FOUNDRY

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MARCH 26, 1953

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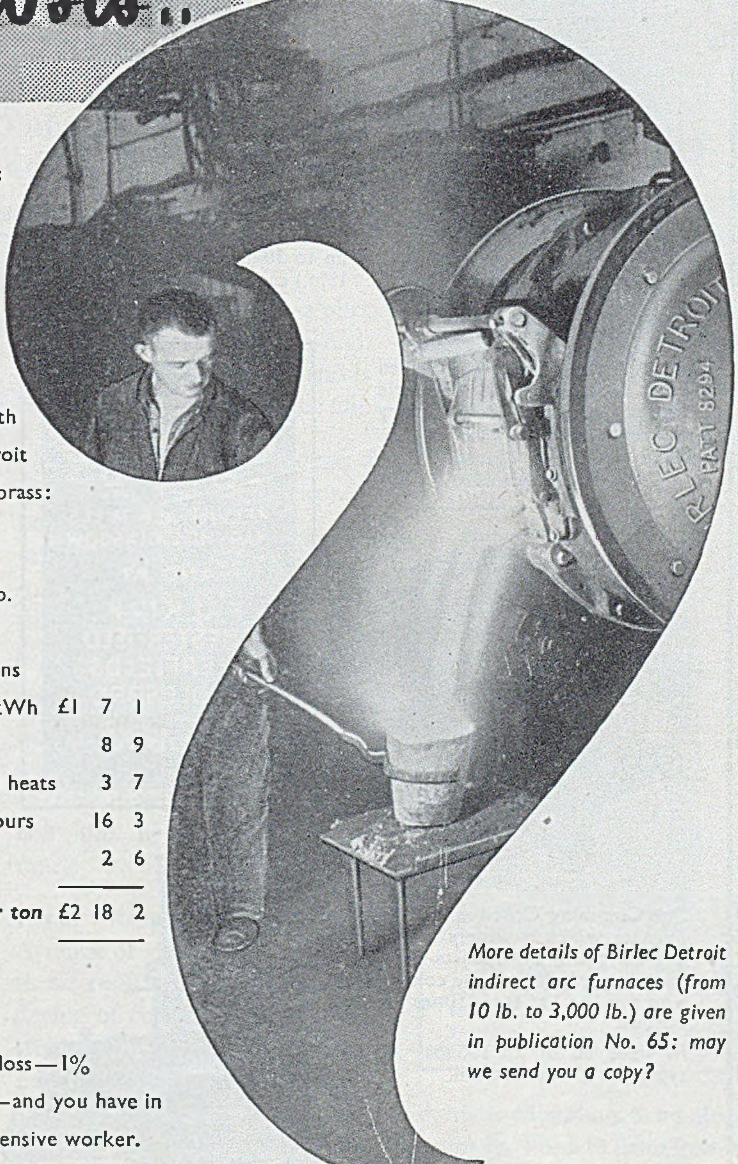
Single Copy, 9d. By Post 11d. Annual Subscription, Home 40/-, Abroad 45/- (Prepaid)

What are your melting costs..



Some metal founders never find out: too few know in advance. BIRLEC DETROITS, however, give reliable, predictable melting performances, producing sound metal at low operating costs.

Compare your present melting figures with these typical costs on a 500 lb. Birlec Detroit furnace (model LFY), working on 70/30 brass:

Average size of heat	500 lb.			
Heats per 8 hours	11			
Average output per 8 hours ...	$2\frac{1}{2}$ tons			
Electricity per ton @ 1d. per kWh	325 kWh	£1	7	1
Electrodes per ton @ 1/9d. per lb.	5 lb.		8	9
Refractories per ton	1,500 heats		3	7
Labour per ton @ 5/- per hour	$3\frac{1}{4}$ hours		16	3
Water and miscellaneous ...			2	6
Direct operating cost per ton		£2	18	2

Also reckon the advantage of low metal loss—1% can be assumed for budgeting purposes—and you have in the Birlec Detroit a hard, reliable, inexpensive worker.

More details of Birlec Detroit indirect arc furnaces (from 10 lb. to 3,000 lb.) are given in publication No. 65: may we send you a copy?

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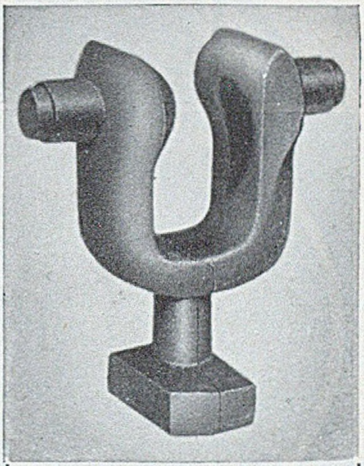
FORDATH'S WORD IS THEIR BOND

– and GLYSO is their word



Careful selection from the Glyso range of binders provides exactly the green and baked strengths required.

GLYSO CORE BONDING COMPOUNDS combine a range with characteristics so varied as to meet exactly the requirements of any given job in the core shop. They have been in daily use in foundries large and small for many years.

Semi-Solid Compounds give a high green bond covering a wide range of sand characteristics.

Creams combine a lower green bond and free-flowing mix with high baked strength; unsurpassed for core-blowing mixtures.

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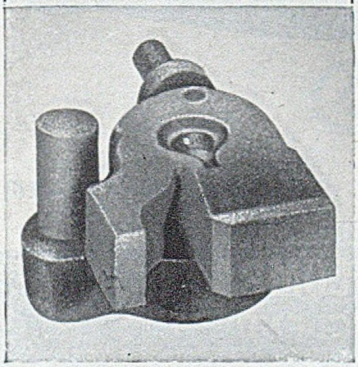
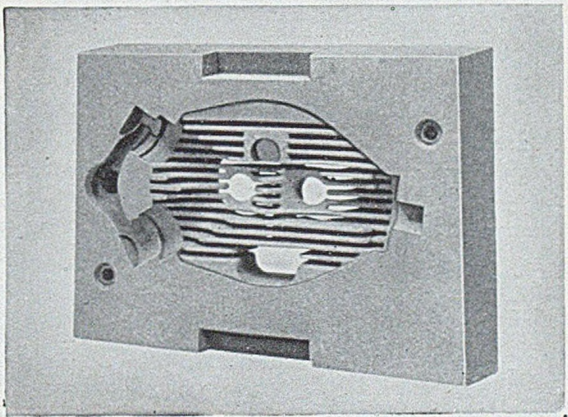
Permol Core Oils are in seven grades, selection being governed by relating dried strength requirements to binder cost. Permol bonded cores have good knock-out after casting.

The confidence with which the core maker uses a Glyso-bonded mix is amply justified in the finished core.



Glyso XL Core Powder, a pure film-dried cereal, produces high green strength in the mix and is best used with Permol Core Oil.

Glyso—Exol Core Powders, a range of cereal powders impregnated with core oil in accurate quantities for different classes of core work.



When Glyso is the bond the core makers skill is seen at its best.

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Glyso Airbond, quick drying without stoving, or stove-dried in half the usual time.

Glyso Resyns. A range of synthetic resin binders for quicker drying of cores by short-period stoving, or by dielectric heating. Excellent knock-out. Enquire also about Glyso Spray Oils, Fordavol, Fordath Parting Powder, Fordath Moulding Sand Regenerator and Fordath Paint Powders.

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THE FORDATH ENGINEERING CO. LTD.

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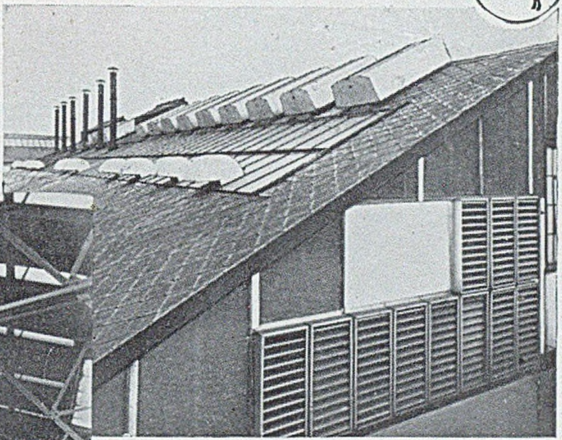

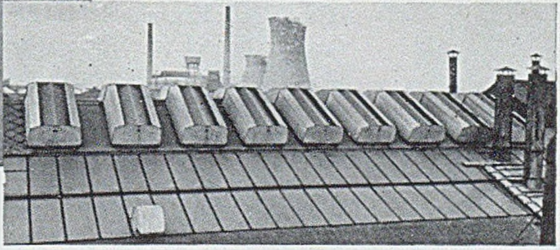

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standards of precision in box dimensions, accuracy and alignment of lugs and pins, are major contributions to the rapid production of

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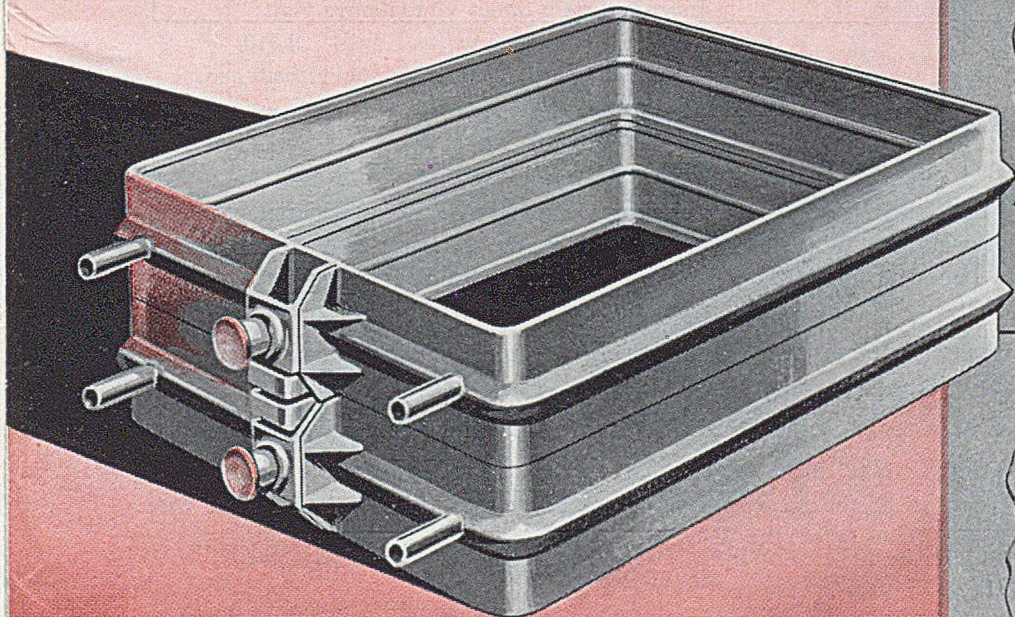

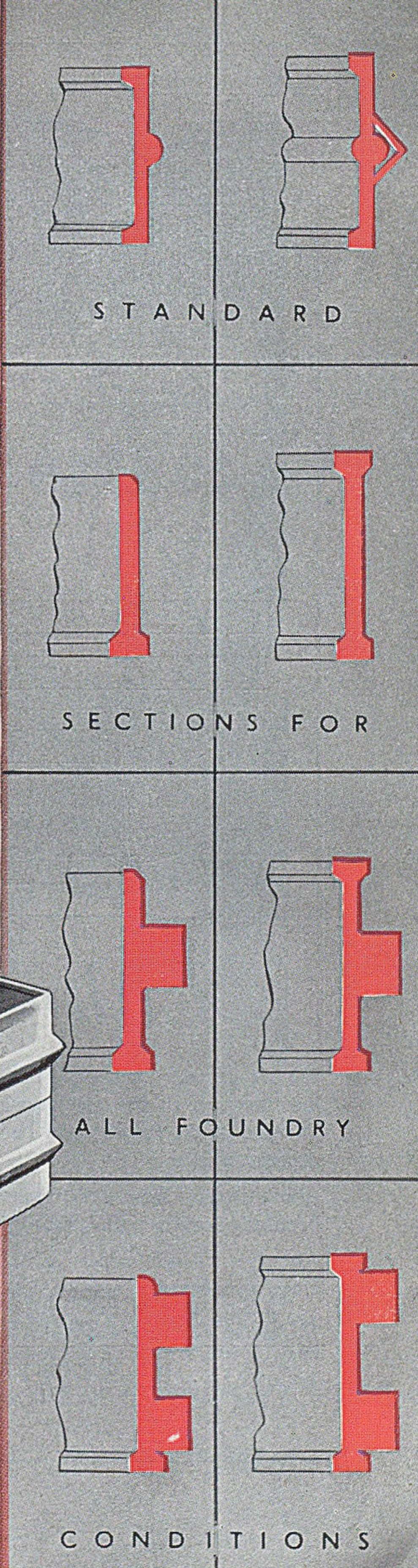

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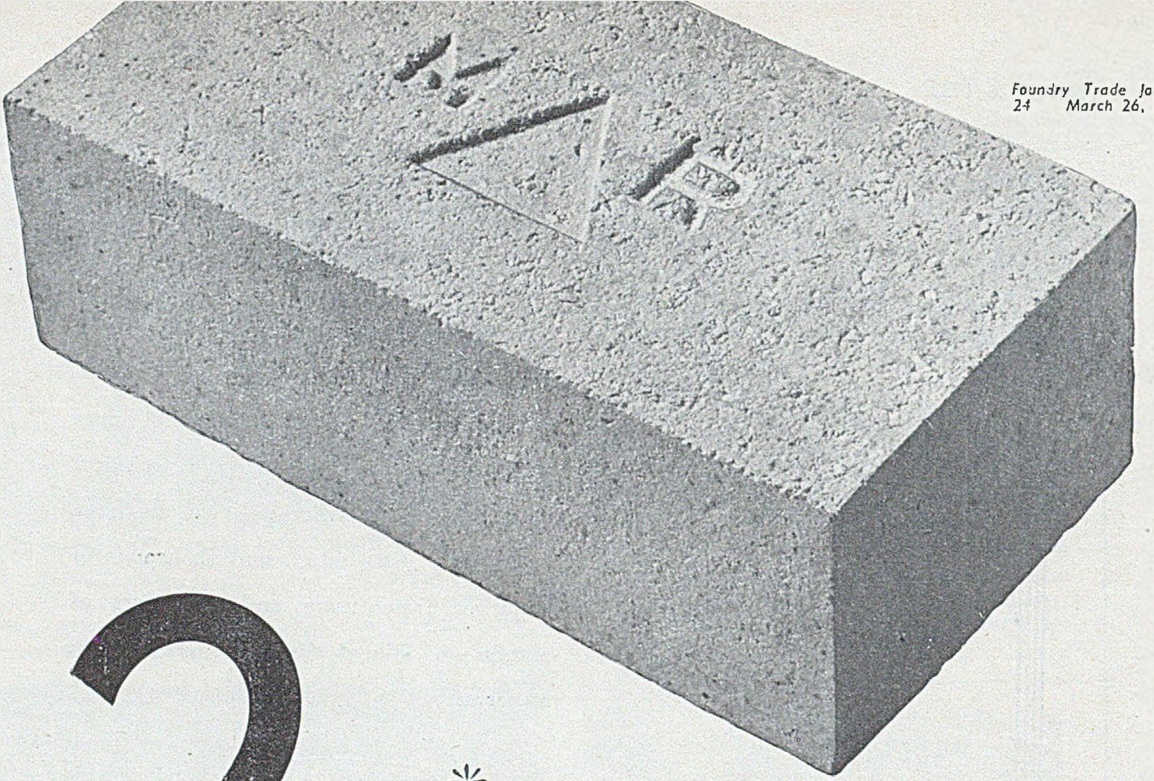

FURNACE MAINTENANCE

✻ THE MORGAN M.R.1

A brick that carries the ordinary high quality firebrick into entirely new fields of usefulness. It can be used, for example, at temperatures as high as 1600°C—far beyond the capacity of other refractories of similar alumina content: up to this temperature after-contraction is negligible. The strength and resistance to abrasion are unusually high. With these bricks, the conventional standard of comparison—alumina content—is no longer valid. They can be judged only on performance, and in performance they are comparable only with special purpose refractories having a very high alumina content indeed.

How is it done? The answer is in the way they are made: in the selection and purification of the clay; in the unusually hard burning and careful grading of the grog; above all in the very high temperature of the final firing. The manufacturing process is a continuous one—which in itself makes for uniformity—and it is carried out under rigorous quality control. All this costs money—but bricks of this type, although not previously manufactured in this country or in Europe, have been in use for some years in the U.S.A. where they have decisively proved their economy in terms of reduced furnace maintenance.

TYPICAL PROPERTIES OF M.R.1

Approximate Chemical Analysis			Physical Characteristics
Silica	(SiO_2)	52-53%	Refractoriness ... Cone 35 (1770°C)
Alumina	(Al_2O_3)	43-44%	Refractoriness under load (25 lb./sq.in.)
Iron Oxide	(Fe_2O_3)	less than 1%	Commencement of subsidence 1600°C
Titanium Oxide	(TiO_2)	less than 1%	10% subsidence 1700°C
Magnesia	(MgO)	less than 2%	Bulk density ... 132-137 lb./cu.ft.
Lime	(CaO)		After-contraction (2 hrs. 1600°C) .. less than 1.0%
Potash	(K_2O)		Thermal expansion .. 4/5 x 10^{-6} per °C.
Soda	(Na_2O)		

whole conception of furnace maintenance and efficiency

✻ THE MORGAN LOW STORAGE REFRACTORY M.I.28

—a brick that can double furnace output. It is a hot-face insulating refractory which can be used at furnace (or interface) temperatures up to 2800°F (1538°C).

At these temperatures it has a lower conductivity than any other type of refractory and therefore provides a greater reduction in the losses from the outside of the furnace. But that is less than half the story. The M.I.28 is only one-third the weight of an ordinary refractory and consequently would require only a third of the heat to raise it to the same average temperature. But, with the same furnace temperature, the average temperature of an M.I.28 is much lower (owing to its lower conductivity), and this still further reduces the amount of heat it takes up. With the same heat input, therefore, furnaces built from M.I.28 bricks heat up rapidly. On batch furnaces the bricks can double the furnace output—to say nothing of the saving in fuel.

There have been hot-face refractories before. What is new about the M.I.28, then? In theory nothing. . . . but in manufacture Morgans have put the whole of the theory into practice. The bricks are made on entirely new plant with scrupulous attention to detail and rigorous quality control from the purification of the clay to the final grinding to size. As in the case of the M.R.1., bricks of this quality have been available for some years in the U.S.A., and the improvements they can make in furnace efficiency have been firmly established.

TYPICAL PROPERTIES OF M.I.28

Maximum Service Temperature		1538°C (2800°F)
Thermal Conductivity:		
Mean Temperature	538°C(1000°F)	2.4 B.Th.U/hr.(sq.ft.)(in.)(°F)
	816°C(1500°F)	2.9 B.Th.U/hr.(sq.ft.)(in.)(°F)
Bulk Density		47.5 lb./cubic ft.
Refractoriness		1710°C (3110°F)
Modulus of Rupture		greater than 120 lb./sq.in.
Heat Capacity Factor		0.105
(the ratio of the heat stored in a M.I.28 furnace wall relative to that stored in a firebrick wall of the same area, and of a thickness giving similar hot and cold face temperatures)		

MORGAN Refractories ARE WORTH FAR MORE THAN THEY COST

THE MORGAN CRUCIBLE COMPANY LTD.
Battersea Church Road, London, S.W.11. Tel: Battersea 8822

FURNACE EFFICIENCY

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FOUNDRY TRADE JOURNAL
Established 1902
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

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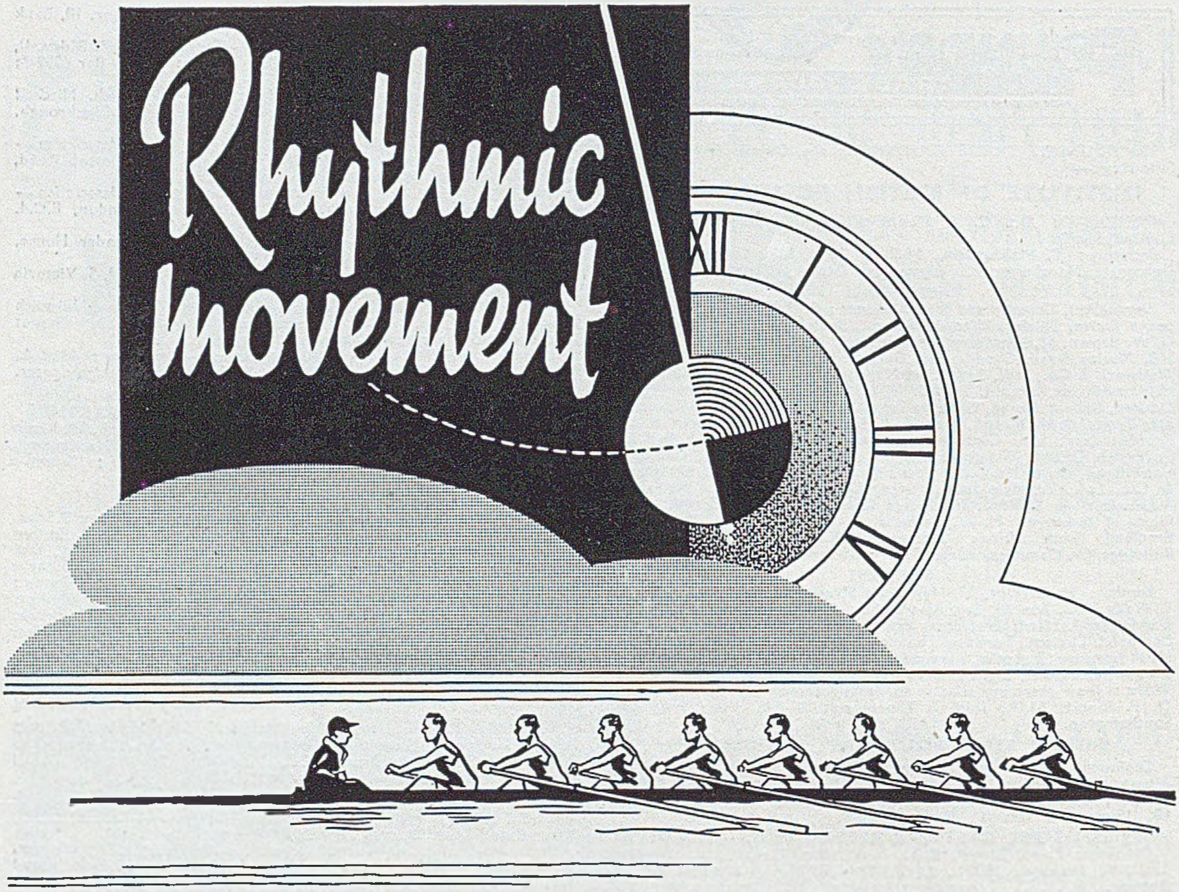
Rhythmic
movement

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PRINCIPAL CONTENTS

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

A Plan for Productivity

Readers will no doubt have learned from the daily Press that the Chancellor of the Exchequer gave an enlightening and inspiring address to a productivity conference held last week in London. However, it is the methods postulated for future action which are of major interest to foundrymen. They were detailed on behalf of the British Productivity Council by Sir Norman Kipping. The first step to be taken is the formation of the "Circuit Scheme," through which the various districts are to form teams consisting of six people, two drawn from management, two technicians and two workmen. A fixture list is then to be drawn up on a plan set out by the Council, which provides for a monthly whole-day "away" visit to another firm and the reception at similar intervals of "home" visits from teams in the same circuit. With competing firms or concerns operating in entirely different fields, the former can if deemed desirable be excluded.

To arrange the visits it is necessary to form district committees and the Productivity Council have listed 105 localities they consider suitable. These committees will no doubt be charged with arranging the fixture list and keeping the organization together. An additional activity the Council are sponsoring is the production of films, all carrying a common title "The Better Way," suitable for showing to the general public. Indeed, the two we have seen are promised for television showing; they are undoubtedly excellent.

It should be appreciated by everybody that our existence as a nation depends upon our ability to export more goods at a price our customers are willing to pay. Thus any effort that can be directed towards this end is to be welcomed. Now, the scheme enunciated, to be successful, requires that six people from ten teams in each of the 105 districts spend 12 days of eight working hours each visiting other factories, plus any time they may give as hosts. Unless our arithmetic is at fault this means a loss to production of 604,800 man/hours per annum. This does seem heavy, but if at a conservative estimate there be five million men engaged in industry, they should work 10,000 million man/hours per year, which, in proportion, makes the time taken up by the visits seem quite insignificant. We approve of the smallness of the teams and doubt if much efficiency would be lost if they were halved, provided that their membership was well chosen. With as few as six, a member of a team, not being particularly interested in a description being given inside a works, can easily manœuvre himself into a position where he can plead he could not hear. With three, to do so would be bordering on rudeness. All these efforts are well worthy of support.

As we go to Press we learn with deep regret of the death of Her Majesty Queen Mary and on behalf of the foundry industry we tender to the Royal Family this expression of most sincere sympathy.

Factory Equipment Exhibition

The Factory Equipment exhibition, being held in London from March 23 to 27 at the New Horticultural Hall, is the first of its kind to be organized in Europe. The main object of the exhibition, which will be repeated from March 22 to 26, 1954, is to stimulate the interest of directors, works and factory managers, welfare officers, personnel managers and others concerned with the control of factories, in the latest equipment designed to contribute to the safety and welfare of employees. Some 95 firms are exhibiting a variety of equipment, including mechanical-handling devices, costing and accounting systems, protective clothing, automatic tools, dust-removal systems and workers' safety and welfare equipment. The exhibition was formally opened by Sir Miles Thomas, Chairman of B.O.A.C.

Several new stacking trucks are on show, one of which, shown by R. H. Corbett & Company, Limited, has electro-hydraulic lifting and lowering gear, but is manually pedal-propelled. It is interesting to note that nearly 7,000 fork-lift trucks of various types and makes have been sold in this country since 1946. In order to emphasize the fact that protective clothing can be attractive as well as merely functional, a series of mannequin parades are being organized, professional models displaying overalls, protective shoes and boots, snoods, caps, helmets, goggles and gloves, etc. This method of popularizing protective clothing undoubtedly represents the correct approach, yet it can be overdone, as, for example, in the case of the foundryman who claimed compensation for a badly burned foot—it was found he used his leather spats only for travelling to and from work.

Among items of interest are:—"Autolec" steam raisers, as shown by G.W.B. Electric Furnaces, Limited; industrial electric ovens, A.E.W., Limited; a new direct-reading portable hardness tester of C. Tennant, Sons & Company, Limited; vibro-electric equipment for flow regulation and for sieving, screening and consolidating various solids, by Podmores (Engineers), Limited; hand pallet-trucks, Eccles (Birmingham), Limited; safety boots and shoes, by Briggs Industrial Footwear, Limited; barrier creams and dispensers, by Rozalex, Limited; cleaning and maintenance equipment, blowers, hot-air apparatus, syrens and sound signals, by Service Electric Company, Limited; hanger equipment for clothes, by James Sieber Equipment Company, Limited; "Totector" safety boots and shoes, by Wilkins & Denton, Limited, and "Microfilter" and "Mark IV" respirators for dusty atmospheres and a range of goggles, gloves and other protective clothing displayed by Siebe, Gorman & Company, Limited. Information on the scrap drive is provided at the British Iron and Steel Federation stand, and the British Electrical Development Association, Limited, has an exhibit supporting its campaign to promote greater industrial productivity by the better use of electricity. This theme is also adopted on the stand of Crompton Parkinson, Limited, under the guise of "More Power—More Productivity."

Shell Moulding. Sheffield City Libraries with their usual enterprise have now purchased a full bibliography on shell moulding, moreover, they state in a covering letter that they will, so long as limited supplies last, send copies on request "to any interested organization." It is suggested that applicants should send a stamped foolscap envelope for a reply when writing to Sheffield.

Iron and Steel Institute

A.G.M. and Special Meeting on Boron in Steel

The Eighty-fourth Annual General Meeting of the Iron and Steel Institute will be held on Thursday and Friday April 30 and May 1, at the offices of the Institute, 4, Grosvenor Gardens, S.W.1. A members' dinner (tickets £1 10s. 0d. each) will be held at Grosvenor House, Park Lane, London, W.1, on April 30 at 7 for 7.30 p.m. The principal guest will be Lieutenant-General Sir Ian Jacob, K.B.E., C.B., Director-General of the British Broadcasting Corporation. (Evening dress; decorations.)

The special meeting which was to have been held on February 18 to discuss recent developments in the U.S.A. in the manufacture and use of boron-bearing steels will now be held on Wednesday, April 29, at the offices of the Institute, 4, Grosvenor Gardens, S.W.1. This meeting has been arranged by the Institute at the suggestion of the Ministry of Supply, acting in conjunction with the Organization for European Economic Co-operation. Dr. H. Rohl (United States Steel Corporation) is coming from the U.S.A. to present the paper for the morning session on April 29; as also is Mr. H. B. Knowlton (International Harvester Company) who will give the first paper for the afternoon session on that day. In addition, a paper giving the results of certain British research will be presented at the afternoon session by Mr. R. Wilcock (United Steel Companies, Limited.). Buffet luncheons (tickets 4s. 6d. per person per day) will be served in the library of the Institute, 4, Grosvenor Gardens, London, S.W.1, on April 29 and 30 and on May 1.

Meeting in Holland

A meeting of the Institute will be held in Holland from September 30 to October 7, 1953. The programme will include visits to works and other places of interest in Holland, and special arrangements will be made for ladies. Details will be announced later.

Latest Foundry Statistics

According to the Bulletin of the British Iron & Steel Federation for February, the total number of people engaged in ironfounding on January 10 was 149,650 some 4,000 fewer than on the corresponding date of 1952, and 2,000 fewer than that in December. People engaged in steelfounding, on the other hand, showed at 20,740 an increase of 13 over the December figures and nearly 1,000 over January, 1952. The production of steel for steel castings made a good start in January with an average weekly melt of 11,400 tons as compared with 10,300 in December, 1952, and 10,200 tons in January, 1952.

The British Bureau of Non-ferrous Metal Statistics reports that the output of phosphor-bronze steels last year was 3,100 tons as against 3,916 tons in 1951.

The Ministry of Supply announce that the total production of aluminium alloys in 1952 was 77,348 tons, made up of 27,021 tons of sand castings; 40,386 tons of gravity die and 9,941 tons of pressure die castings. The output of magnesium castings was 3,406 tons.

Cocktail Party.—At the May Fair Hotel, Berkeley Street, London, on March 18, members of the Council of Ironfoundry Associations met the representatives of the Press. The guests were received by Mr. N. P. Newman, the president, who in a brief address detailed the work of the Council and its future policies.

Ramming Cores with Reclaimed Sand

*By Harold W. Haynes**

It is a common experience to-day where "more and more production" is the cry, that "bottle-necks" in the production flow of castings inevitably develop in certain sections of the foundry. One of the most frequent is a shortage of cores. This may be the result of several causes; for instance, labour may be unobtainable in sufficient numbers to obtain the requisite number of cores by the existing method of coremaking, or alterations in the design of castings may necessitate greatly increased requirements of cores which cannot be satisfied with the labour force then employed—to mention only two possible causes. Such a situation prompted the writer to consider the advisability of using impellor ramming in conjunction with reclaimed sand from the Hydroblast plant, to overcome difficulty. Increased core-production, however, meant that the foundry also required additional facilities for drying, and this had to be tackled at the same time. In inaugurating a policy designed to increase coremaking and reduce operating expenses, proper consideration had to be given to the proper functioning of the mechanical equipment available.

The trend of the times shows an ever-growing demand for better castings, and high-grade castings cannot be made economically without proper equipment. In this connection, the use of an impellor-type rammer for producing certain kinds of cores is worthy of consideration. In the foundry under consideration reclaimed sand is used in the ramming machine in conjunction with pneumatic turnover/draw machines, fitted with roller-conveyor tracks, and a tunnel-type drying stove for the smaller cores. Light-alloy coreboxes adequate to stand up to the job ensure the production of precision cores requiring a minimum of finishing and dressing before use. This combination is capable of economically producing all kinds of cores up to a maximum size of 4 ft. 6 in. long by 3 ft. wide by 1 ft. 10 in. high; in this set-up is included an electrically-driven push-button jib-crane of 2 tons lifting capacity. The total floor space occupied by this plant is 28 by 20 ft., and includes all the sand-ramming plant, one large and one small turn-over machine, roller conveyor tracks, tunnel stove and storage room for cores, and coreboxes. The impellor-type rammer is placed so that it can service both the turnover machines, as is shown in Fig. 1.

Operational Sequence

Fig. 2 shows the rammer in operation working in conjunction with a turnover-and-draw machine. On the left, a lever controls the main cylinder of the latter machine which raises and lowers the table; a second one controls the vertical pneumatic clamps, whilst a third controls the horizontal clamps. This machine has four pneumatic clamps to secure the corebox to the base plate. When the corebox is set in position, the ramming head is swung round into position over it. Sand is then rammed up for a few inches by the impellor; the operator tucks sand into undercut portions of the box, afterwards continuing ramming until the correct level for the insertion of the core irons or grid, and ash vents, is reached. He then rams to the top of the box and finishes off with a flat pneumatic rammer. The joint is strickled off, and a plate laid in position on top of the box. A 4 ft. 6 in. by 2 in. by 4 in. H-section steel girder is placed along the centre of the plate and air pressure is applied to the two pneumatic clamps to grip the girder. The first control lever raises the table with the clamped corebox on it; the table is turned over on its trunnions and a bogie is run on its lines under the table and corebox, which are then lowered on to it. The clamps are released by turning off the air supply, and the H-girder falls into a recess provided for the purpose in the centre of the bogie. A pneumatic vibrator then loosens the core and the table with corebox clamped to it is lifted, leaving the core in position on the plate. It is pushed away on the bogie, finished, blacked, and lifted by a 2-ton jib crane, on to the adjacent core carriage, to be dried. The box and

* Foundry Manager, National Gas & Oil Engine Company, Limited.

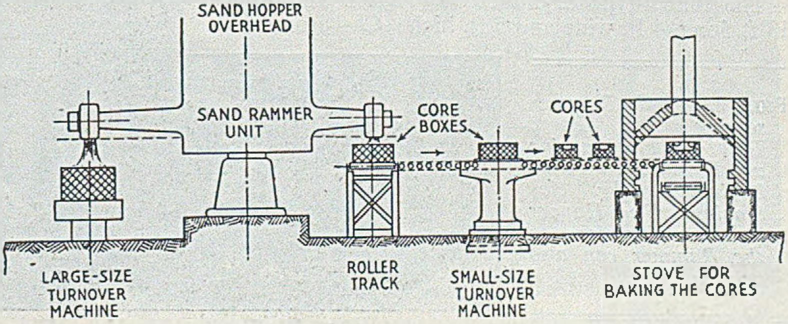


FIG. 1.—*Sketch showing the Layout of the Impellor-type Sand Ramming Machine, working in conjunction with both a Large and Small Core-turnover Machine.*

Ramming Cores with Reclaimed Sand

table are then turned over and lowered into position for the next core to be rammed. The use of the jib crane ensures that these cores can be handled without requiring any lifts from the overhead crane which is serving the rest of the coreshop.

Production of Smaller Cores

On the reverse side of the sand rammer (Fig. 3) to that occupied by the machine which has just been described, roller conveyors are situated capable of being serviced by the rammer head, which can be swivelled round into position over a series of coreboxes placed five in a row on the conveyor for ramming (Fig. 3). (It should be noted here that these are rammed when the impellor rammer is not being used for the table turnover machines, thus ensuring that the ramming machine is in continuous operation.)

After ramming, these boxes are moved on the conveyor to a turnover machine (Fig. 4), which clamps them, vibrates and draws off the box, leaving the cores on their plates on the roller-conveyor. These cores are then pushed on the rollers, finished and blacked and pass subsequently along the rollers to the tunnel-type stove, through which they are slowly drawn on an endless metal conveyor, which is motor driven. These cores are for vertical-engine cylinder moulds and are produced from collapsible light-alloy coreboxes, accurately machined and containing draw-back pieces, which are dovetailed in position. Core irons used in these boxes are placed in position before ramming commences, as also are the rod vents, which are withdrawn before the box is lifted off the core. The sizes of these boxes are 13 by 12 by 10 in. and 16 by 8 by 6 in. Such cores are rammed, finished and dried, whilst remaining on the roller conveyor, and thus do not have to be lifted until they are ready for the mould. Since they remain on their plates until dry, they are not subject to size variation. On an average, 28 of these cores are required for one vertical-column mould. The turnover machine used for these smaller cores is capable of handling boxes 2 ft. wide, with a 12-in. draw, and it will be noted that the use of this plant is not confined to the jobs described, but it is capable of producing any core which can be accommodated by either of the turnover machines.

Tunnel-type Drying Stove

The tunnel-type drying stove (Figs. 5 and 6) is 13 ft. long, 4 ft. wide and 5 ft. high. Cast-iron side-plates, held by bars, are bolted through and placed on a brick base 1 ft. deep. The inside is lined with firebrick and also has an arched firebrick roof. Through the roof, 2 ft. from the core-inlet end of the stove, a vent chimney 8 in. square is placed. A counterbalanced steel door is fitted at each end of the stove. The stove is gas fired by town's gas at 3 lb. per sq. in. pressure, boosted from the foundry supply plant, and uses 1-in. gas pipe to supply four burners, two at each end of the stove. Each of these burners is equipped with a pilot light. The conveyor running through the stove is driven by a 1-h.p. geared electric motor; its output speed is 26 r.p.m. through a 29:1 ratio gearbox reduction, giving the conveyor a speed of $2\frac{3}{4}$ ft. per min., which allows 5 min. for cores to traverse the length of the stove. The motor can be stopped or reversed at any stage of the core positions to suit the requirements of the operator.

The time taken for drying cores is naturally governed by the volume of sand in each core, assuming that the stove temperature be constant. This constant temperature has been arranged by equipping the stove with a recording thermometer to ensure that a temperature of 215 deg. C. (420 deg. F.) is maintained throughout.

Reclaimed Sand

Sand is reclaimed from the Hydroblast plant in the dressing shop, where it is washed, after which it is dried in a rotary drier. The mixture used for coremaking consists of four buckets of reclaimed sand, one bucket of milled red sand, and 6 lb. of

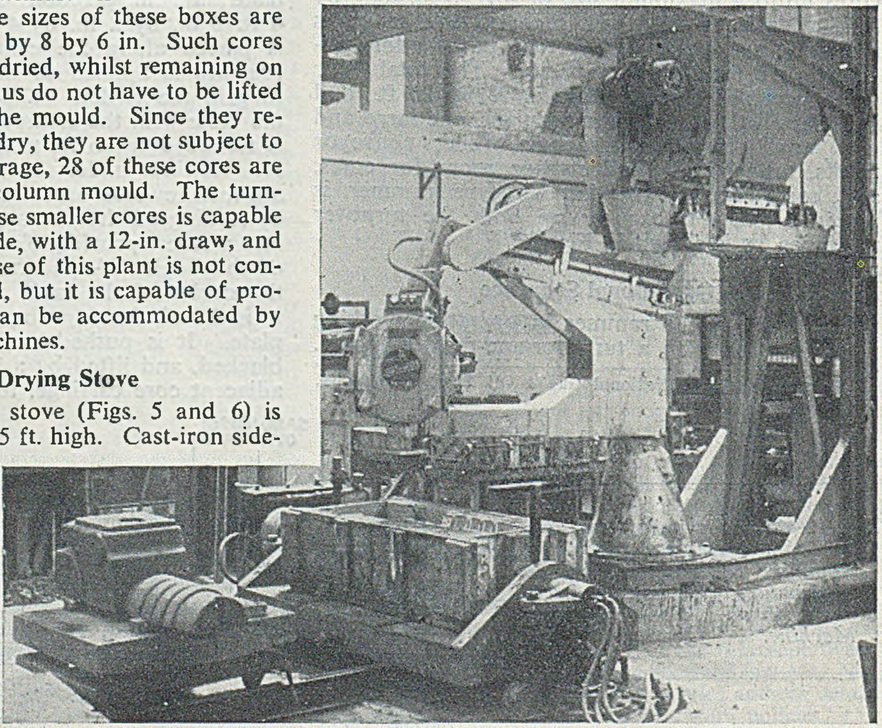


FIG. 2.—*Sand Rammer serving the Large Turn-over Machine and Finished Core on a Bogie ready for Stoving. The Hopper for supplying sand to the Rammer can also be seen.*

semi-solid corebinder, the whole being mixed in a rotary machine and delivered to the skip loader on the impellor-type sand rammer. This sand mixture possesses the following properties:—Dry permeability, 210; dry strength, 390 lb. per sq. in.; green strength, 2.00 lb. per sq. in.; moisture, $2\frac{3}{4}$ per cent., and hardness of the baked core, No. 97.

It should be emphasized that, when oil-sand is used in a plant of this description, cleanliness is of the utmost importance. Such sand readily adheres to all metal parts, and in order to keep the plant described in smooth, working order, it receives a thorough cleaning down each night, after the day's work has finished. Good-housekeeping is the foundation of production, and it is only by cleanliness that high rates of production can be maintained, or even increased, over a period of working, and repair and maintenance costs be kept down to a minimum.

Moulding a "Vertical Column"

Figs. 7 and 8 show a mould for a seven-crank vertical oil-engine column casting. The cores (28 in all) can be seen in position, all having been made on the two turnover machines described. It will be appreciated that these cores must conform strictly to size, as these castings are drilled in jigs. Also the maximum section of the casting, which is from $\frac{7}{16}$ to $\frac{3}{4}$ in., precludes the use of any cores which would leave a "fin" between the joints. This would lead to inaccuracy and difficulty in machining, and might even cause cracking of the casting before it left the box in which it was cast. It is apparent, at this point, that the use of precision-made light-alloy coreboxes is fully justified, for they produce cores of uniform size, which require practically no dressing before insertion in the mould. The venting methods of such cores can, because of the use of these boxes,

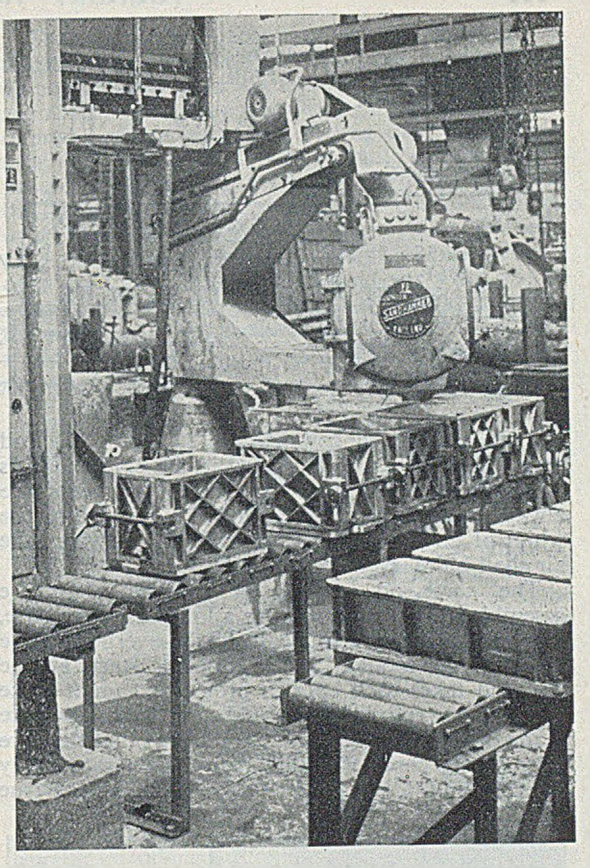


FIG. 3.—*Identical Rammer shown in Fig. 2 after swivelling to serve a Batch of Five Smaller Coreboxes carried on a Roller Conveyor.*

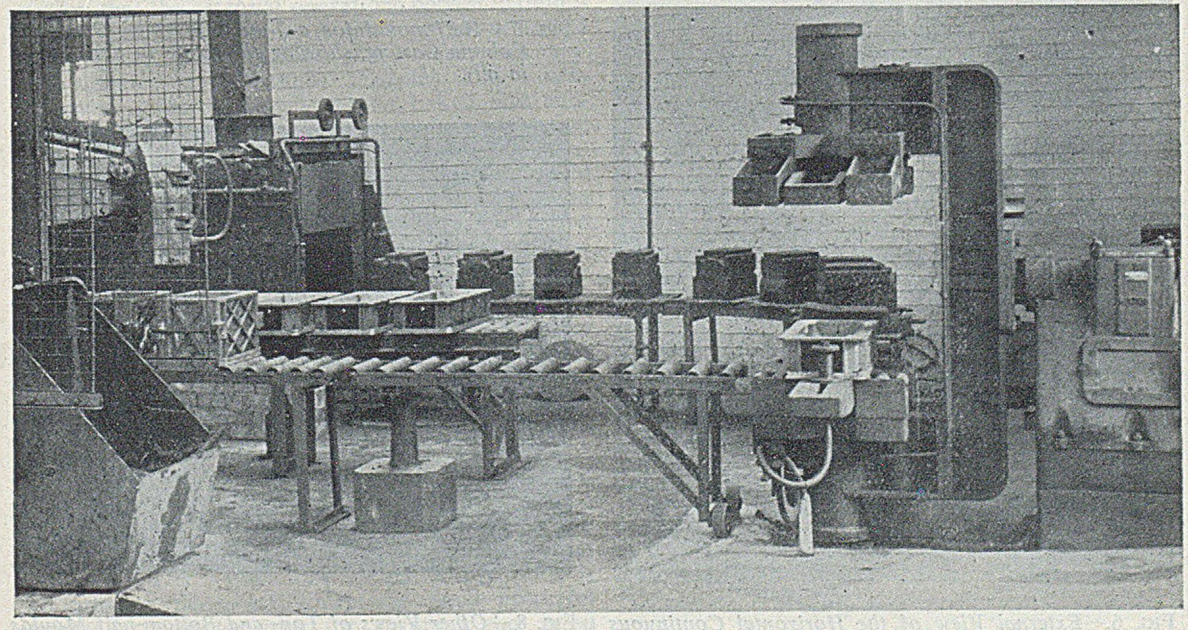


FIG. 4.—*Core-turnover Machine used for the Smaller Coreboxes shown in Fig. 3. The Ramming Head, Roller Conveyor and (background) Tunnel Drying Oven can also be seen.*

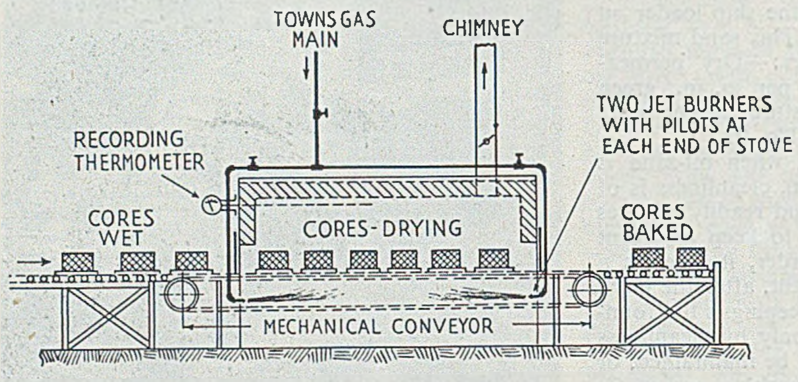


FIG. 5.—*Sketch showing the Construction of the Tunnel-type Core-drying Stove, 13 ft. long, through which Cores are carried on a Motor-driven Metal Conveyor.*

be standardized; a combination of ashes and rod insertion (through holes drilled in the coreboxes), is employed for this purpose. Thus, the vents are always in the correct place, and it is not left to the whim of any particular coremaker as to where the air shall be relieved from any core.

The cores, on leaving the rammer plant, are assembled in correct order on a long cast-iron plate, and transferred by a single lift by the overhead crane direct to the mould. If the moulder starts at one end and takes each core in order, he cannot place a core incorrectly in the mould. As these cores are made of oil-sand, it will be appreciated that they are very strong cores, and that they disintegrate easily after casting, leaving a nice skin. Their being true to shape prevents "whiskers" on the internal portions of the casting, which are formed solely by their use.

Acknowledgment

The writer thanks the managing director of the National Gas and Oil Engine Company, Limited, and all colleagues for the facilities given in arranging this equipment and for giving permission for this short article to be published.

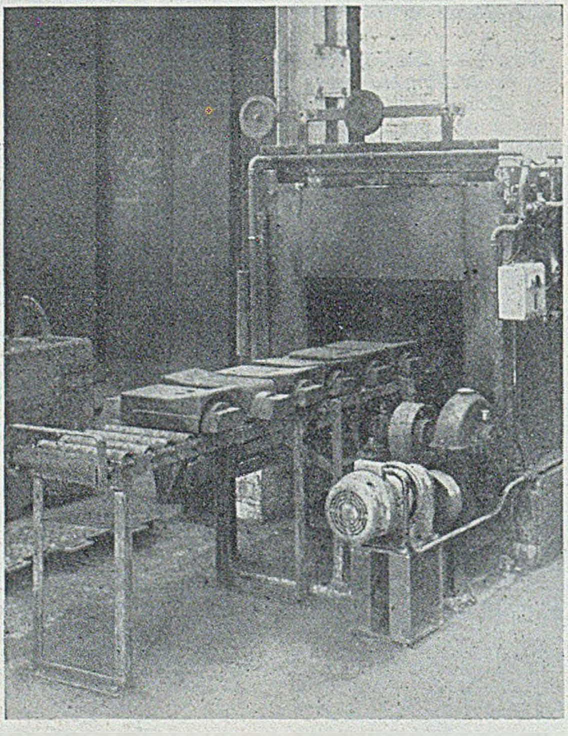


FIG. 6.—*External View of the Horizontal Continuous Core Oven taken from the Discharge End. Dried Cores are delivered on to a Short Roller Conveyor.*

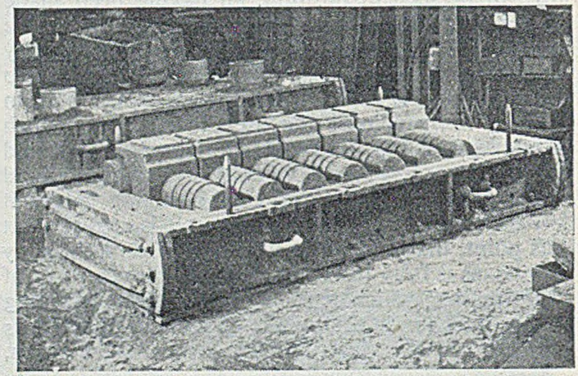


FIG. 7.—*Half-mould for a 7-crank Vertical Oil-engine Column Casting, showing the Cores in position* (28 *in all*).

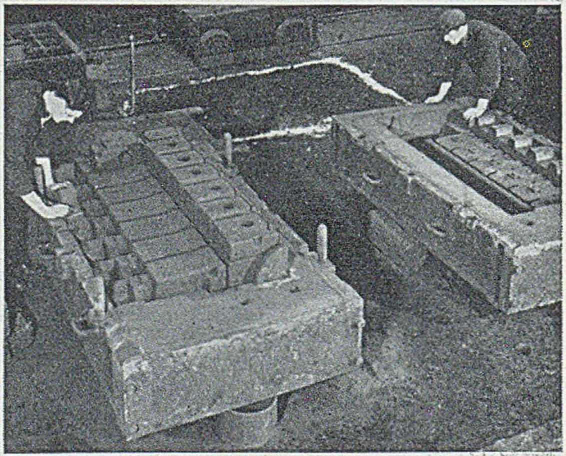


FIG. 8.—*Other Views of Top- and Bottom-half Moulds for the 7-crank Oil-engine Casting being "Finished" prior to Assembly and Casting.*

Shell-moulding Machinery

Established Designs being built in Great Britain

Shell-moulding developments in this country have received much impetus by the announcement that Foundry Equipment, Limited, of Linslade Works, Leighton Buzzard, have taken over manufacture in this country of shell-moulding machines made by Sutter Products Company of America. These are now being marketed under the name of the F.E. (Sutter), and the British concern holds selling rights in the British Isles, British Commonwealth and Empire (including Canada—an important dollar market), the whole of Western Europe and all South America. It is understood that a number of machines are already in hand for delivery to well-known foundries in this country and abroad. Continuing the JOURNAL policy of including descriptions of new foundry plant, details of the machines are given in what follows:—

Operating Sequences

Two of the Sutter range of machines are at present being manufactured at the Linslade works; these are the S.P. 1000, which will produce shells up to 30 by 20 in., and the S.P. 1100 for shells of 41 by 26 in. maximum size. These machines are otherwise identical—apart from the matter of size—so that, except where stated, the following details apply equally to both models. They are completely automatic machines, operated by compressed air, to a continuous, pre-set sequence. The actual automatic control is effected through an electrically driven master camshaft operating a bank of air valves, which in turn bring air cylinders into play for providing motive force at the various points.

Those already familiar with shell moulding will realize that the essential operations consist in dumping a special resin-bonded sand on to a heated patternplate, so that a shell of the sand/resin mixture adheres to the pattern. Surplus sand is next removed. The half-shell is then baked and subsequently stripped from the pattern. Two mating half-shells are next assembled, made ready to receive metal and then cast. The shell mould decrepitates after the metal has solidified and an extremely fine casting results, having a very good surface finish and conforming to unusually close dimensional tolerances.

In the F.E. (Sutter) machine, the patternplate is carried horizontally between trunnions contained in a U-shape frame, and is rotatable pneumatically. Below is a bin of 300 lb. capacity for holding the sand/resin mixture, and a powered clamping arrangement enables this to be lifted and fixed to the patternplate and rotate with it. At the back of the machine, mounted so as to be capable of swinging over the patternplate, is an electric oven for baking the shell. This consists of radiant heating elements mounted below the concave side of an insulated cover. Built into the pattern supports is an adaptor plate, on which are fixed powerful (spring-less) ejector pins for stripping the cured shell from the pattern.

The operational sequence of the machine is, therefore, (1) lowering of the frame on which are mounted spray-guns containing a silicone parting agent; (2) automatic spraying of the pattern; (3) removal of the frame; (4) rolling over of the pattern; (5) raising of the sand bin; (6) locking in position; (7) rolling over the pattern and bin; (8) dwell period for investment; (9) reverse rolling over (bin downwards); (10) unlocking the bin; (11) rolling the pattern face upwards; (12) bringing over the oven; (13) dwell period for curing; (14) oven removal; (15) stripping and (16) taking away the half-shell. Some of these stages are illustrated in Figs. 2 to 5. The controlled times for the sequence quoted add up to 34 secs. for the S.P. 1000 model and 43 secs. for the S.P. 1100. To these must be added the (variable) dwell times of pattern investment (from 3 to 20 secs. for S.P. 1000 and 3 to 30 secs. for S.P. 1100) and the dwell time for curing, for which a somewhat similar time range is allowed. Thus, a half-shell can be produced at approximately one a minute and all the unskilled operator has to do is press a button. In fact, so simple are the operator's duties that it is quite obvious he could easily look after more than one machine. After making about 20 half-shells, it is necessary to replenish the sand/resin supply in the bin.

Other Details

So as to maintain sufficient heat in the patternplate, heating elements are fitted into it. Where direct heating is difficult, a preheating operation can be introduced into the cycle, using the curing

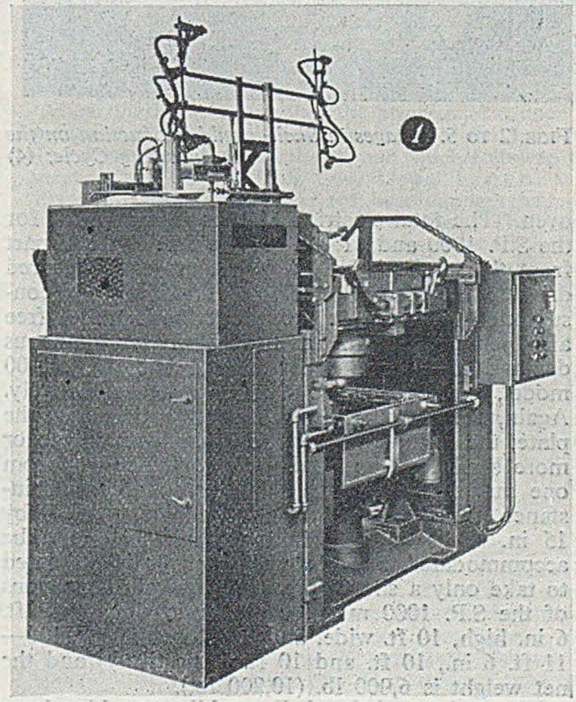
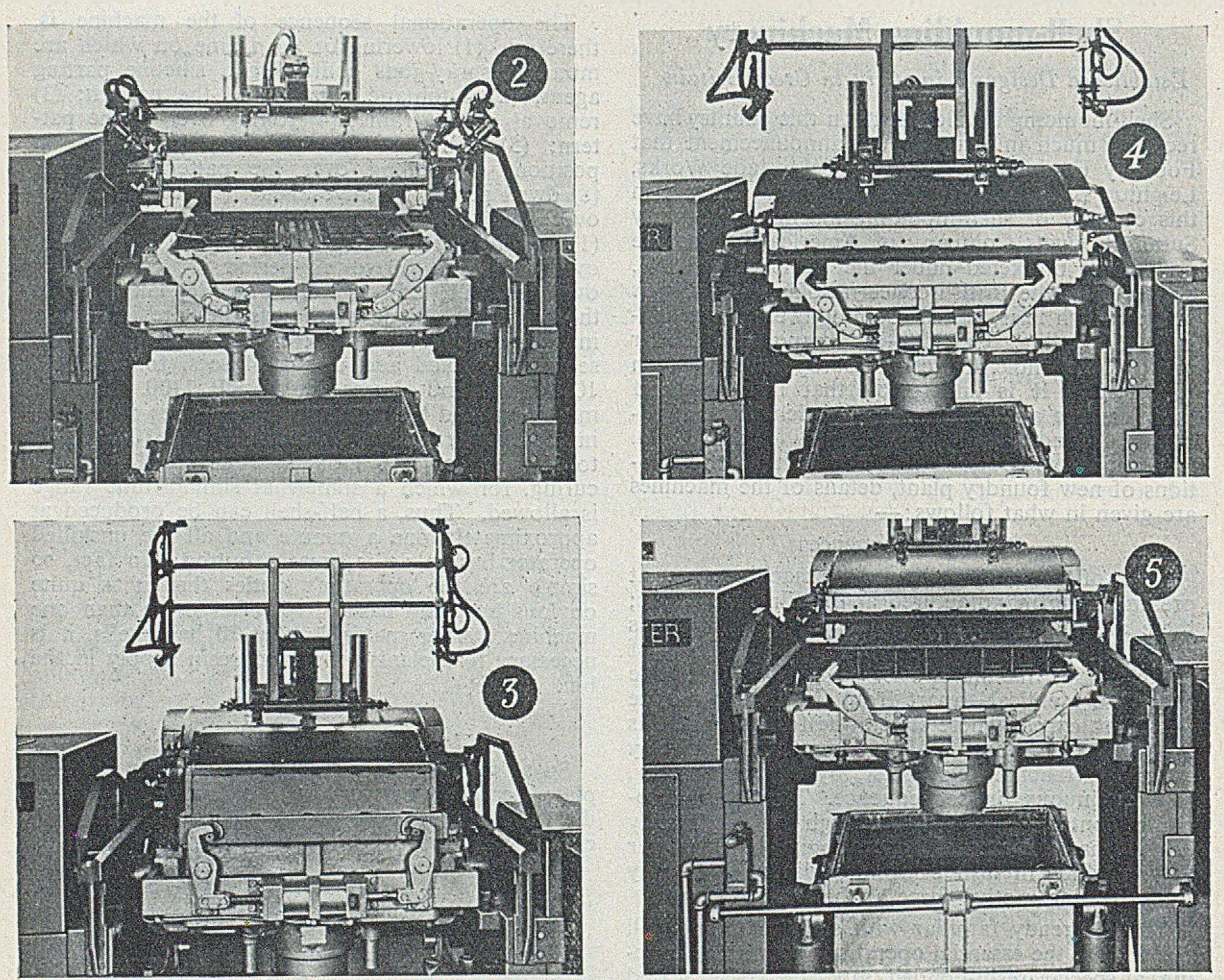


FIG. 1.—*F.E. (Sutter) Shell-moulding Machine.*



FIGS. 2 TO 5.—*Stages in Shell-mould Production on the F.E. (Sutter) Machine: (2) Spraying the Patternplate; (3) Investing Cycle; (4) Curing; and (5) Stripping.*

oven. The total electrical load is about 40 kw. for the S.P. 1000 and 61 kw. for the S.P. 1100. Apart from this, there is only a $\frac{1}{2}$ h.p. motor for geared drive to the master camshaft. Maximum air consumption for the S.P. 1000 is 18.2 cub. ft. of free air per min., with a maximum instantaneous demand of 40 cub. ft. per min. For the S.P. 1100 model, the figures are 44.5 and 79 respectively. Again, for permissible depth of pattern on the plate, the relative figures are 6 and 8 in. Two or more shells can be produced simultaneously from one machine up to the total platen area, for instance, for the 30 by 20 in. machine, two 20 by 15 in. shells or four 15 by 10 in. shells can be accommodated. Pattern changeover is estimated to take only a short time. The overall dimensions of the S.P. 1000 machine are approximately 9 ft. 6 in. high, 10 ft. wide, and 7 ft. deep (S.P. 1100—11 ft. 6 in., 10 ft. and 10 ft. respectively) and the net weight is 6,000 lb. (10,200 lb.).

The makers of the shell-moulding machine have realized that no single machine which forms only part of a process is more efficient than the subsidiary items. Therefore, they have concentrated on providing proper auxiliary services for the whole process. These include the adaptation of a sand mixer specially for resin sands, advice on pattern design layout and manufacture, and the subsequent assembly for pouring of the shell moulds. The method of backing moulds with steel shot, so widely used in America, has been replaced by a novel system. For this, an impeller-type sand rammer, such as the firm manufacture, could look after the output from two shell-moulding machines of the type described.

It is understood that a comprehensive display of shell-moulding, embodying the F.E. (Sutter) machine, will be on show at the company's stand at the Birmingham section of the 1953 British Industries Fair.

MONOTYPE CORPORATION, LIMITED—Mr. H. L. T. Buckle has resigned from the board.

Institute of Vitreous Enamellers

Spring Conference at Buxton, May 13 to 15

The 1953 Spring conference of the Institute of Vitreous Enamellers will be held in Buxton, Derbyshire, from May 13 to 15 inclusive with headquarters at the Palace Hotel. At this conference, the Society of Glass Technology and the British Ceramic Society have accepted an invitation to join and a programme of technical sessions and works visits of mutual interest has been arranged. All members of the three societies are invited to attend and those wishing to do so should complete a reply form, and return it not later than April 17, to the secretaries, John Gardom & Company, Ripley, near Derby. The programme contains a number of social functions as well as technical sessions and works visits. Members' ladies are invited to attend the social functions and a special excursion into Derbyshire, visiting Chatsworth House, has been arranged for them. No registration fee will be charged in respect of this conference. A short list of other hotels in Buxton is issued by the secretaries but in no case can hotel reservations be made through the Institute's offices.

It should be noted that on some occasions papers will be presented concurrently.

The Institute is indebted to the companies who are allowing members to inspect their works. It is absolutely essential that a second and, preferably, a third choice of visit should be given when applying, as numbers on some of the visits are strictly limited. It is hoped that the papers to be presented will be preprinted and any member requiring copies should apply. A Conference Office will be established at the Palace Hotel.

Programme*

Wednesday, May 13

9.00 p.m. to 11.30 p.m. Reception and dance by invitation of His Worship the Mayor of Buxton and the Mayoress in the Pavilion Gardens, Buxton (members and ladies, evening dress optional).

Thursday, May 14

9.30 a.m. Technical sessions at the Palace Hotel: *Session "A"*—" Fuel and Economics," by Professor R. J. Sargant, O.B.E., D.SC., followed by three simultaneous technical sessions: *Session " B "*—" Strains in Vitreous Enamel," by Professor H. Moore, D.SC., A.R.C.S., F.INST.P. *Session " C "*—" On the Erosion of Silica Bricks for Open-hearth Furnace," by Professor Takeo Ao; and *Session " D "*—" Some Aspects of the Testing of Clays for the Pottery Industry," by D. A. Holdridge, B.SC., F.R.I.C., and D. G. Beech, B.SC., PH.D., F.S.S.

Works visits. Members may participate in one only of the following. Coaches will depart from the Palace Hotel promptly at the times given.

12.15 p.m.: (1) To Simplex Electric Company, Limited, Blythe Bridge; (2) to Mintons, Limited, Stoke-on-Trent; (3) to Josiah Wedgwood & Sons, Limited, Barlaston; (4) to W. T. Copeland & Sons, Limited, Stoke-on-Trent (for all these, luncheon will be taken *en route* at the Red Lion Hotel, Leek); and (12.30 p.m.) (5) to Derbyshire Silica Firebrick Company, Limited, Hartington (luncheon will be taken at the Newhaven Hotel, Hartington). All coaches to return to Buxton for approximately 6.00 p.m. Members and ladies will make their own arrangements for dinner and it is suggested that they notify their hotel of their intentions.

9.00 p.m. to midnight. President's evening at the Palace Hotel; buffet and dancing (informal dress).

* Times and detailed arrangements are subject to revision. Final arrangements will be shown in a conference handbook which will be sent with tickets.

Friday, May 15

9.30 a.m. Technical sessions at the Palace Hotel: *Session " E "*—" The Study of Flame Radiation," by M. W. Thring, M.A., F.INST.P., F.INST.F.; followed by: two simultaneous technical sessions: *Session " F "*—" Mechanical Handling," by J. Bain, A.M.I.MECH.E.; *Session " G "*—" Presentation of Data as Aids to Production Efficiency," by B. P. Dudding, M.B.E., PH.D., A.R.C.S.

Works visits: Members may participate in one only of the following. Coaches will leave from the Palace Hotel promptly at 12.15 p.m.

(1) To Arthur Lee & Sons, Limited, Sheffield, rolling mills; (2) to Newton, Chambers & Company, Limited, Chapeltown, iron foundry. (For (1) and (2) luncheon will be taken *en route* at Devonshire Arms Hotel, Baslow); (3) to C.W.S. Glass Works, Worksop; and (4) to the General Refractories Laboratories, Worksop. (For (3) and (4) luncheon will be taken *en route* at the Station Hotel, Chesterfield). All coaches will return to Buxton at approximately 6.00 p.m.

7.30 p.m. for 8.00 p.m. to 1.00 a.m. Banquet and dance at the Pavilion Gardens, Buxton (members and ladies, evening dress and decorations).

The special programme for ladies on *Thursday, May* 14, consists of a coach excursion to the Peak district of Derbyshire, for which coaches depart from the Palace Hotel for Chatsworth House, at 9.30 a.m. Chatsworth House, the historic home of the Dukes of Devonshire, will be visited, and then the party will proceed to Grindleford, *via* Calver, for luncheon at the Maynard Arms Hotel, Grindleford. In the afternoon the route will take in Hayfield, *via* Hathersage, Ladybower and Glossop, with tea at the Royal Hotel, Hayfield, and the return to Buxton *via* Chapel-en-le-Frith and Dove Holes arriving at approximately 5.30 p.m.

Institute of Materials Handling

The inaugural meeting of the Institute of Materials Handling, 20/21, Took's Court, Cursitor Street, London, E.C.4, was held on March 19, at the Trocadero Restaurant, London. The object of this meeting was to hear the interim report of the provisional council of management and to approve the rules of the Institute. The principal speaker at the dinner which followed the meeting was the Rt. Hon. Lord Llewellin, C.B.E., M.C., T.D., who stressed the need for overcoming reluctance to use labour-saving appliances, saying, " The most modern equipment is useless if it is not properly used."

Replying for the Institute, Mr. E. G. Whitaker said sections had already been established in London. Birmingham and Manchester, a Glasgow centre was about to be formed, and membership was now about 600.

He pointed out that of the 40 reports so far published by the British Productivity Council, 28 made reference to materials handling, and the report dealing with materials handling itself had been a best seller, 25,000 copies having been sold. At a conservative estimate about £50 million could be saved by British industry annually by developing techniques of materials handling, he said.

Lt.-General Sir Thomas J. Hutton, K.C.I.E., C.B., M.C., general manager of the British Productivity Council, Mr. D. Cherry Paterson, M.I.MECH.E., president of the Mechanical Handling Engineers' Association, and Mr. E. C. Dickens, M.B.E., immediate past chairman of the Institute of Packaging represented the bodies most closely allied to the subject of materials handling.

Personal

Mr. G. B. Judd has joined the Board of Whessoe, Limited, to fill the vacancy caused by the death of Mr. Harry Clayton.

Earl Peel, who is a director of the Lancashire Steel Corporation, Limited, has been appointed a director of the District Bank, Limited.

Mr. F. C. Toplis, a director of Midgley & Son, Limited, ferro-alloy merchants, of Sheffield, returned recently from a three-week trip to South Africa.

Mr. E. Graham Clark, secretary of the Institution of Civil Engineers, is to receive the honorary degree of Master of Science from Durham University.

Mr. John A. Drake, managing director of Drakes, Limited, constructional gas engineers, Ovenden, Halifax, left last week-end for a two-month business trip to Australia.

Mr. H. D. Roberts, A.C.C.A., has been appointed a director of Air Control Installations, Limited, Ruislip, Middx. Mr. Roberts has been secretary of the company since its inception in 1935.

Mr. A. Cork has resigned his position as foundry metallurgist with the Wellworthy Piston Ring Company, Limited, Ringstead, to join the technical staff of the British Electro Metallurgical Company, Limited.

Mr. Arthur Ruston, the production superintendent at the Goodyear Tyre & Rubber Company (Great Britain), Limited, works, Wolverhampton, has been appointed manager at the firm's new plant in Luxembourg.

Mr. Charles L. Norwood has been appointed researcher by the Production Engineering Research Association of Great Britain. He was formerly employed by the Westinghouse Brake & Signal Company, Limited.

Mr. James Nicol has been appointed steelworks manager of the Clyde Alloy Steel Company, Limited, Motherwell. Mr. Thomas T. Shepherd, B.Sc., has been appointed chief engineer in control of all engineering and drawing-office activities of the Clyde Alloy works.

Mr. J. F. B. Jackson, B.Sc., A.R.I.C., F.I.M., who was director of research to the British Steel Founders' Association since the formation of its Research and Development Division in 1949, has now been appointed director of the recently formed British Steel Castings Research Association.

Mr. E. C. Dickinson has been appointed deputy general manager of Morris Motors, Limited, engines branch, which he joined in 1927. Previously, he had been with the British Cast Iron Research Association. He is to continue personal supervision of the foundries at Courthouse Green and Wellingborough.

Mr. Jean Cavallier, Mr. E. Colliard, Mr. Roger R. Meyer and Mr. Charles Schneider have been nominated or promoted to the grade of Officer of the Legion of Honour. Mr. Raymond de Fleury, Mr. J. de Langardiere and Mr. C. Heurtey have received the decoration of Chevalier of the Legion. All are well known in French foundry circles.

Mr. Douglas A. Smedley, managing director of Smedley Brothers, Limited, Eagle Ironworks, Belper, has completed more than 50 years' service with the firm. To celebrate the occasion he was presented with a silver cigarette-box by his fellow directors, and a barometer by the employees; later a dinner is to be given for more than 100 present and former employees.

Associated British Engineering, Limited, announce the appointment of Mr. Frederick Henry Harris as group production adviser. Mr. Harris is a graduate of London University and a member of the Institution of Production Engineers. Towards the end of 1951 he served as a member and secretary of the Anglo-American Council on Productivity team on metal-working machine tools, which visited the United States. Before his present appointment he was works manager for B.S.A. Tools, Limited, in Birmingham.

Dr. Thomas King has been appointed assistant professor in metallurgy at Massachusetts University of Technology, Boston. In 1945 he took his B.Sc. degree with first-class honours, at the Royal Technical College, Glasgow. He also gained his A.R.T.C. and, in 1951, graduated Ph.D. Later that year he was a winner of the Dr. James Mackenzie Prize presented to the outstanding research student of the year at the Technical College. Dr. King, who has been a lecturer in metallurgy at the College for a number of years, will take up his new appointment in September.

Obituary

Mr. Edward Cyril Frith, a director of Coleridge Engineering Company (Sheffield), Limited, died on March 14 at the age of 58.

Mr. Ralph Ison, secretary and director of Henry Wallwork & Company, Limited, died on March 11, at the age of 42. Mr. Ison, who had been with the firm for 19 years, had been a director since 1945.

Mr. John Austin, former casting inspector with Qualcast, Limited, Victory Road, Derby, has died at the age of 76. He had been connected with the firm for 60 years, having joined the Derwent Foundry (as it was then known) in 1891, and retired in July, 1951.

Mr. John McIntyre, who has died at the age of 92, was foreman of the turning and finishing shop of William Denny & Bros., Limited, shipbuilders and engineers, of Dumbarton, for 42 years, retiring in 1931. He was the last surviving founder-member of Glasgow and West of Scotland Foreman Engineers' Association.

Mr. Frederick Harold Reeves, founder of the Revo Electrical Company, Limited, Tipton, who has died at the age of 76, became, when he was 30, manager of Cable Accessories, Limited, Tipton. This company in 1926 changed its name to the Revo Electric; with Mr. Reeves as managing director, it became a public company in 1936.

I.B.F. Conference Papers, 1954

The Council of the Institute of British Foundrymen is prepared to receive offers of papers for presentation at the fifty-first annual conference to be held at Glasgow in June, 1954. The invitation is again issued earlier than is usual, as owing to printing difficulties it has been found necessary to arrange the conference programme earlier than in past years, and manuscripts will be required not later than December 31, 1953. It is emphasized that the opportunity to consider papers of a practical character will especially be welcomed.

Members and non-members who contemplate offering papers are asked to communicate immediately with the secretary of the Institute, who will forward them a copy of the Institute's publication "Notes for the Guidance of Authors of Papers." It is desirable that all formal offers of papers should be sent to the secretary not later than June 1 so that they can be considered by the meeting of the appropriate committee which will be held later in that month.

The "C" Process of Casting*

By M. C. Dixon, M.I.B.F., and R. S. Bushnell, A.M.I.B.F.

The "C" process, or shell-moulding process, which is extremely simple in principle and can be operated with very elementary equipment, is being used by a large number of foundries in this country with remarkable results. Unfortunately, much of the work on the process being carried out by foundries is shrouded in a veil of secrecy caused partly by a natural desire to overtake competitors, and partly by a pioneering spirit. By nature of their daily work, the Authors have access to much of the work which is being carried out in such foundries, but as confidences are carefully maintained, it is only possible to give in this Paper a picture of the process as it is generally known in this country.

History

The original conception of what is now known as the Cröning, "C" or shell process, was made by Johannes Cröning of Hamburg during the recent world war. Cröning had been working for some years on methods for producing accurate castings which would be simpler to operate than those employed in the lost-wax process. In one phase of this work, he reduced the water content of the slurry and replaced part of the bonding agent with thermo-setting resin. Similar work was carried out in Great Britain and in the United States, but Cröning was alone in finally substituting a ground resin and employing a heated patternplate. These developments were covered by patent applications filed in Germany in 1943 and 1944 in the name of Johannes Cröning. Considerable progress was made by Cröning and others in Germany and large numbers of hand-grenades were being made by the process before the cessation of hostilities in 1945. A member of a United States Technical Intelligence Team visiting Germany examined the process which was reported in F.I.A.T. (Field Investigation Agency Technical) Final Report No. 1168, dated May 30, 1947. The possibilities of this new process have excited the imagination and ingenuity of the industry, and many production foundries in this country are engaged in assessing or developing the process. Remarkable results have been reported and, in practically all cases, greatly improved castings have been produced.

* Paper read before the Birmingham, Coventry and West Midlands branch of the Institute of British Foundrymen. The Authors are attached, respectively, to Bakelite, Limited, and British Industrial Plastics, Limited.

The finish obtained in all metals is much better than that produced in green-sand, oil-sand, or other conventional methods, but not so good as that usually expected from the lost-wax process. In certain cases, however, where extra care has been taken, finishes have been obtained comparable with the latter. Die-casting foundries engaged on casting aluminium-bronze, etc., have reported that whilst the shell process does not give results as good as those obtained during the initial runs, results are superior to the average of a long run and the castings are consistent and cheaper.

General Properties

Scabbing and sand buckles due to bad ramming or lack of sand control, are of course entirely unknown, whilst blows are rare, as the permeability of shell moulds and cores is very high indeed. The permeability of shell moulds is many times greater than that of green-sand or oil-sand moulds. The accuracy of castings made by the shell process is generally accepted as from 0.003 to 0.007 in. per linear in., but in some cases tolerances of 0.002 in. and lower have been maintained. The consistency of accuracy has been an outstanding feature. Due to the method of making shell moulds and cores, troubles such as sagging and distortion are avoided. Pattern wear is negligible and identical castings have been produced from patterns after eighteen months' continuous use.

Most castings require very little fettling. Gating is reduced to a minimum and it is possible to produce castings with no risers or vents. Foundrymen find that many castings produced by the shell pro-

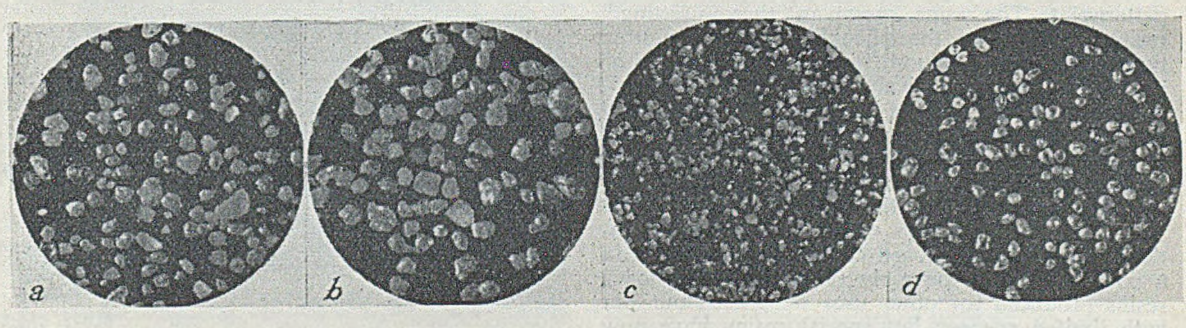


FIG. 1.—*Selection of Sands used in the Shell-moulding Process, all ×20 mags.; (a) Chelford Processed, fine grade; (b) King's Lynn, washed; (c) Redhill grade H; and (d) Zircon Sand.*

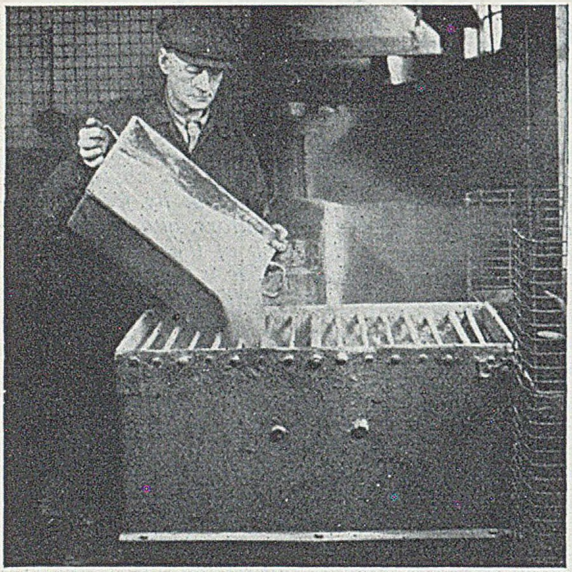


FIG. 2.—*Kneader-type Mixer for Incorporating the Resin with the Sand.*

cess are perfectly satisfactory in the as-cast state and are able to dispense with expensive machining operations. Castings produced by the process are free from sand inclusions and other defects, and will pass the most exacting examinations such as X-ray and gamma-ray inspection.

The shells are very light and take up little room. Less floor space is required, and it has been found that a much greater casting capacity can be handled by a given labour force. No large and heavy equipment is necessary and foundries can be small, compact, and very clean in operation and attractive even to the most fastidious labour. Shells and cores do not " damp back " and can be stored indefinitely.

THE PROCESS

Resins

The process is extremely simple to carry out. It is based on using a mixture of synthetic resin and sand to form a thin shell or crust on a heated metal patternplate. The resins, known as " thermo-setting " resins, may be of the phenolic, cresylic or urea types, which are produced by condensing phenol or cresol or urea respectively with aqueous formaldehyde in the presence of a catalyst. The resulting product is dehydrated, cooled and ground to a fine powder. A hardener is incorporated during manufacture of the resin thus making it unnecessary for the foundryman to add this when milling the resin with the sand. These resins can be stored indefinitely if kept in closed containers and stored in a cool place. In the early stages of the process, resins produced for other uses were tried out but with limited success, but special resins have now been developed for the process. The cost of these resins varies between 1s. 6d. and 3s. 6d. per lb., whilst the percentage of binder required varies from 3 to 10 per cent. depending on the type of resin and the nature of the work. Much work is being carried out by the resin manufacturers to obtain optimum flow characteristics and also to improve the strength of the resin so that further economies may be made in resin addition.

Sands

The choice of sand is very important as it has a major effect on the surface finish of the casting. The sand must be dry, clay free and have a high silica content, but all sands answering to these broad qualifications have not been found suitable. Experience has shown that round and sub-angular sands having a screen distribution on three or four sieves are generally best for most metals and economical in resin addition. The high permeability of shell moulds allows much finer sands to be employed than in standard foundry practice, and this feature makes a major contribution to the high surface-finish of metal obtained. The ultimate limit of sand fineness is generally dependent on economics, because the greatly increased surface area of superfine sands will naturally necessitate increased additions of binder. When casting certain metals having pronounced " searching " properties, such as phosphor-bronze, high-phosphorus iron, etc., a wider sieve distribution is recommended.

Chelford (processed, fine) and Redhill (grade H) Fig. 1, are two sands which have found general approval in this country and give good results. The chemical and sieve analyses of these sands are given in Table I. Foundries who have tried mixing various types of sand together have obtained encouraging results.

The rapid development of the shell process has put a great strain on the supplies of sand available, but it is anticipated that certain deposits of clay-free silica sands of fine sieve analyses will be worked specially for the process. Glacial and lower greensand deposits are most likely to be suitable. Many well-known foundry sands, including those classified as silica sands, do not always give optimum results in this process and should be avoided.

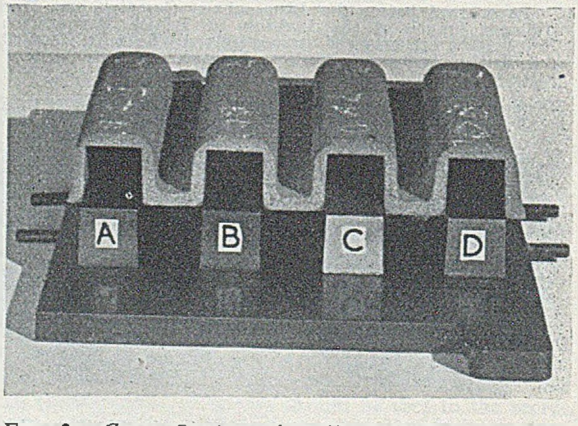


FIG. 3.—*Cross Section of a Typical Shell obtained when using Patterns made from Various Metals mounted on a Steel Plate.*

TABLE I.—*Sieve Grading of Suitable Sands.*

B.S. sieve.	Per cent, retained on B.S. sieve.								Chemical composition, per cent.			
	44	60	72	100	150	200	—200	Clay	SiO_2	Fe_2O_3	Al_2O_3	Loss on ignition
Chelford processed, fine grade	0.2	0.5	1.9	29.3	45.4	17.2	5.5	0.4	93.31	0.68	4.48	0.49
Redhill, grade H	—	—	—	2–6	25–40	25–35	15–25	—	98.5	0.15	0.3	0.05

Obviously, much work on the supply position and the physical properties and behaviour of sands in the process remains to be done.

Resin/Sand Mixture

One hundred parts weight of the chosen sand and 5 to 8 per cent. of resin are mixed together in a sand mixer or mill (Fig. 2). Various types of mixers can be used and consequently the time of mixing varies considerably. From one minute with the standard type muller (which has had the two cast-iron wheels raised ½ to 1 in. off the pan) to 15 min. with wire mixers may be occupied. The strength and other properties of the shells are dependent on the thoroughness of mixing. To avoid separation and segregation of the flour-like resin from the mixture during storage, a small percentage of a "pick-up" agent such as paraffin, lubricating oil or liquid resin, is often mixed with the sand before adding the resin. Resin/sand mixtures may be stored for a considerable time, if precautions are taken to prevent moisture pick-up and resin separation. It will be appreciated, therefore, that much routine sand control, similar to that necessary with clay- and oil-bonded sands, is unnecessary when using the shell process.

Patterns

The pattern and patternplate must be single-sided and made of metal, such as steel, grey-iron, brass or bronze. Aluminium and magnesium alloy patterns are sometimes used, but these can be damaged and marked easily in use. Patternplates should be robust to withstand thermal distortion and have a high heat capacity. This latter property is important; the plate should be at least ½ in. thick and contain sufficient heat to prevent appreciable drop of temperature during the formation of the shell. The different heat and heat-transfer capacity of various metals has been employed by patternmakers to give greater thicknesses in certain parts of the shell and more economical thicknesses in the "land" areas. Recent experiments carried out with a patternplate specially produced with contours made from steel, grey-iron, brass and aluminium respectively, however, gave results which contradict this theory (Fig. 3). Some foundries with experience in the process, have reported that the use of dissimilar metals causes binding of the shell on the pattern and has an effect on accuracy.

Patternplates are often constructed so that the male and female half-patterns are contained on the same plate. Shells produced from these patterns mate up with one another, thus affording economy in pattern construction. Patternplates must be fitted with ejector pins located in areas likely to cause binding of the shell and preferably situated in the "land" area of the plate and where the shell is thickest. They should have a large head area and be sufficiently long to lift the shell free from any contour having a vertical draft. Strong, heat-resistant springs are generally fitted to all ejector pins to ensure satisfactory reseating after operation.

The general finish of the plate and pattern must be good, as the shell formed will record even the slightest imperfection. Patternmakers are advised to allow a minimum of one or two degrees draft when constructing the pattern and carefully avoid any undercuts, even of a very minor nature, as these may cause the rigid shell to bind during ejection. Low-melting-point solders must not be used in the construction of patterns for the shell process. The temperature to which the pattern is heated varies with the type of resin used and also the speed of operation required (Fig. 4). Comparative temperatures used frequently are for urea-type resins 180 to 220 deg. C.; for phenolic-type resins 200 to 260 deg. C.; and for cresylic-type resins 220 to 280 deg. C. The heating of the pattern is usually carried out in gas- or oil-fired stoves or by gas jets whilst travelling on a conveyor system. Electrical cartridge-type heaters built into the patternplate are ideal, as they can be thermostatically controlled, but supplementary heating arrangements are necessary to complete the baking of the shell. The temperature of the pattern can be checked by thermocouple temperature recorders but the use of temperature indicating crayons is quicker and more convenient.

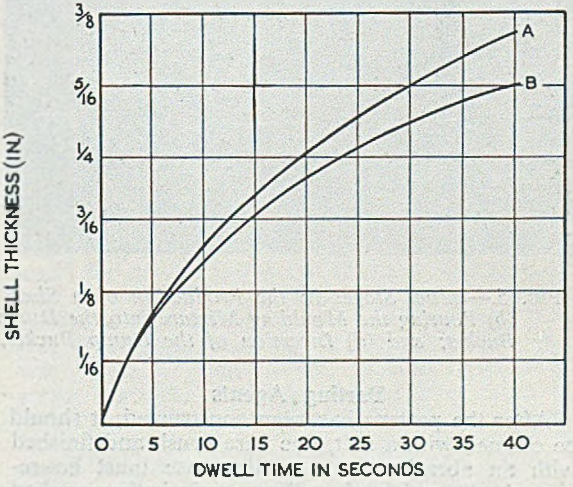


FIG. 4.—*Shell Thickness as affected by the "Dwell" Time for Two Pattern Temperatures* (A) 260 *and* (B) 200 *deg. C.*

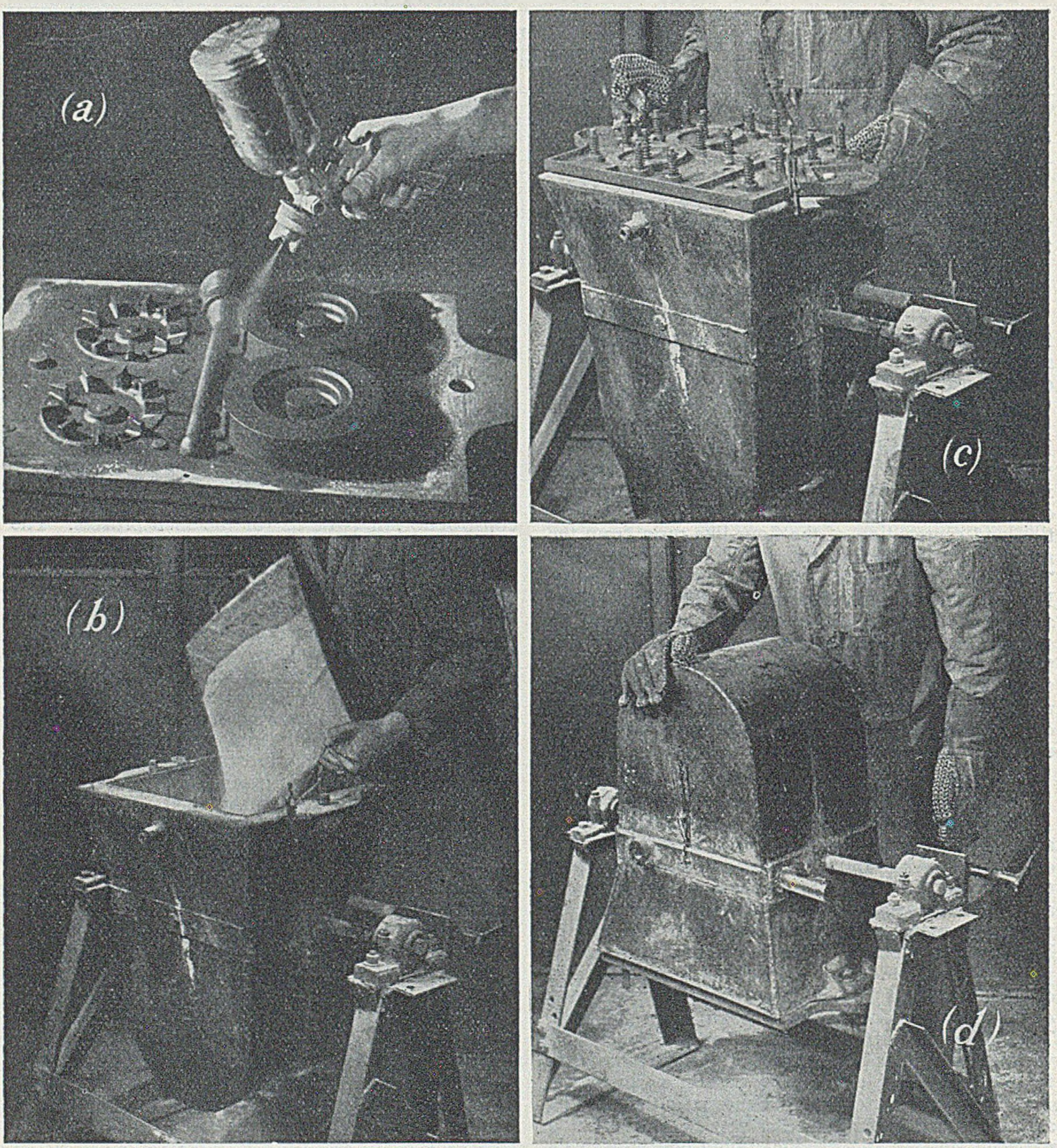


FIG. 5.—*Initial Stages in the Production of a Shell Mould;* (a) *Spraying the Pattern with a Parting Agent;* (b) *Pouring the Moulding Mixture into the Dump Bucket;* (c) *Patternplate fixed in Position on the Dump Bucket; and* (d) *Inversion of the Dump Bucket, with the Pattern Below.*

Parting Agents

After the pattern has been constructed, it should be cleaned with a soft, fine wire brush and finished with an abrasive soap. All grease must be removed. A coating of a silicone resin is then applied and the pattern is baked at 200 to 250 deg. C. for several hours to give a heat-resistant immovable film. With intricate patterns, it may be found expedient to repeat the treatment two or three times. After the patternplate has been primed as given above, it is only necessary to give a very light application of the parting agent prior to fixing on the dump bucket. Suitable concentrations for this purpose can be made by taking five parts by volume of "Releasil" silicone emulsion No. 35, and diluting with 100 parts volume with water or by diluting " Releasil " fluid to a similar extent with white spirit or paraffin. It is recommended that a mist spray is given before each shell is made (Fig. 5 (*a*)). Patterns which have been treated as recommended above and used continuously will attain a beautiful, glossy finish and retain dimensional accuracy.

Dump Bucket

This is a welded steel or aluminium box supported on trunnions which can be inverted quickly by means of a lever or hand wheel. The resin/sand mixture is placed inside the bucket (Fig. 5 (*b*)) with the hot patternplate on top, pattern side inwards. The depth of the box is important and should not be less than 18 in. to give a positive vertical drop of the resin/sand mixture on to the pattern, whilst the capacity should be sufficient to make a number of shells without refilling. Continued contact of the hot patternplate with the dump bucket sometimes causes some coalescing of resin on the rim and it may be found necessary to fit an asbestos gasket to the rim of the bucket. Some foundries engaged on continuous production have fitted a water-cooled jacket round the top of the bucket and this overcomes entirely any tendency to build up through transfer of heat from the pattern.

Moulding Cycle

Attachment of Pattern.—Quick-setting clamps are preferred to facilitate fixing (and removal) of the hot patternplate to the dump bucket (Fig. 5 (*c*)).

Inversion.—The assembly must be turned over quickly so that the resin/sand mixture falls vertically on to the pattern (Fig. 5 (*d*)). This is especially important when the pattern has deep contours, such as fins. A foot-operated pneumatic system is ideal. When working with deep patterns, care should be taken also to see that sufficient material is contained in the bucket to cover the highest peak of the pattern by at least three inches. Some operators attach vibrators to the side of the dump bucket, as it is considered that this gives a stronger and more compact shell. If this vibration is too severe, however, heavy packing may result with an appreciable reduction in the permeability of the finished shell.

The pattern remains in an inverted position for several seconds to allow the resin/sand to fuse and build-up on the pattern. The actual time given depends on the thickness of shell required and will vary with the type and percentage of resin used, with the metal used in the pattern, and with the temperature. From Fig. 4, referred to earlier, it will be seen that a dwell of 15 to 20 secs., for a typical resin/sand mix, is sufficient to produce shells $\frac{3}{16}$ in. thick.

Reversion.—The bucket is reversed leaving a crust of fused resin/sand on the pattern, whilst the remainder falls back into the bucket for the next cycle. The patternplate is then removed (Fig. 6 (*a*)).

Curing.—The pattern and the crust adhering is transferred to an oven to complete the baking of the shell (Fig. 6 (*b*)). It should be explained that the baking of the shell takes place partly by heat transfer from the plate and partly from the heat of the oven. The type of oven is, therefore, very important. Gas- and oil-fired and electric ovens all have proved satisfactory and work is now being carried out with infra-red element heaters which are particularly convenient for use with shell-moulding machinery.

It is difficult to advise on the optimum temperature for ovens, as this depends on the efficiency of the equipment, but temperatures of 300 to 500 deg. C. are normal and from one to four minutes' heating is generally adequate. Where partial mechanization has been introduced, the patternplate can be conveyed over a gas line situated in a tunnel construction similar to a Dutch oven. The pattern is maintained at the correct temperature, whilst the heat rising to the top of the oven is found sufficient to complete the baking of the shell. Care must be taken to prevent over-baking or scorching of the outside of the shell, as this will lead to warping and possible fracture in use. Excessive baking gives weak and friable surfaces, whilst under-baking gives lack of strength and causes distortion during casting.

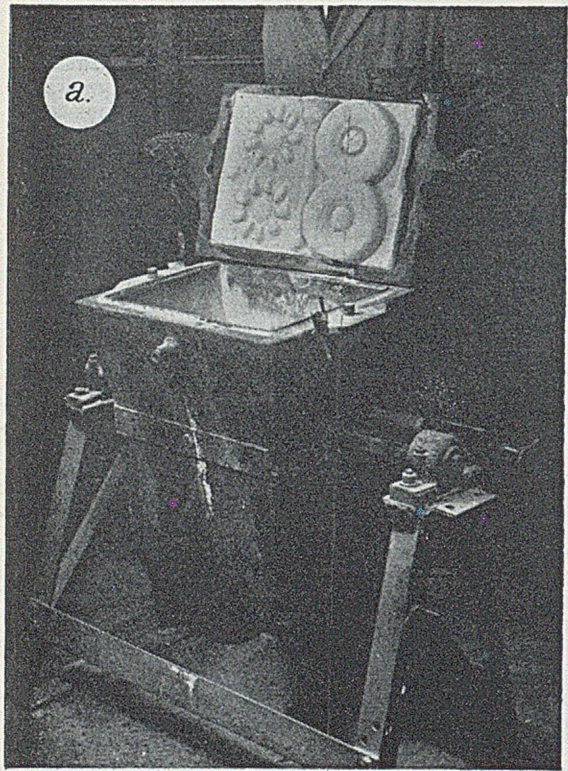
Ejection.—The pattern and shell is then removed from the oven (Fig. 6 (*c*)) and placed on a pneumatic or foot-operated extractor table, or more simply, on a block, to raise the ejector pins, and the shell ejected (Fig. 6 (*d*)). The ejection should take place immediately to prevent any binding caused by cooling of the shell.

The patternplate is then given a sharp air blast to remove any grains of sand, followed by a mist spray of lubricant, and the complete cycle is then repeated. When conducting experiments, it may be found necessary to reheat the pattern to the original temperature. In this case the parting agent should be applied after the reheating period.

Shell Assembly.—The finished shells are mated together either by bent sprigs, bulldog clips, bolts or glue (Fig. 6 (*e*)). In some cases where horizontal pouring is carried out, no jointing of any kind is necessary, and a suitable weight, such as a piece of pig-iron placed on top of the shell, will be found satisfactory. The moulds are then ready for casting.

Casting

Normal casting techniques are often carried out (Fig. 6 (*f*)) for shell-moulds, but slight variations are often necessary to obtain optimum results. Moulds may be poured vertically or horizontally. If shells are made for casting horizontally, either feeding heads may be moulded in the shell face or they may be produced separately and glued in position. Metal free from dross, slag, etc., is poured in the usual way. In a very short time, the sand starts to fall away from the feeder areas and later from the mould proper. The casting should be allowed, however, to stand for a short period, whilst the metal solidifies and until all the binder has been burned out of the sand. No sand will then be found to remain on the castings and they are ready for finishing operations (Fig. 7). Gates are generally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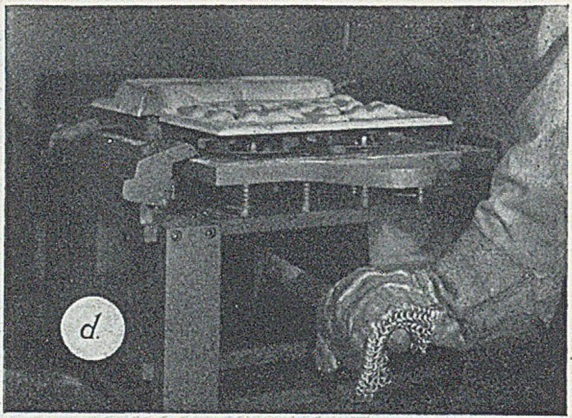
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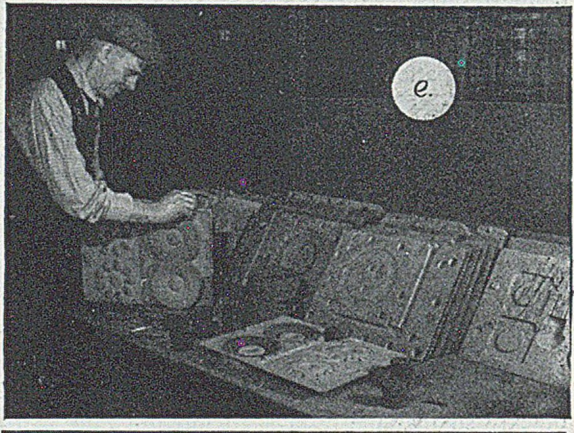
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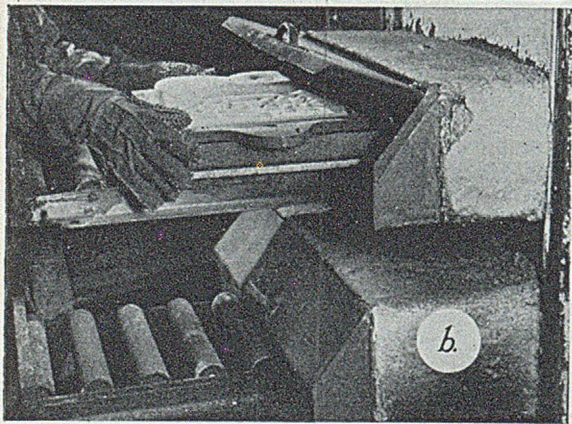
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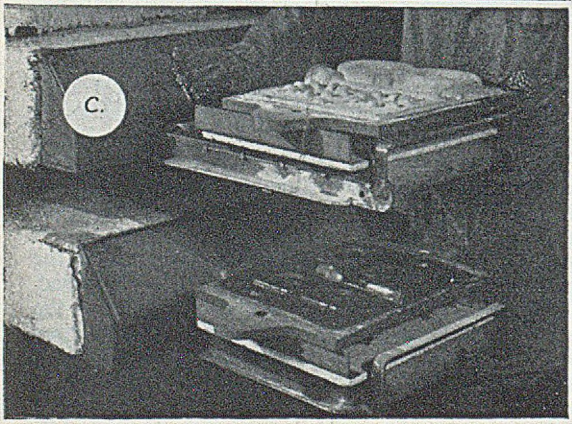
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f.

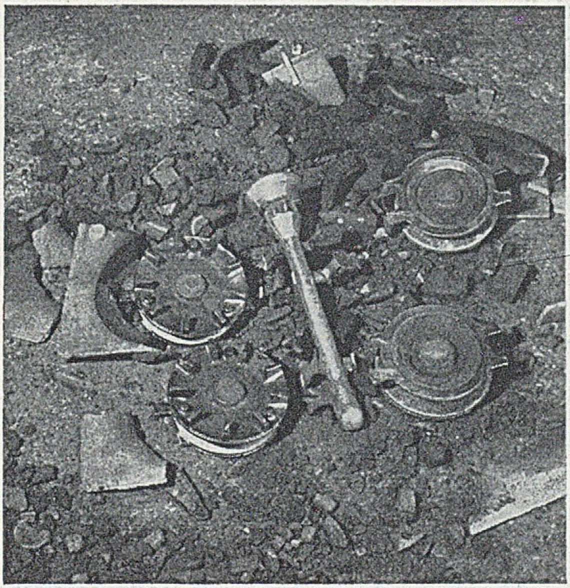
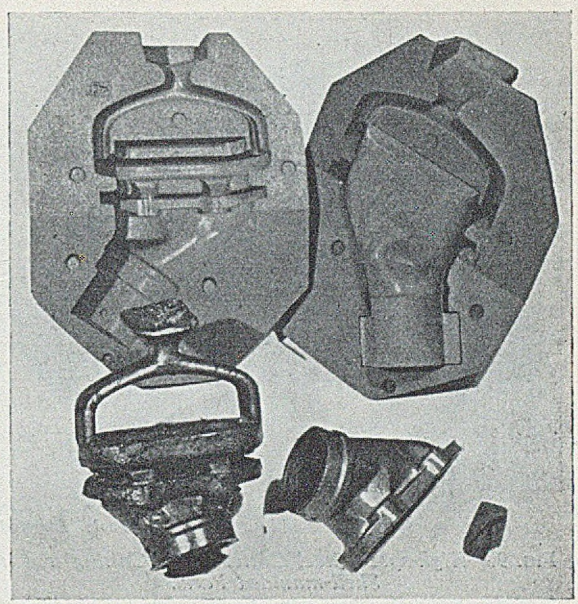


FIG. 7.—*The Shell Mould decrepitates almost immediately after Pouring and leaves a Clean Casting.*



[*Courtesy Rolls Royce, Limited.*

FIG. 8.—*High-alloy Steel Aeroplane Casting produced from the Shell Mould shown.*

easy to remove, as the ingates are usually of smaller section than those used for ordinary sand castings. No flash should be present on shell-moulded castings.

Cores

In the manufacture of cores, the same general routine is followed, except that the heated corebox is filled, either by hand or hopper, and allowed to stand for 15-30 secs. The corebox is placed in the heating oven for a further 1 to 4 min., after which it is split and the core removed. In the majority of cases ejectors are not necessary in coreboxes.

Mechanization

Foundries have been quick to realize that the process lends itself readily to mechanization. Machines have been designed which carry out the complete cycle of operations, including the application of the parting compound, preheating of the pattern, forming and baking of the shell, and subsequent ejection of the finished shell. The use of such machines speeds the time of production to approximately 60 secs. per shell, and reduces considerably the labour involved. Several automatic machines are already in operation in the United States and manufacturers in this country are working to produce similar machines.

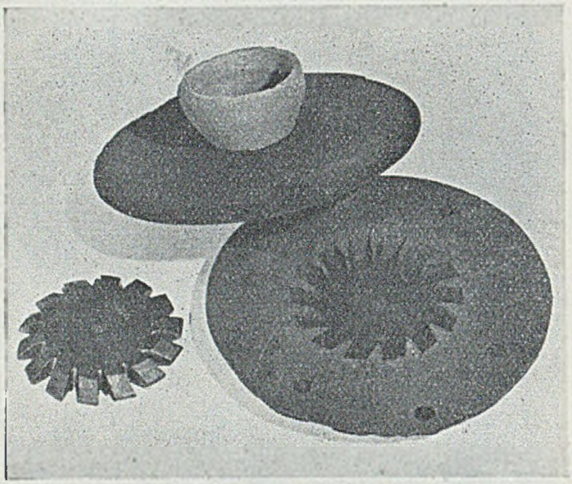
Work on the shell process is proceeding in all spheres of the foundry industry and much valuable experience with various metals is being gained. As mentioned earlier, much of this information cannot be disclosed by the Authors, but the following notes may be of interest. It will be appreciated, of course, that conditions such as variations in the resin/sand mixture, etc., are made to meet the particular requirements of each class of metal.

Steels.—Steels give little difficulty when cast in shell moulds (Figs. 8 and 9). The surface is very good; the metal is free from porosity and sand pick-up and tolerances are very close. Some confusion arises with regard to low- and medium-carbon steels over reputed pick-up of carbon from the sand binder. The phenomenon has not been reported in this country, however, but investigations are being carried out. High- and low-alloy steels give excellent results, and considerable work has been carried out.

Cast Iron.—In practically all cases, outstanding results have been obtained by iron foundries (Fig. 10). Surface finish is good, and intricate castings requiring little or no machining can be made. Scabbing and " blows " are eliminated and machining is minimized. Malleable and nodular irons are also cast successfully in shell moulds.

Non-ferrous Metals.—Excellent castings can be produced in practically all brasses, bronzes, and copper-base alloys (Fig. 11). The chief advantages shown are good finish, elimination of machining and cutting down of polishing costs. Appreciable savings in metal can be effected and foundrymen will be quick to realize that this feature alone makes the process worth adopting. Phosphor-bronze and aluminium-bronze have proved the most difficult metals in the non-ferrous group,

FIG. 6 (*Facing Page*).—*Further Stages in the Production of a Shell Mould and Casting; (a) Removal of the Pattern from the Dump Box; (b) Placing the Pattern and Unbaked Shell in the Oven for Curing; (c) Baking Completed; (d) Removal of the Shell by means of Ejector Pins; (e) Assembling the Shells preparatory to Casting; and (f) Pouring of Shell Moulds arranged Vertically in a Frame.*



[Courtesy B.S.A. Tools, Limited.

FIG. 9.—*High-speed Steel Cutter-wheel Casting and its Shell-moulded Parts.*

owing to their characteristic "searching" effect on the sand, but simple modifications, such as the use of finer sands with slightly higher resin contents, have given marked improvement. Considerable numbers of castings from these metals are now being produced in shell moulds.

The lead "sweating" of high-lead bronzes is not overcome by using the shell process.

Light Alloys.—Aluminium does not present any difficulties when cast by this process (Fig. 12). It has been found that lower resin contents in the moulding mixture may be advisable with this metal to ensure even quicker collapsibility of the shell walls. Easier running of the metal is possible, whilst an excellent finish can be obtained and hot tears are avoided. Considerable progress has also been made with magnesium and its alloys in this country. There do not appear to be any major difficulties and inhibitors may be incorporated in the sand mixture in the usual way. The high permeability and quick collapsibility of the shells and cores show outstanding possibilities in this field.

General Founding Technique

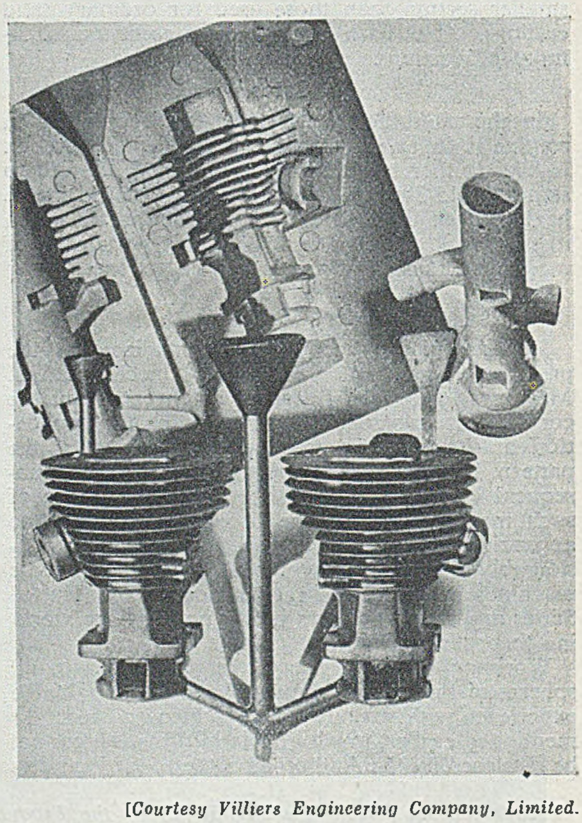
The basic principles of the shell process eliminate many troubles which are so often present in foundries. Very hot metal, for instance, is rarely required, thus minimizing shrinkage and porosity. Cold metal will not necessarily cause misruns or cold shuts and will assist in giving good finishes. Thin sections are adequately fed, without the necessity for additional gates and risers.

The alternative methods of vertical or horizontal pouring are debatable and both systems are used in this country. In most cases, the type and shape of casting determine the method, but vertical casting takes less floor space. On the other hand, shells poured horizontally do not always require jointing by the methods mentioned, and a suitable weight may be sufficient. Horizontally poured shells require slightly more complicated patterns, but less gating is necessary, and there is even less possibility of sand-wash occurring.

Much thought has been given to the design and construction of gates and sprues. Opinion recommends that these should be round in cross section and somewhat smaller than normally employed. The feeder head can also be reduced in size and height, as the hydrostatic pressure required is low. Bottom gating is preferred to prevent wash of metal on the mould surface. Blind feeders, spinners and filters can be incorporated in the shell construction when required.

Vents are unnecessary generally and risers can be omitted unless used to overcome shrinkage or to remove dross or slag from the metal. The skin of a shell mould which is to be in contact with the metal should not be broken as this will invite metal wash and cause sand inclusions.

Some confusion appears to exist regarding the comparative hardness of certain metals cast in shells and ordinary moulds. It has been established, however, that the skin of the metal is not chilled as, for example, it may be in green-sand moulds, thus reducing machining costs considerably. Some foundries have reported that the quicker cooling of metal in shell moulds assists in obtaining fine-grain structures and increases the impact and tensile strengths of the metal.



[Courtesy Villiers Engineering Company, Limited.

FIG. 10.—*Shell Mould, Core and Casting for a Grey-iron Air-cooled Motor Cylinder.*

The exceptionally high permeability of shell moulds and cores prevents build-up of internal gas-pressure and allows rapid pouring. These properties, combined with the low frictional qualities of the mould surface, make it possible to produce castings having only 0.030 in. thick cross section.

Costs

Naturally, all foundrymen want to know what the process costs. This depends on a number of factors and can only be expressed comparatively. The sands recommended are more expensive and the price and percentage of binder must be computed, giving a resin/sand mixture between 14s. and 20s. per hundredweight. A square foot of shell $\frac{3}{16}$ in. thick weighs approximately 20 oz., so that material for a simple mould of these dimensions will cost approximately 4d. to 6½d. each. When comparing these figures with alternative green-sand, dry-sand, or core-sand, the estimator should bear in mind of course that only $\frac{1}{10}$th to $\frac{1}{20}$th of the normal amount of mixed sand is used in the shell process.

The general equipment cost is low, only simple apparatus being required even on a large production scale. Conveyor systems, when necessary, are light and are not subject to excessive wear. Sand-reconditioning and sand-conveyor systems are not necessary. On the other hand, pattern costs are high, if compared with wooden patterns, but yet are only slightly more expensive than metal match-plate patterns used in many foundries. Patterns do not show wear over long runs, and their overall contribution to cost is relatively small.

Labour costs are definitely down, but these must

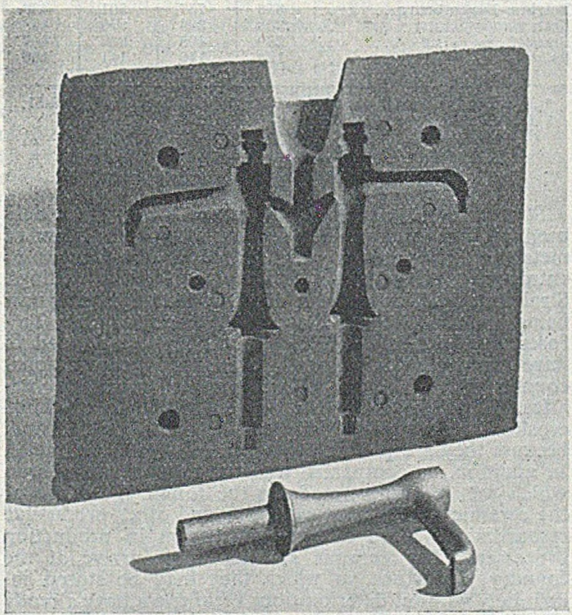
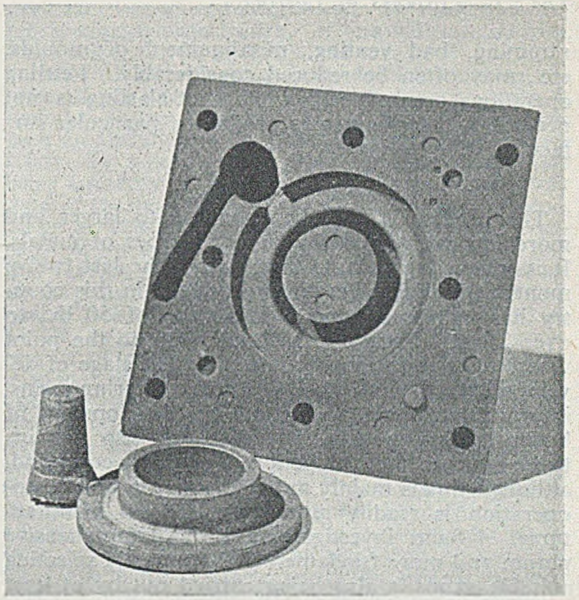


FIG. 11.—*Domestic Water Tap Cast in Brass and a Half Shell Mould used to produce it.*



[*Courtesy of C. & L. Hill & Company, Limited.*

FIG. 12.—*Aluminium Flange Casting and Half Shell Mould of the Type used for its production.*

be related to output. It is generally agreed that one shell per minute is a reasonable output from one man on a machine using a single pattern, but the matter becomes more involved when basing it on production from a non-mechanized unit. The number of patterns handled by an operator working with an assistant (who ejects and lubricates) can be increased to six or more. Based on a three-minute stoving schedule, the output may therefore approach two per minute. In this case, of course, the capital outlay is lower, but the continuity is erratic. More flexibility may, however, be obtained with various patterns especially when situated in a smaller size foundry.

At least three companies in this country have established separate foundries away from their normal sand foundry. Under these ideal conditions, the true labour and equipment costs can be worked out, showing very promising comparisons. In most cases, a saving in machining time makes the process very attractive and there are many cases where machining and even drilling operations can be avoided altogether. The polishing time for brass castings, such as plumbers' ware, can be reduced to a minimum in addition to considerable saving in metal.

Certain foundries have estimated that up to 5 per cent. more castings can be made in shells from the same quantity of metal melted, owing to the reduction in gate size and dimensions of risers. This means that there is less back scrap to handle. Other foundries previously concerned with producing hot metal have shown that coke-to-metal ratios have been appreciably reduced owing to the easier running of thin sections. Scrap due to the human element, *i.e.*, in sand preparation, in inconsistent

The "C" Process of Casting

ramming, bad venting, misalignment of moulds, etc., may often be reduced considerably. Fettling operations are reduced, while shot-blasting is not necessary, unless given to produce a particular surface on the casting.

Future Outlook

The process is rapidly extending to larger and more intricate castings and to all types of metals. It is interesting to note that, within the last twelve months, the size of castings produced in this country has increased from a maximum of 50 lb., to over 2 cwt. Progress has been made to the point where mechanization becomes the next stage of development. This will call for quicker-curing resins, improved stripping agents and the development of better heating systems. Much work also remains to be done on the production of intricate cores and, although this is mainly an engineering problem, co-operation is readily given by the resin manufacturer. Sand investigations of a comprehensive nature and more fundamental than merely selecting suitable sands is also being carried out by at least one sand supplier.

Already the original expectations of the process have been surpassed and it is anticipated that considerable additions to this review would be possible within a short time. In the meantime, it is hoped that these notes will be of assistance to those who are not yet acquainted with the process and maybe to some who have commenced experimental work already.

The Authors wish to thank the directors of Bakelite Limited, and British Industrial Plastics Limited, for permission to publish this paper, and all their colleagues and friends in the foundry industry who have been so helpful. Grateful acknowledgment is also made to John Harper & Company, Limited, for the use of illustrations Figs. 2, 4 to 7, and 9 to 15 inclusive, as well as to the other firms mentioned in various captions.

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First Prefabricated Ship

The small engraving of the Aaron Manby, which has recently been placed in the Science Museum, South Kensington, recalls the history of the iron ship 120 ft. long overall, with a beam of 17 ft., which Aaron Manby, master of the Horseley iron works made in 1821. It ran its trials on a Staffordshire canal, and then was taken to pieces and transported to Surrey docks in the Thames—the first iron steamship, and the first prefabricated ship in the world. For the next 40 years the Aaron Manby plied on the Seine in France. Later Aaron Manby, who had by then built more iron ships, settled in France and the Horseley iron works changed hands, eventually becoming the present Horseley Bridge and Thomas Piggott Steel Company, Limited.

Steel Consumption per Head

Steel consumption per head in the United States in 1951 is estimated at 1,343 ingot lb. This compares with 642 lb. in the United Kingdom. On a *per capita* basis, consumption in the U.S.A. is thus twice as high as in the U.K. Consumption in France is two-thirds, and in Italy about one-quarter, that of the United Kingdom. The accompanying table, prepared by the British Iron and Steel Federation, gives the apparent consumption per head in the principal industrial countries.

Since before the war, consumption in the U.S.A. has more than doubled as a result of the expansion of the consuming industries and the general rise in the standard of living. Even more rapid has been the rate of advance in Canada, that country having risen from seventh to second place in terms of *per capita* consumption. The U.K. has occupied fifth place since the war, consumption per head showing a steady advance. The actual figure for 1951 was influenced by raw material shortages, which temporarily depressed steel production and from which a sharp recovery has since been made.

German consumption has naturally made a marked recovery in recent years, though in 1951 it was still below the pre-war level. A decline in home production and an increase in exports are the reasons for the post-war fall in apparent consumption in Belgium-Luxembourg. A stable level of consumption seems to have been maintained in France between 1948 and 1951, while in Holland and Italy considerable increases were recorded.

Apparent Consumption of Steel per Head (in ingot lb.).

—	Average, 1937-8.	1948.	1950.	1951.
U.S.A.	641	1,131	1,237	1,343
Canada	346	623	614	793
Sweden	482	625	645	715
Australia	428	415	538	643
U.K.	495	614	630	642
Germany*	596	273	469	497
Belgium-Luxembourg	353	757	501	488
Netherlands	333	326	370	428
France‡	289	408	332	407
Italy	123	110	141	166

* Includes the Saar in 1937 and 1938; W. Germany only 1948-51.
‡ Includes the Saar 1948-51.

Refractory Strainer Cores

Strainer cores, either of oil-sand or metal, are widely used in the foundry industry to control the flow of metal into the moulds, and to reduce the danger of entrapped non-metallic material in the castings. Strainer cores made from ceramic materials are now being manufactured by Coupe & Tidman, Limited, Treforest Trading Estate, Treforest. They are claimed to have valuable advantages over their conventional counterparts. These ceramic strainer cores are unaffected by molten metals, are not prone to cracking, erosion or collapse during pouring of the metal, and, because they are prefired, they do not "gas" the metal. In addition, as compared with oil-sand strainer cores, which are, of course, made in the foundry, the use of the ceramic article releases labour and other productive resources for more direct participation in production processes. The ceramic strainer cores arrive at the foundry in cartons, in which they may be stored indefinitely without deterioration. Field trials have already established their effectiveness, which in several instances has enabled founders to achieve a significant improvement in the reduction of scrap castings.

Pig-irons of Other Days

By T. R. Harris

Some interesting sidelights on pig-iron of the last century can be caught from the letters written by the pig-iron manufacturers to the engineers and iron founders of the period. One such letter, written in February, 1836, by an agent for the Pentwyn Iron Works, is in answer to a complaint as to the quality of the pig-iron supplied to a large user of this material. "I cannot account" writes the agent "for the Pentwyn Iron being objected to by you. I have sold many hundred tons to different parties which has always given satisfaction. I never had a complaint but from one party (excepting yourselves) and that was made before trial but after they had used it they candidly agreed with me the quality was excellent and that they had been premature in deciding from appearance; the pigs are turned out very rough and persons not acquainted with the quality at sight would consider it inferior. If you do not wish to take the 29 tons I will dispose of it and let you have another make instead. I annex copy of Messrs. Hunt Brothers' letter respecting the trial of the No. 2." The letter referred to in the above stated *inter alia* "Last week we received about 3 tons of the pig-iron which we have remelted in our cupola and the produce we intend sending on . . . we think upon receiving it they will be convinced they have complained without a cause. Our sand is not suitable for the purpose, or we could *without* any admixture of other iron run it into Grate Fronts of very fine description and the castings may be drilled and filed with the greatest facility. We cannot pretend to send iron of a better quality or we would offer to exchange it . . ."

Also in February, 1936, William Crawshay writes from the Cyfarthfa Iron Works, "I have some No. 1 and No. 2 best foundry pig-iron now ready at Cardiff, as good as ever I made in my life, and can ship you at a moment's notice one hundred tons of No. 1 and fifty of No. 2 warranted made of cold blast, and which I will sell you at £6 for No. 1 and £5 15s. for No. 2 nett, payable by your acceptance at 3 months, or by cash less 1½ per cent. discount. . . . The weakness of hot-blast iron has caused all contracts for chairs and other castings where strength is required to be specified of cold-blast pigs. . . . I have now 500 tons of No. 1 pigs in stock and have refused to sell them to a speculator at £6 a ton. I beg you not to act upon my opinion, but I give it honestly, which is, the price of iron is more likely to advance than fall, though the trade is a little dull at present."

On June 4, 1836, Crawshay writes from London "Pig-iron is in great demand and it is now positively said that the French Government will require 50,000 tons in the next 12 months *for making in France* the pipes for the Paris Water Works, now actually determined to be carried into effect"; while in August, 1837, he writes "No. 1 cold-blast pigs of my make will sell to France faster than I can make them. . . ." In the following October Crawshay states "I shall have great pleasure in laying by 20 tons more pig-iron for you, though I am daily refusing orders from France, when my cold-blast pigs are now in very high estimation" Writing from Cyfarthfa in December, 1838, W. Crawshay, jun., answers an enquiry for pig "I am sorry," he writes," I cannot offer you a pig having sold all my stock and I am consuming all I make for chairs." By 1844 Crawshay had commenced the making of the newer iron, writing in July of that year he says "If you are again in the market for best cold-blast pigs I will ship you a cargo same as last, at £4 per ton six months. I am making at one of my works most excellent warm-blast pig-iron. It is soft, and very much stronger than Scotch. If you will try 100 tons, I will sell it to you at £3 10s. per ton. . . ."

Industrial disputes often caused fluctuations in the price of pig-iron and the following from an agent is typical. Written in April, 1837, it states, "There has been an alteration in the price of Scotch pig-iron since I last saw you, there is every appearance of there being a scarcity of that kind of iron from the refractory state of the miners and colliers. . . ." Wm. Brunton, acting on behalf of the Cambrian Iron & Spelter Company, writes in December, 1840 "I have now to suggest that as you are large consumers of iron and we are now making No. 1 foundry iron of the very best quality and delivering the same at Porth Cawl at £4 15s. six months bill . . . that you take a cargo or part of a cargo of iron . . . when I say the iron is good I hardly do it justice. I have not seen better iron anywhere for many years. . . ." Later in the same month a copy of a report from a satisfied customer was sent the prospective customer as the latter did not seem very anxious to buy. The report read as follows: "We have to-day (3/11/1840) melted a charge of your No. 1 foundry iron by itself and feel much pleasure in being able fully to confirm the report made to our friend James M. Buckland on the 17th ult. It is fluid, contracts very little, retains its greyness and thus bears the chisel and files well, and finally it is strong and suitable for heavy castings as well as light. We are yours very respectfully and obliged, Neath Abbey Iron Company, signed p. Nath. Tregellas.

Campaign for Higher Productivity

Some progressive British firms are already benefiting from the results of the teams which visited America under the auspices of the Anglo-American Council on Productivity. The new British Productivity Council, which superseded the Anglo-American Council, in an effort to put over higher productivity methods to as many industrialists as possible, held a national conference on productivity in London on March 19. The conference was the start of a campaign to increase productivity throughout British industry. Many members of the teams which have visited the U.S. in the last four years were present, together with industrial employers, trade union leaders, and heads of the nationalized industries.

The Chancellor of the Exchequer, Mr. R. A. Butler, addressed the conference, which was opened by Sir Peter Bennett, chairman of the council. Sir Lincoln Evans, secretary of the Iron and Steel Trades Confederation, and deputy chairman of the council, spoke on "Trade Unions and Productivity," and Sir Ewart Smith, a director of Imperial Chemical Industries and a member of the council, discussed the council's objective. It is understood that the council is anxious not only to consolidate the work of the teams, but to increase contact between British firms and industries.

SPEAKING AT THE DINNER of the Midland branch of the Institution of Mechanical Engineers in Birmingham recently, Sir Arthur Smout said that Birmingham University's forthcoming appeal to Midland industry for financial support provided a practical means by which industry, and the engineering industry in particular, could repay in some measure the debt owed to the University, which had often produced the men and the means for the rapid application of scientific and technical knowledge essential for progress.

World Steel Production

Record Figure Expected this Year

World steel production in 1952 is estimated by the British Iron and Steel Federation at 208,000,000 tons, or about 1,000,000 tons above the 1951 level. This year world production may well rise to between 235,000,000 and 240,000,000 tons. Steel should, therefore, become more plentiful.

The steady growth of world steel production was arrested last year by the eight weeks' strike in America, which cost the U.S. some 16,000,000 tons of steel. But whereas the American output fell by 11 per cent., from 94,000,000 to 83,000,000 long tons, production in the rest of the world rose by 10 per cent., from 113,000,000 to 125,000,000 tons. World production is now about 36 per cent. above the 1948 level and as much as 72 per cent. above the 1937-38 average.

World Steel Production : Table prepared by the British Iron and Steel Federation (millions of long tons).

Country.	Average, 1937-8.	1948.	1951.	1952.
U.S.A.	39.46	79.14	93.93	83.18
United Kingdom	11.68	14.88	15.64	16.42
Western Germany	18.49*	5.80*	13.20	15.56
France	6.96	7.12	9.68	10.70
Belgium	3.02	3.86	4.99	5.02*e*
Luxembourg	1.94	2.41	3.03	2.95
Italy	2.17	2.09	3.01	3.48
Saar	2.41	1.21	2.56	2.78
Netherlands	0.05	0.34	0.54	0.67*e*
Total Schuman countries	35.04	22.83	37.10	41.16*e*
Austria	0.65	0.63	1.01	1.04
Sweden	1.02	1.24	1.48	1.64
Spain	0.36	0.61	0.81	0.88*e*
Yugoslavia	0.19	0.36	0.42	0.44*e*
Denmark	0.02	0.07	0.16	0.17*e*
Switzerland	—	—	0.14	0.15*e*
Turkey	—	0.10	0.14	0.14*e*
Finland	0.07	0.11	0.13	0.14*e*
Norway	0.06	0.07	0.08	0.10
Trieste	‡	0.02	0.05	0.06*e*
Greece	0.01	0.02	0.03	0.04*e*
Irish Republic	—	—	0.03	0.03*e*
Total other Western Europe	2.38	3.23	4.48	4.83*e*
TOTAL WESTERN EUROPE	49.10	40.94	57.22	62.41*e*
U.S.S.R.	17.62	18.60	30.80	34.45*e*
Czechoslovakia	2.03	2.61	3.26	3.44*e*
Poland	1.48	1.92	2.75	3.20*e*
Eastern Germany	†	†	1.53	1.97*e*
Hungary	0.65	0.75	1.21	1.37*e*
Roumania	0.26	0.33	0.64	0.68*e*
Total other Eastern Europe	4.42	5.61	9.39	10.66*e*
TOTAL EASTERN EUROPE	22.04	24.21	40.19	45.11*e*
Southern Rhodesia	—	—	0.03	0.03*e*
Canada	1.28	2.86	3.10	3.32
India	0.92	1.26	1.50	1.57*e*
Australia	1.14	1.38	1.43	1.61
South Africa	0.33	0.68	0.93	1.18
TOTAL COMMONWEALTH	3.67	6.18	7.08	7.71*e*
Brazil	0.00	0.48	0.83	0.92*e*
Mexico	0.05	0.27	0.45	0.39
Argentina	0.01*e*	0.17*e*	0.25	0.25*e*
Chile	—	0.03	0.18	0.30*e*
TOTAL LATIN AMERICA	0.15*e*	0.95*e*	1.71	1.86*e*
Japan	6.04	1.69	6.40	6.97
Other	0.54	0.15	0.87	—
TOTAL ALL OTHER COUNTRIES	6.58	1.84	7.27	8.00*e*
GRAND TOTAL	121.00	153.26	207.40	208.27*e*

e Estimated.
* Includes Eastern and Western Germany.
† Included in Western Germany. ‡ Included in Italy.

Recovery in Britain

In Britain last year there was a sharp recovery from the difficulties of 1951 as new capacity was brought into use and raw-material supplies improved. The Schuman group recorded an increase of 4,000,000 tons (about 10 per cent.), of which the lion's share was contributed by Germany. With the removal of former restrictions, indeed, German production is climbing rapidly to the British level. Progress was slower last year in France, Belgium, and Italy, while Luxembourg registered a slight decline owing to the slackening of export business. Among the smaller producers of Western Europe, advances were general, these countries showing an aggregate increase of 350,000 tons, to an estimated total of 4,800,000 tons.

The British Commonwealth producers—Canada, Australia, India and South Africa—also continued to make headway, their combined output in 1952 being estimated at about 7,700,000 tons, or 9 per cent. more than in the previous year.

Substantial progress seems also to have been achieved in the Soviet Union and its satellites. An estimate by E.C.E. credits Russia with an output of 34,450,000 tons last year, against 30,800,000 tons in 1951. With output also rising in Czechoslovakia, Poland, Hungary, and Rumania, total steel production in the Russian sphere probably now exceeds 45,000,000 tons a year. Compared with pre-war, output has more than doubled in what is now the Russian sphere, as well as in the U.S.A., and (at a much lower absolute level) in the British Commonwealth. In the U.K. it has risen by 40 per cent., in the Schuman countries by 17 per cent.. and in Western Europe as a whole by 27 per cent.

U.K. Trade in February

United Kingdom exports in February, a short month containing only 24 working days, were provisionally £194,800,000. Imports, which are usually low in February, were £243,000,000. The average for January and February of exports was £206,000,000, compared with the average of £213,000,000, to which exports had recovered in the fourth quarter of 1952; the average of imports—£267,000,000—was only slightly greater than in the final quarter of last year.

Exports to North America in February totalled provisionally £22,600,000, of which £12,800,000 was for exports to the U.S., and £9,800,000 to Canada. The relatively low total was to be expected in the short month, and exports to Canada tend to be seasonally low in the early months of the year. The average of January and February, £23,800,000, was less than that of the last quarter, but higher than the earlier quarters of 1952.

Export Licensing Changes

Changes in export licensing control are made by a Board of Trade Order which came into operation on March 25. Macao is now included specifically by name in the list of countries to which the export of all goods is prohibited except under licence. Licences are now required for specific gauges, certain wheeled tractors, certain communications equipment, and specified electrostatic precipators for all destinations other than the Commonwealth (excluding Hong Kong), the United States, or Irish Republic. Licences are not now required, except for exports to China, Hong Kong, Macao, or Tibet, for boron minerals, certain semi-manufactures of zinc, combine harvesters, and certain textile machinery.

Pig-iron and Steel Production

Statistical Summary of January Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table I summarizes activities during the previous six months. Table II gives production of steel ingots and castings in January, and Table III, deliveries of finished steel in December, 1952. Table IV gives the production of pig-iron and ferro-alloys in January, 1953, and furnaces in blast. (All figures weekly average in thousands of tons.)

TABLE I.—*General Summary of Pig-iron and Steel Production.*

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.[2]	Output of ingots and castings.	Finished steel deliveries.	Stocks.[3]
1937	273	119	—	163	144	21	250	—	—
1938	228	89	—	130	118	16	200	—	—
1951	284	170	200	186	175	8	301	244	585
1952[4]	306	190	228	202	171	29	310	252	739
1952—August	300	194	232	202	151	31	280	213	816
September	318	198	234	209	184	30	330	279	783
October[1]	302	196	227	204	182	31	328	271	725
November	312	194	229	207	189	23	345	277	717
December[1]	296	189	227	206	166	26	314	245	739
1953—January	325	199	234	214	188	25	346	—	766

TABLE II.—*Production of Steel Ingots and Castings, January, 1953.*

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derby, Leics., Notts., Northants and Essex	—	3.7	11.9 (basic)	1.9	0.2	16.6	1.1	17.7
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire; Yorkshire (excl. N.E. Coast) and Sheffield	1.8	20.8	—	1.9	0.6	23.8	1.3	25.1
Lincolnshire	—	36.1	—	—	0.1	36.1	0.1	36.2
North-East Coast	1.8	61.2	—	1.3	0.6	62.9	2.0	64.9
Scotland	3.7	37.9	—	1.6	0.8	42.1	1.9	44.0
Staffs., Shrops., Worcs. and Warwick	—	17.7	—	1.2	0.8	17.8	1.9	19.7
S. Wales and Monmouthshire	7.6	68.0	5.4 (basic)	1.3	0.1	81.7	0.7	82.4
Sheffield (incl. small quantity in Manchester)	9.7	28.3	—	9.9	0.6	46.2	2.3	48.5
North-West Coast	—	2.0	5.2 (acid)	0.5	0.1	7.7	0.1	7.8
Total	24.6	275.7	22.5	19.6	3.9	334.9	11.4	346.3
December, 1952[1]	21.1	250.1	21.8	17.3	3.4	303.4	10.3	313.7
January, 1952[1]	24.3	227.8	19.9	17.2	3.8	282.8	10.2	293.0

TABLE III.—*Deliveries of New Non-alloy and Alloy Finished Steel.*

Product.	1951.	1952.	1951.	1952.	
			Dec.	Nov.	Dec.
Non-alloy steel:					
Ingots, blooms, billets and slabs[5]	4.0	4.5	4.1	4.8	4.1
Heavy rails, sleepers, etc.	10.1	9.8	9.3	11.1	9.1
Plates ⅛ in. thick and over	41.0	41.4	41.4	46.4	42.6
Other heavy prod.	39.9	39.0	35.9	42.6	37.0
Light rolled prod.	46.7	46.0	43.6	51.7	45.4
Hot-rolled strip	19.5	18.8	17.5	20.7	18.2
Wire rods	15.9	15.9	12.3	17 6	14.9
Cold-rolled strip	6.0	6.1	5.9	6.2	5.4
Bright steel bars	6.5	6.5	5 5	7.8	6.6
Sheets, coated and uncoated	30.4	31.6	27.6	34.5	30.4
Tin, terne and blackplate	13.8	16.0	13.0	17.6	16.1
Steel tubes and pipes	20.3	20.1	21.9	22.4	20.5
Steel tube and pipe fittings	0.5	0.7	0.4	0.8	0.6
Mild wire	11.6	12.2	10.2	12.8	10.6
Hard wire	3.5	3.6	3.2	4.4	3.6
Tyres, wheels and axles	3.7	3.5	3.4	4.1	3.6
Forgings (excluding drop forgings)	2.3	2.8	2.4	3.6	3.0
Steel castings	3.8	4.2	5.5	4.1	4.1
Tool and magnet steel	[8]	0.3	[8]	0.4	0.3
Total	279.5	283.0	263.1	313.6	276.1
Alloy steel	11.4	13.7	12.7	16.4	14.3
Total deliveries from U.K. prod.[6]	290.9	296.7	275.8	330.0	290.4
Add: Imported finished steel	5.8	13.8	9.2	10.2	10.2
Deduct: Intra-industry conversion[7]	55.0	60.2	52.3	64.5	57.5
Total net deliveries	241.7	250.3[4]	232.7	275.7	243.1[1]

TABLE IV.—*Production of Pig-iron and Ferro-alloys during January 1953.*

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants and Essex	27	1.8	16.7	24.4	1.8	—	44.7
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire; Yorkshire (incl. Sheffield, excl. N.E. Coast)	7	—	8.4	—	—	1.4	9.8
Lincolnshire	13	—	30.4	—	—	—	30.4
North-East Coast	25	7.4	42.6	0.1	—	1.5	51.6
Scotland	9	0.8	13.3	2.5	—	—	16.6
Staffs., Shrops., Worcs., and Warwick	8	—	7.3	1.6	—	—	8.9
S. Wales and Monmouthshire	9	3.3	30.8	—	—	—	34.1
North-West Coast	7	16.6	—	0.1	—	1.1	17.8
Total	105	29.9	149.5	28.7	1.8	4.0	213.9
December, 1952[1]	106	26.4	145.6	28.5	1.5	4.3	206.3
January, 1952[1]	102	26.4	137.5	29.9	1.5	3.1	198.4

[1] Five weeks all tables.

[2] Weekly average of calendar month.

[3] Stocks at the end of the years and months shown.

[4] Average 53 weeks ended January 3, 1953.

[5] Other than for conversion into any form of finished steel listed.

[6] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.

[7] Material for conversion into other products also listed in this table.

[8] Included with alloy steel.

ATLAS *announce* a new range of PNEUMATIC RAMMERS

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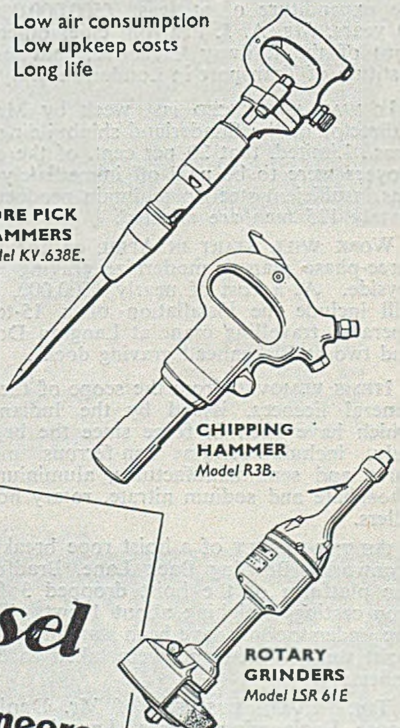

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News in Brief

THE HEAD OFFICES of the Impianti Fonderie Olivo have been transferred to new premises at 18 Via Fabio Filzi, Milan, Italy.

THE OUZLEDALE FOUNDRY COMPANY, LIMITED, has been granted a £20,500 building licence to carry out developments at Long Ing Foundry, Barnoldswick, Yorks.

IT IS ANNOUNCED that Lord Hives, chairman of Rolls-Royce, Limited, will open the extensions to the civil and mechanical laboratories at Nottingham University on April 14.

DIESEL EQUIPMENT, LIMITED, who are exhibiting for the first time at the British Industries Fair this year, will be showing a selection of equipments from their range of Diesel generating and welding sets.

THE BRITISH INSTITUTE OF MANAGEMENT, Management House, 8, Hill Street, London, W.1, are holding a second management conference in Scotland at Gleneagles Hotel, Perthshire, from April 10 to 12.

A SUBSTANTIAL ORDER for Diesel trucks, valued at over £100,000, has been received by Leyland Motors, Limited, for operation in the Middle East. The order comprises 39 vehicles which will be specially equipped for constructional work.

AT A MEETING of Scottish members of the Association of Bronze and Brass Founders being held to-day at the St. Enoch's Hotel, Glasgow, two films will be shown: "A Study of the Principles of Gating" and "Dust Suppression on Stand Grinders."

CAPITAL INVESTMENT in British Railways called for the expenditure of at least £500,000,000 in the next 10 years, Mr. A. J. Pearson, chief officer (administration) of the Railway Executive, told members of the Institute of Transport in London recently.

IT WAS ANNOUNCED last week by Mr. John Short, a director of the Sunderland shipbuilding firm of Short Bros., Limited, that 20 per cent. of the company's employees were to be paid off immediately because there was insufficient steel to maintain production. Approximately 125 men are affected.

WORK WILL START IN APRIL on the first part of a three-phase plan to modernize graving docks on Merseyside. At a cost of nearly £500,000, the first phase will include the installation of a 15-ton electrically-operated travelling crane at Langton Dock, Liverpool, and two at Birkenhead graving docks.

ITEMS REMOVED from the scope of the expiring open general licences, issued by the Indian Government, which have been in force since the beginning of last July, include certain non-ferrous metal manufactures and semi-manufactures, aluminium ingots, rock phosphate and sodium nitrate, rotary hoes, and rotary tillers.

AS THE RESULT of a hoist rope breaking at Bowling Ironworks, Bowling Back Lane, Bradford, last week, the platform of the hoist dropped 3 ft., spilling out iron castings weighing about 1 cwt. Three men who are understood to have been standing at the foot of the hoist were injured and were taken to Bradford Royal Infirmary.

THE PRIVATE BUSINESS of Mr. Daniel Ross, Newhouse Engineering Works, Lanark, now one of the largest concerns in the town, has just been registered under the Companies Act as Daniel Ross (Engineers), Limited, with a capital of £20,000. The firm are motor, agricultural, constructional and general engineers, the directors being Mr. Ross and Mrs. A. S. Foster Ross.

ABOUT 600 sq. ft. of the roof in the machine-shop at High Duty Alloys factory at Redditch was damaged by a fire which broke out on March 19, the second fire there in the course of a month. The fire appeared to have been started in magnesium swarf, which in turn set fire to a turret lathe and then ignited part of the cat-walks round the shop and the roof, which are made of compressed fibre board.

IN TIPTON about 400 men are working short time and 145 are unemployed or temporarily stopped from work. Nearly all are from the ironfoundry trade. These figures were given on Friday last when it was stated there was "a distinct and unfortunate change in the level of employment in the area." A spokesman said that there had been a fall of 6 per cent. in the numbers of men employed in the ironfoundry trade.

MIDLAND SUCCESS in "spearheading," a new form of export drive in the dollar markets—the banding together of small firms with complementary products to establish a combined selling organization—has been reported to the Midland Regional Board for Industry. Mr. Barry Kay, Regional Controller, Board of Trade, said that the Midlands had got off to a good start while Mr. S. A. Davis, Regional Controller, Ministry of Supply, said that the diversity of industry in the Midlands made the region ideal for such a venture.

AMONG British firms taking part in India's five-year plan of reconstruction is Ransome & Rapier, Limited, of Ipswich, whose sluice gates are being used in connection with the construction of a number of large dams in India, Pakistan, and other south-east Asian countries. One of the outstanding projects in India in which the firm has recently participated has been the providing of six deep sluices for the Tansa-Vaitarna scheme, which is being undertaken to increase the supply of water to Bombay. A particular problem which the firm had to overcome was in connection with the silt which had developed in the lakes Tansa and Vaitarna.

PLANS FOR THE DEVELOPMENT of the Department of Engineering Production at Birmingham University include the extension of training facilities for senior managers and engineers, Professor T. U. Matthew, Professor of Engineering Production, states in the current issue of the University "Gazette." For the past four years the department has held a series of short residential summer schools at Primrose Hill and these have proved so successful that it is proposed to extend them throughout the year, largely due to an endowment of £57,400 from Joseph Lucas, Limited, which has enabled a house in Norfolk Road, Birmingham, to be bought and equipped as a research centre.

AS PART of the Gal Oya development scheme, the Government of Ceylon proposes to set up an up-to-date rice mill. The mill machinery and power plant have been purchased (the former from Dunniker Foundry of Fife, Scotland, the latter from John Robey) and the Ceylon Government have applied to the United Kingdom Government, through the Technical Co-operation Scheme of the Colombo Plan, for the loan of the services of an engineer to prepare the lay-out for the mill, set up the machinery, supervise its working for the first year and to train Ceylonese mechanics and foremen. The United Kingdom authorities have selected for the post Mr. A. A. Waddell, who is a partner in the firm of J. Cairns, of Saigon and Cholon, Indo-China, who import and instal rice-milling and rubber-factory machinery, Diesel engines and power plants.

Raw Material Markets

Iron and Steel

The foundries are already feeling the effect of the latest price increases. Costs have been raised at a time when most trades to which the foundries supply castings are short of work, and are demanding reduced prices to meet the present keen competition for business in the home and export markets. Even on a four-day working week, which is the most many foundries can now manage, it is difficult to secure sufficient business to warrant continuing at this level of production; in some instances it has only been made possible by accepting orders at low prices, which with the increased production costs cannot be repeated.

Buyers of castings are not specifying above their immediate needs, with the result that orders now being placed are completed quickly and forward bookings are scarce. This contrasts markedly with the position at this time last year, when plants were operating at maximum levels, many working both day and night shifts. Increased cost of raw materials would have had little effect on production in the boom period which then existed, as some foundries, short of home-produced pig-iron, found it necessary and advisable to obtain consignments of foreign iron at prices greatly in excess of United Kingdom figures.

The bulk of the output of pig-iron from present production continues to flow to the steelworks, whose needs are continually increasing. A furnace now producing high-phosphorus foundry pig-iron in the Derbyshire area is being switched over to the production of basic pig-iron at the end of this month. This will reduce considerably available supplies of this grade for the foundries, to the extent of about 2,000 tons per week, but with the shortage of work at the light and jobbing foundries, the loss in supplies is not likely to be serious, as it is assumed that present outputs of this grade will be adequate to meet current demands. All other grades of pig-iron are generally sufficient for current needs, apart from hematite, which is still scarce. Consignments of imported hematite are relieving the position.

The re-rolling mills are still in need of semi-manufactured steel, their production being entirely dependent on the amount they can acquire. Orders from home buyers for light sections, bars, and strip are well maintained, but outputs at many mills, particularly those in the Birmingham area, are erratic and uncertain, as they are entirely dependent on day-to-day deliveries of billets.

The decreased demand for steel in South Wales owing to the shortage of tinplate orders is expected to release larger supplies of sheet bars and possible billets for other areas.

Non-ferrous Metals

There has been a fair amount of unrest and trouble in the copper-mining areas of late and the strike at the Chuquicamata mine, which was settled last Friday, is reported to have caused a loss of production of as much as 60,400 metric tons of electrolytic and blister copper. Fortunately, the stoppage which occurred at the Nkana mine in Northern Rhodesia was short-lived, and it may be presumed that the loss of output was in no way serious. But all these troubles add up and any forward look in copper must take notice of the fact that, judging by the experience of the past months, it would seem that due allowance must be made for loss of production due to strikes and disputes. Whether this aspect of things is causing the Government to hesitate in reaching a decision to open a free copper market is a matter of opinion, but, in view of the very large stocks held in this country and the relatively poor rate of demand from consumers, it is doubtful whether considerations of this kind would make a difference to the course which the authorities decide to take.

According to the British Bureau of Non-ferrous Metal Statistics, January 31 saw a total stock of 135,221 tons of copper in the United Kingdom, with another 30,000 tons afloat or in stock abroad. Since consumption of virgin copper was barely 25,000 tons in January, it follows that we can see six months ahead from the stock angle and this would seem to take care of any risk from even a prolonged stoppage. The amount of copper scrap used in January was just under 18,000 tons, rather less than the December figure.

Further details made available by the bureau relate to lead and zinc. In the case of the former, Metal Exchange warehouse stocks increased to 330 tons at January 31 and the tonnage in consumers' hands to 14,758 tons. Imports from British Empire sources were 21,274 tons, while consumption of all grades amounted to 27,192 tons, an increase of about 3,000 tons on December. In zinc 21,179 tons were used, against 18,256 tons in December. Consumers were holding 9,602 tons at January 31, against 7,326 tons a month earlier. Consumption of tin was 1,722 tons, well below the average and 112 tons less than in December. Exports and re-exports came to 938 tons, of which about one-half went to the United States. U.K. stocks at January 31 were 3,866 tons. The Government's holding of lead and zinc, which is very considerable, is now no longer shown in these monthly figures.

Sectionally, conditions were pretty active on the Metal Exchange last week, price movements being rather erratic. March lead, after being below £90, staged a brisk recovery, while zinc showed surprising strength in view of the somewhat poor demand in the U.K. for this metal. Although business in tin was not brisk, the backwardation again narrowed. In New York movements on the Commodity Exchange followed the course of the London market pretty closely, and it is evident that events on this side are of the first importance. It has been reported that a revised contract for trading in copper futures in New York is being prepared and that business may begin 30 days after its adoption. Now that price control in copper has been lifted, there is nothing to stop resumption of futures business.

The following official tin quotations were recorded:—

Cash—March 19, £941 to £942; March 20, £941 10s. to £942 10s.; March 23, £943 to £944; March 24, £942 to £943; March 25, £943 to £944.

Three Months—March 19, £937 to £938; March 20, £934 10s. to £935 10s.; March 23, £938 to £938 10s.; March 24, £936 to £937; March 25, £936 to £937.

Official prices of refined pig-lead were:—

March—March 19, £90 to £90 5s.; March 20, £91 10s. to £92; March 23, £93 to £93 5s.; March 24, £93 10s. to £93 15s.; March 25, £93 15s. to £94.

June—March 19, £87 10s. to £88; March 20, £88 10s. to £88 15s.; March 23, £90 5s. to £90 10s.; March 24, £90 to £90 5s.; March 25, £89 7s. 6d. to £89 10s.

Official zinc quotations were as follow:—

March—March 19, £79 7s. 6d. to £79 10s.; March 20, £80 7s. 6d. to £80 10s.; March 23, £81 7s. 6d. to £81 10s.; March 24, £81 2s. 6d. to £81 7s. 6d.; March 25, £80 2s. 6d. to £80 5s.

June—March 19, £79 10s. to £79 12s. 6d.; March 20, £80 10s. to £80 12s. 6d.; March 23, £81 15s. to £81 17s. 6d.; March 24, £81 12s. 6d. to £81 15s.; March 25, £80 12s. 6d. to £80 15s.

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

(Delivered unless otherwise stated)

March 25, 1953

PIG-IRON

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

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

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

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

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

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

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

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered).

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

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

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

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

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

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

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

Cobalt.—98/99 per cent., 20s. per lb.

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

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

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

SEMI-FINISHED STEEL

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

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

Sheet and Tinplate Bars.—£25 11s. 6d.

FINISHED STEEL

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

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

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

Tinplates.—57s. 10d. per basis box.

NON-FERROUS METALS

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

Tin.—Cash, £943 to £944; three months, £936 to £937; settlement, £943.

Zinc.—March, £80 2s. 6d to £80 5s.; June, £80 12s. 6d. to £80 15s.

Refined Pig-lead—March, £93 15s. to £94; June, £89 7s. 6d. to £89 10s.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £108 15s.; rolled zinc (boiler plates), all English destinations, £106 15s.; zinc oxide (Red Seal), d/d buyers' premises, £110.

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

Brass.—Solid-drawn tubes, 25¾d. per lb.; rods, drawn, 34d.; sheets to 10 w.g., 280s. per cwt.; wire, 31¾d.; rolled metal, 265s. 9d. per cwt.

Copper Tubes, etc.—Solid-drawn tubes, 32¾d. per lb.; wire, 317s. 9d. per cwt. basis; 20 s.w.g., 346s. 3d. per cwt.

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

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

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

Nickel Silver, etc.—Ingots for raising, 2s. 8½d. per lb. (7 per cent.) to 3s. 11d. (30 per cent.); rolled metal, 3 in. to 9 in. wide × .056, 3s. 2½d. (7 per cent.) to 4s. 5d. (30 per cent.); to 12 in. wide × .056, 3s. 2¾d. to 4s. 5½d.; to 25 in. wide × .056, 3s. 4¾d. to 4s. 7¼d. Spoon and fork metal, unsheared, 2s. 11¼d. to 4s. 2d. Wire, 10 g., in coils, 3s. 9½d. (10 per cent.) to 4s. 11d. (30 per cent.). Special quality turning rod, 10 per cent., 3s. 8½d.; 15 per cent., 4s. 1¾d.; 18 per cent., 4s. 6½d. All prices are net.

Forthcoming Events

MARCH 31

Institute of Metals

Oxford section :—Annual general meeting, followed by discussion, 7 p.m., at Black Hall, St. Giles.

Institution of Production Engineers

Luton section :—" Some Visits to American Factories Engaged in Jobbing Engineering," by G. P. E. Howard, 7.15 p.m., at the Small Assembly Room, Town Hall.

Institute of Industrial Supervisors

South Wales section :—" Developments at the Steel Company of Wales," by W. G. Mainwaring, 7.30 p.m., in the South Wales Institute of Engineers.

APRIL 1

Institution of Production Engineers

Nottingham section :—" Lighting for Production," by F. Jamieson, 7 p.m., at the Victoria Station Hotel, Milton Street.

Institute of Industrial Supervisors

Birmingham section :—" Budgetary Control and the Supervisor," by F. B. Anscombe, 7.30 p.m., at the College of Technology, Suffolk Street.

APRIL 2

Institute of Metals

London section :—Annual general meeting, followed by open discussion, 6.30 p.m., at 4, Grosvenor Gardens, S.W.1.

Incorporated Plant Engineers

Peterborough branch :—" Industrial Fire Protection," by W. H. Tuckey, 7.30 p.m., at the Eastern Gas Board's Demonstration Theatre, Church Street.

Institution of Production Engineers

Reading section :—" Fatigue of Metals," by Prof. J. A. Pope, 7.15 p.m., at the Great Western Hotel.

Yorkshire graduate section :—Works visit to Hepworth & Grandage, Limited, St. John's Works, Bradford, 6.45 for 7 p.m.

APRIL 4

Institute of Economic Engineering

Glasgow branch :—" Paper Work as Time Study sees it," by E. Ronalds, 10.30 a.m., at the Christian Institute, 70, Bothwell Street.

National Service Registrations

The Ministry of Labour and National Service announced on Monday that it is proposed to hold the last two National Service registrations of 1953, for young men born in the fourth quarter of 1935 and the first quarter of 1936 respectively, on September 5 and December 5, 1953. The next registration, covering men born in the third quarter of 1935, will be held on June 13 next. Thus details of the next three registrations are:—

Men born between (all dates inclusive)	*Registration Day*
July 1 and September 30, 1935	June 13, 1953
October 1 and December 31, 1935	September 5, 1953
January 1 and March 31, 1936	December 5, 1953.

Men Only Dinner.—The annual Stag Party of the London branch of the Institute of British Foundrymen brought a record attendance of over 180 members and guests to the Horse Shoe Hotel, Tottenham Court Road, last Friday. It was quite informal, and the good dinner, free beer, and light entertainment were thoroughly enjoyed.

CLASSIFIED ADVERTISEMENTS

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

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

SITUATIONS WANTED

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

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

YOUNG, fully qualified, METALLURGIST, with several years' research experience on cast iron and steel, requires progressive position in Midlands area.—Box 3360, FOUNDRY TRADE JOURNAL.

MANAGER (45), M.I.B.F. Fully experienced man, successful record as Manager in full control of heavy jobbing, repetition and mechanised foundries, producing machine tools, marine pump bodies, diesel engine general castings in loam, dry and green sand. High duty and grey iron, mechanite, non-ferrous metals. Technical, commercial and sales experience. Good connections with heavy engineering concerns. Must be progressive position.—Box 3359, FOUNDRY TRADE JOURNAL.

SENIOR FOUNDRY EXECUTIVE/FOUNDRY FOREMAN/MANAGER. Specialist AIR COOLED CYLINDER, diesel, auto., electrical switchgear, conduit, tube fittings, general to 8 tons, etc. Age 44, M.I.B.F., A.M.I.P.E. Grey iron, high duty, whiteheart malleable and non-ferrous experience. Fully practical man, technically trained, rigid metal, sand, material control, commercial sales, costs. Many useful connections trade. Accustomed complete charge on salary/results basis. Economic production minded, tactful, and able to cope with varying conditions. Desiring change to small/medium Foundry (Midland area preferred). Available short notice. Proven record and excellent referees. Would pioneer tied foundry if required. Salary range £1,000/£2,000 over years.—Box 3345, FOUNDRY TRADE JOURNAL.

TO AIR COOLED ENGINE MANUFACTURERS, etc., who are desirous of being self supporting for castings, available very shortly, EXECUTIVE, fully practical, many years managerial posts, aged 45, M.I.B.F., A.M.I.P.E., would develop, organise or pioneer for firm interested, on salary/results basis. Full knowledge really proven modern methods, economic production, commercial sales, costs. Able introduce labour, material supplies. Guarantee results on salary/turnover basis. Iron, light alloy and non-ferrous experience. Conversant "C," lost wax, and up to date repetition methods. Weights up to 5 cwt., engineering to 10 tons. Rigid metal, sand and material control. Practical metallurgist. Excellent record and references. Principles only. Midlands preferred.—Box 3346, FOUNDRY TRADE JOURNAL.

SITUATIONS WANTED—*Contd.*

FOUNDRY FOREMAN / MANAGER desires post with small Foundry (Midlands area). Fully practical, accustomed full control, M.I.B.F., age 43, metallurgist, expert repetition, jobbing, 1 lb. to 8 tons. Available short notice.—Box 3344, FOUNDRY TRADE JOURNAL.

PATTERNMAKER (40), M.I.B.F., married, with family, wide experience designing and manufacturing plant for highest production, iron, steel, non-ferrous, also jobbing, desires post in Planning Office, or where intelligence and experience can be used to mutual advantage.—Box 3362, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER (47), M.I.B.F. Life experience vast and varied. Practical and technical. Proven record of developments. Ferrous and non-ferrous, light and heavy. Mechanised plant. Patt. and laboratory. Costs, sales. Anywhere. West country preferable.—Box 3363, FOUNDRY TRADE JOURNAL.

FOUNDRY TECHNICIAN / METALLURGIST, young, desires progressive position. Able to take charge laboratory, high duty iron, sand and cupola control, mechanisation. Production minded. Final C. & G., foundry practice. A.I.B.F. Birmingham area. No housing required.—Box 3364, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

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

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

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

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

SITUATIONS VACANT—*Contd.*

APPRENTICED ENGINEER (28-35), single, required for the Technical staff of a Motor Component Manufacturer in Slough. Must have obtained Higher National Certificate in Mechanical Engineering and have had at least 2 years' experience in a ferrous foundry. A working knowledge of the internal combustion engine will be an advantage. The position may entail some travelling in the U.K. Applicants should give fullest details of experience, qualifications, etc., and state highest salary earned.—Box 3365, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN (35/45) required for Iron Foundry producing castings in grey and high duty iron up to three tons in weight. Sand slinger and machine moulding experience essential. Gloucestershire, modern house available. Applicants should state in confidence their complete experience, age, and salary required.—Box 3366, FOUNDRY TRADE JOURNAL.

COMMISSION SALESMAN wanted for low cost Paints, preferably already with foundry connection for other goods. Big sales possibilities.—Box 3367, FOUNDRY TRADE JOURNAL.

REPRESENTATIVE required for Bronze Repetition Castings (preferably for pressure work). The appointment to be on a salary plus commission basis. Whole or part-time would be considered.—Write NEWMAN, HENDER & CO., LTD., Woodchester, Stroud, Glos.

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

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

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

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

SITUATIONS VACANT—*Contd.*

EXPERIENCED IRON FOUNDRY FOREMAN required for Foundry producing Castings by mechanised system. Squeeze and Jolt Machines and Sand Slinger experience necessary. Wolverhampton district.—Please state age, experience and salary required to Box 3354, FOUNDRY TRADE JOURNAL.

REPRESENTATIVE required for Non-ferrous Foundry, London area. Machine and Loose Pattern moulding. First-class castings to any specification and test. Commission basis only.—Apply Box 3355, FOUNDRY TRADE JOURNAL.

INGOT and Billet Manufacturers require SHIFT FOREMAN at their Birmingham branch foundry. Must be thoroughly conversant with Reverberatory, Electric and Tilter type furnaces and labour control. Salary £625 per annum. Excellent opportunity for active man with initiative and drive.—Full details, age, experience, BOX 3347, FOUNDRY TRADE JOURNAL.

DRAUGHTSMAN (18-20 years), active and adaptable, capable of working on own initiative in non-ferrous foundry. Post offers scope and sound prospects. Applicants must be prepared to learn and study all phases of foundry engineering.—Full details, age, qualifications, experience, etc., Box 3348, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN required by Grey Iron Foundry in South Midlands. Applicant must have thorough experience of general and mechanised production, and be capable of taking full control. Ability to introduce new business an advantage. Accommodation available.—Write, stating age, experience and salary required, to Box 3357, FOUNDRY TRADE JOURNAL.

LARGE Iron Foundry, West Birmingham, requires an ASSISTANT CHEMIST. Knowledge of sand control and cast iron analysis preferred, but not essential.—Please state experience and salary required to Box 3358, FOUNDRY TRADE JOURNAL.

AGENCY

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

FINANCIAL

FOUNDRY in the South of England, present turnover £12,000 per month, manufacturing iron and non-ferrous castings, patternmaking (wood and metal), wishes to join up with another Company, or would consider Partnership.—Box 3352, FOUNDRY TRADE JOURNAL.

DIRECTOR in North Lincs. Engineering and Foundry Business, with over £50,000 turnover p.a., wishes to sell shares to practical Foundryman to control Foundries and to become a Director.—Apply Box 3353, FOUNDRY TRADE JOURNAL.

FOUNDRY FOR SALE

GREY IRON FOUNDRY for Sale as going concern. Floor area, 5,000 sq. ft. 2-ton manual overhead travelling crane, capacity over 30 tons per month. 20 miles west of London. Complete with all necessary equipment. Adequate supplies of raw materials.—Box 3350, FOUNDRY TRADE JOURNAL.

MACHINERY WANTED

WANTED.—Jackman Conical Roller, Self Delivery, Sand Mill and Mixer. Complete with overhead motor.—Apply Box 3355, FOUNDRY TRADE JOURNAL.

HIGH Frequency Steel Melting Furnace. About 5 cwts. capacity, with change over.—Box 3349, FOUNDRY TRADE JOURNAL.

MACHINERY FOR SALE

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

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

FOR SALE.—"Ajax" Plain Jolt Moulding Machine, No. 16 size. Table 5 ft. 5 in. square. Good condition.—For further particulars apply R. W. COLLIN, LTD., Pallion Foundry, Sunderland. Telephone 4987.

FOR SALE.—Brand new, and unused, "Cumming," drop bottom type, coke-fired, Crucible Furnace. 200 lbs. capacity, complete with motor and fan, 440 volts, 3-phase, 50 cycles.—WHYTE & EDWARD (METALS), LTD., 30, Symers Street, Dundee.

1 CUPOLA, 30 cwts. per hour. Complete with fan and motor.
1 Pneumatic Jolt Squeeze Machine, capacity 18 in. by 14 in., by Foundry Equipment.
1 ditto, by Fisher Foundries.
1 10-cwt. Jackman Geared Ladle.
1 Portable 10-in. Grinder.
1 Rattle Boc, complete.
Quantity of Steel Moulding Boxes, Snap Flasks and Bands.

FYLDE FOUNDRY,
Treales, near Kirkham, Lancs.
Tel: Kirkham 3170

2 COLEMAN WALLWORK Jolt Squeeze, pattern draw, Moulding Machines. Type CN. Can be seen working.
7 Coleman Wallwork, Shockless Jolt Squeeze, straight draw pin-lift, Moulding Machines. Type WT.553C. Unused since overhaul by makers.
2 Coleman Wallwork, Shockless Jolt Squeeze Turnover draw Moulding Machines. Type WT.562C. Dismantled, and part complete.
1 B.M.M. Jolt Squeeze Turnover Moulding Machine. Type RD5. Unused, supplied 1950.
West Midlands area.
Box 3861, FOUNDRY TRADE JOURNAL.

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

MACHINERY FOR SALE—*Contd.*

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MOTOR DRIVEN BLOWERS (400/3/50 cycles):
SEVERAL ELECTRIC FORGE BLOWERS. 125 c.f.m., 3 in. w.g., 3½ in. inlet, 2 in. outlet. ¼ h.p. Motor.
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SIZE 20 MULTIVANE STEELPLATE PRESSURE FAN. 1,500 c.f.m. against 18 in. w.g. 10 h.p. S.C. Motor, 12 in. inlet, 8½ in. by 3½ in. outlet.
SIZE 15 MULTIVANE STEELPLATE PRESSURE FAN. 2,500 c.f.m., 10 in. w.g. 10 h.p. S.C. Motor.
SIZE 24 MULTIVANE STEELPLATE PRESSURE FAN. 2,820 c.f.m., 22 in. w.g. 20 h.p. S.C. Motor, inlet 13 in. dia., outlet 12 in. by 4½ in.
BELT DRIVEN:
BELT DRIVEN BLOWING FANS, by KEITH BLACKMAN, TYPE NP4. 8 in. flanged outlet; 2,800 c.f.m. against 24 in w.g., or 2,200 against 15 in. w.g., and intermittent duties.
STEELPLATE MULTIVANE FAN. 24 in. dia. inlet, 16 in. by 26 in. outlet; grooved pulley for two ⅝ in. vee ropes.
EXHAUST FANS:
SIZE 9 PADDLE BLADE. 450 c.f.m., 3 in. w.g. .75 h.p. Motor, inlet 5¾ in. dia., output 5¾ in. by 4½ in.
SIZE 12 PADDLE BLADE. 1,000 c.f.m. against 5 in. w.g. 2 B.H.P. S.C. Motor, 8 in. dia. inlet, outlet 9 in. by 9¾ in.
SIZE 15 PADDLE BLADE FAN. 2,000 c.f.m. against 6 in. w.g. 5 h.p. S.C. Motor, outlet 8½ in. by 8 in., inlet 9 in. dia.
SIZE 17 PEERLESS EXHAUST FAN. Capacity 6/7,000 c.f.m., 3 in. w.g. 10 h.p. S.C. Motor, Starter, slide rails, 17 in. inlet, outlet 12 in. by 15 in.

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Core Making Machine, for multiple round cores; motorised, a.c., 3-phase. £55.
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Plenty of good Core Ovens in stock.
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Tilting and Bale-out Furnaces; over 100 in stock; cheap.
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ELECTROGENERATORS LTD.,
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MACHINERY FOR SALE—*Contd.*

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NO. 16 ATRITOR CRUSHER by Alfred Herbert, complete with Feed Hopper, overhauled and with a quantity of spares. Also a No. 12 Atritor by Alfred Herbert, for which we have available about 6 tons of spares. Both these machines are offered at extremely low prices for quick clearance.

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1,000-C.F.M., vert., 2-stage, Air Compressor, by Fullerton, Hodgart & Barclay. 100 lb. pressure; speed 290 r.p.m.; arranged belt drive. Overhauled ready for use.

665-c.f.m., 2-stage, Air Compressor, by Sullivan. Speed 188 r.p.m.; direct coupled to a 170-h.p. auto-synchronous Crompton-Parkinson Motor, 400/3/50; complete with Control Gear.

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GEORGE DENHAM, LTD., Low Mill Foundry, Darlington, have capacity available for Aluminium, Phos. Bronze and Gunmetal Castings from ¼-lb. to 3-cwts., at competitive prices, including patterns if required. 'Phone Darlington 5017.

CAPACITY AVAILABLE—*Contd.*

MECHANISED FOUNDRY.—Malleable and Grey Iron Castings offers 20 tons per week free capacity at early date. Preference for boxes up to 28 in. by 16 in. by 5 in. by 5 in. Snap Flasks up to 14 in. by 14 in. by 3 in. by 3 in. Hand moulding capacity also available. Cast Iron Pipes flanged and specials. Patternmaking facilities if required.—E. J. WALLACE, 39, Constitution Street, Dundee.

GREY IRON FOUNDRY, Midland district, have spare capacity for castings up to 10 tons each.—Box 3314, FOUNDRY TRADE JOURNAL.

CASTINGS.—Grey Iron Castings, up to 10 cwt. First-class products. Prompt deliveries.—ALDAM (MISTERTON), LTD., Misterton, near Doncaster.

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TIVIDALE FOUNDRY, LTD., Local Board Road, Watford. (Tel. 3743.) Non-ferrous Sand Castings, 2 cwt. maximum. Prompt quotations and deliveries.

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CAPACITY AVAILABLE—*Contd.*

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CASTINGS.—We can save your porous castings, ferrous or non-ferrous, by an approved Impregnation Process; sample castings treated.—RECUPERO, LTD., 66, South Harrow Viaduct, Harrow, Middx. 'Phone: Byron 1178.

CAPACITY for Phosphor Bronze, Gun Metal, Leaded Bronze Castings from 1 lb. to 56 lb. Keen prices will be given against sample castings. Good deliveries. —SNEYD ENGINEERING CO., LTD., Sneyd Street, Leek, Staffs.

MISCELLANEOUS

INDIAN IRON AND MANGANESE ORES.—Any quantities. Immediate and regular deliveries.—For further detail please contact Box 3351, FOUNDRY TRADE JOURNAL.

SMALL Midland Foundries, requiring analysis, tests, consultant service, grey, malleable, non-ferrous, for rigid metal, sand, material control. Expert economic production advice, please contact Advertisers. Life experience trade; guarantee results, and elimination of troubles.—Box 3343, FOUNDRY TRADE JOURNAL.

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MISCELLANEOUS—*Contd.*

REFRACTORY MATERIALS.—Moulding Sand, Ganister, Limestone, Core Gum; competitive prices quoted.—HENSALL SAND CO., LTD., Silver Street, Halifax.

FIREWOOD for Cupolas. Sleepers and Sleeper Wood in wagon loads.—TILLEY'S (WOLVERTON), LTD., Wolverton Bucks.

PATTERNS for all branches of Engineering for Hand and Machine Moulding.—FURMSTON AND LAWLOR, LTD., Letchworth.

MISCELLANEOUS—*Contd.*

GRAPHITE / PLUMBAGO.—In all qualities and all meshes for every industry—a personal service and prompt deliveries.—WOODSTOCK (LONDON), LTD., 33, The Little Boltons, London, S.W.10. FREmantle 6646/7.

C. PROCESS.—Cast Iron Pattern Plates, suitable for Shell Moulding. Made to customer's patterns or drawings.—ROBERT R. SHAW, Falkirk Road, Larbert, Scotland. 'Phone 300.

MISCELLANEOUS—*Contd.*

SEA SAND for Castings, any quantity, by road or rail.—JOHN LIVESEY, LTD., Leamington Road, Ainsdale, Southport.

FLAME CUTTING OF STAINLESS STEEL demands an Iron powder specially manufactured for the job which POWDER METALLURGY LTD., 59-62, High Holborn, W.C.1 can supply you at approximately 7d. per lb.

NOTICE TO ADVERTISERS AND AGENTS

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

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

March 5th, 1953

Foundry Trade Journal
49, Wellington St.,
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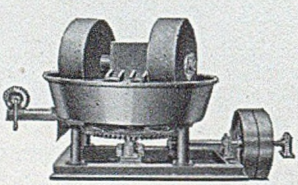

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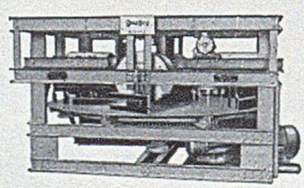

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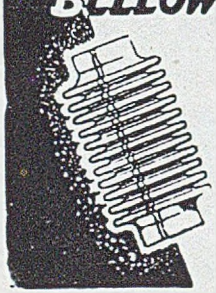

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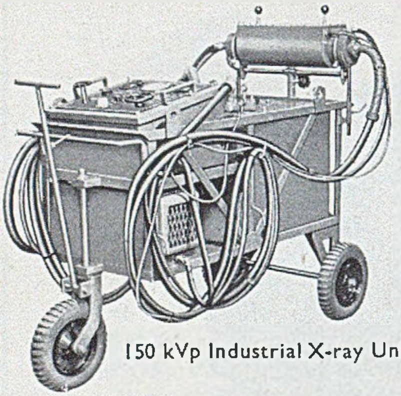

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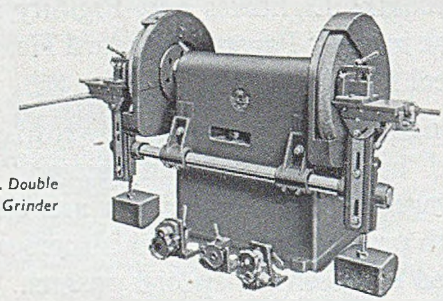

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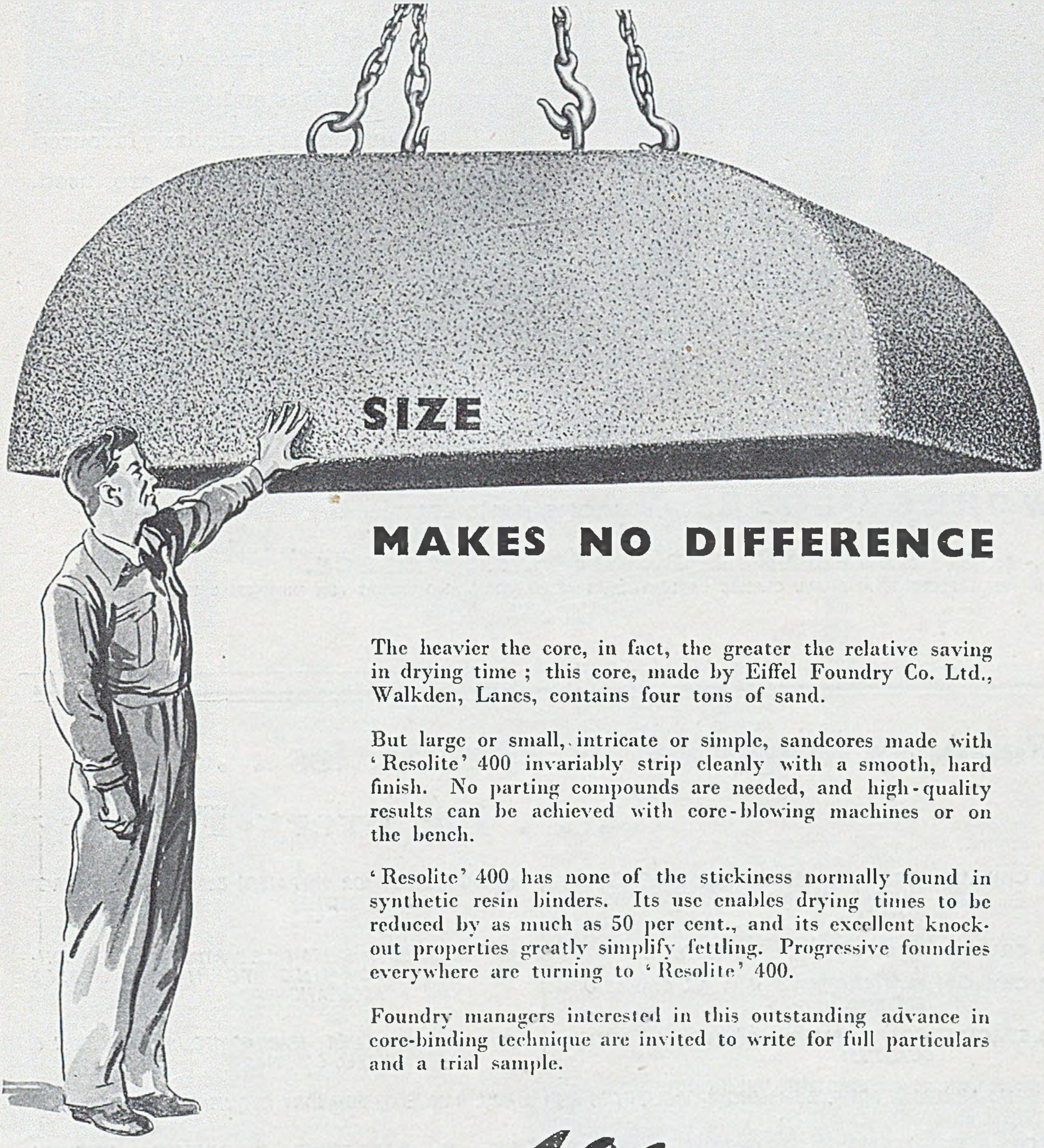
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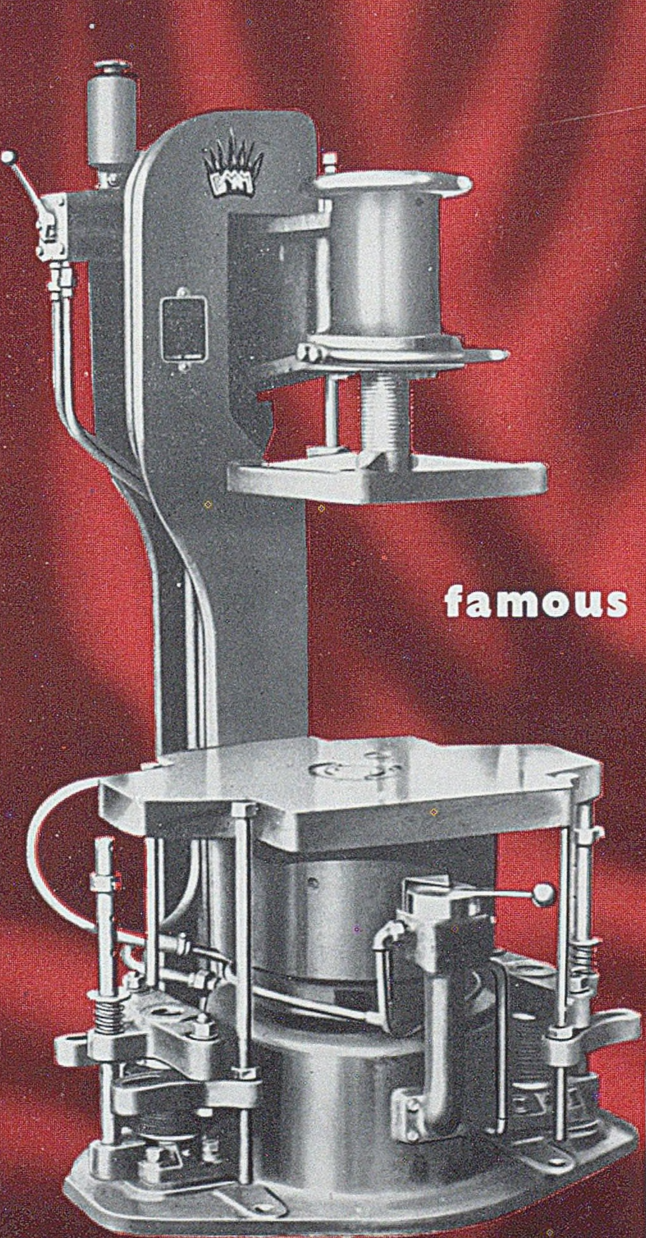

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