Fans. Dust Collecting Units, Electric Motors, etc. All types of Air Compressors in stock, with or without electric motors.

S. C. BILSBY, A.M.I.C.E., A.M.I.E.E.,
Crosswells Engineering Works, Langley Green near Birmingham. Broadwell 1359

MOULDING MACHINES IN STOCK

FOUNDRY Equipment Type HRO, with hand rollover table and pneumatic pattern draw.
F.E. Jolt Squeeze Type CA1.
F.E. Hand Ram Pneumatic pattern draw size PRO. No. 5, turnover table.
F.E. Hand size AB2 swing head pin lift.
Nicholls Jolt Squeeze pillar type swing head-press, type 10.
Mumford Type plain Jolter PJ4.
B.M.M. Hand Squeeze SF1.
Jackman Squeeze Pneumatic Pattern Draw.
B.M.M. Type AT4 Pneumatic Jolt Squeeze.
Pneulec Herman Jarr Rollover, 750 lbs. capacity.
Coleman Type CNS. Pneumatic Squeeze.
Standard size Adaptables, modern type.
B.I. Magnetic Moulding Machines; types SS960 and DFB; 240 volts d.c.

S. C. BILSBY, A.M.I.C.E., A.M.I.E.E.,
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ALBION WORKS

BLOWING & EXHAUSTING FANS

BLOWING FANS:

SEVERAL NEW ELECTRIC FORGE BLOWERS, 125 c.f.m., 3 in. w.g., 2½ in. inlet, 2 in. outlet, wound for 400 volts, 3-phase, 50 cycles.

SEVERAL NEW KEITH BLACKMAN BLOWING FANS, 10,000 c.f. hour, 13 in. w.g., 1 h.p. Motor, 400/3/50. Blast gate and starters.

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TWO MOTOR DRIVEN BLOWING FANS, by Keith Blackman, 12 in. inlet, 7⅛ by 4⅛ in. outlet. Driven by 2 h.p. FLAMEPROOF MOTOR, 400/3/50, 1,450 r.p.m., 450 c.f.m., 12.6 w.g.

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