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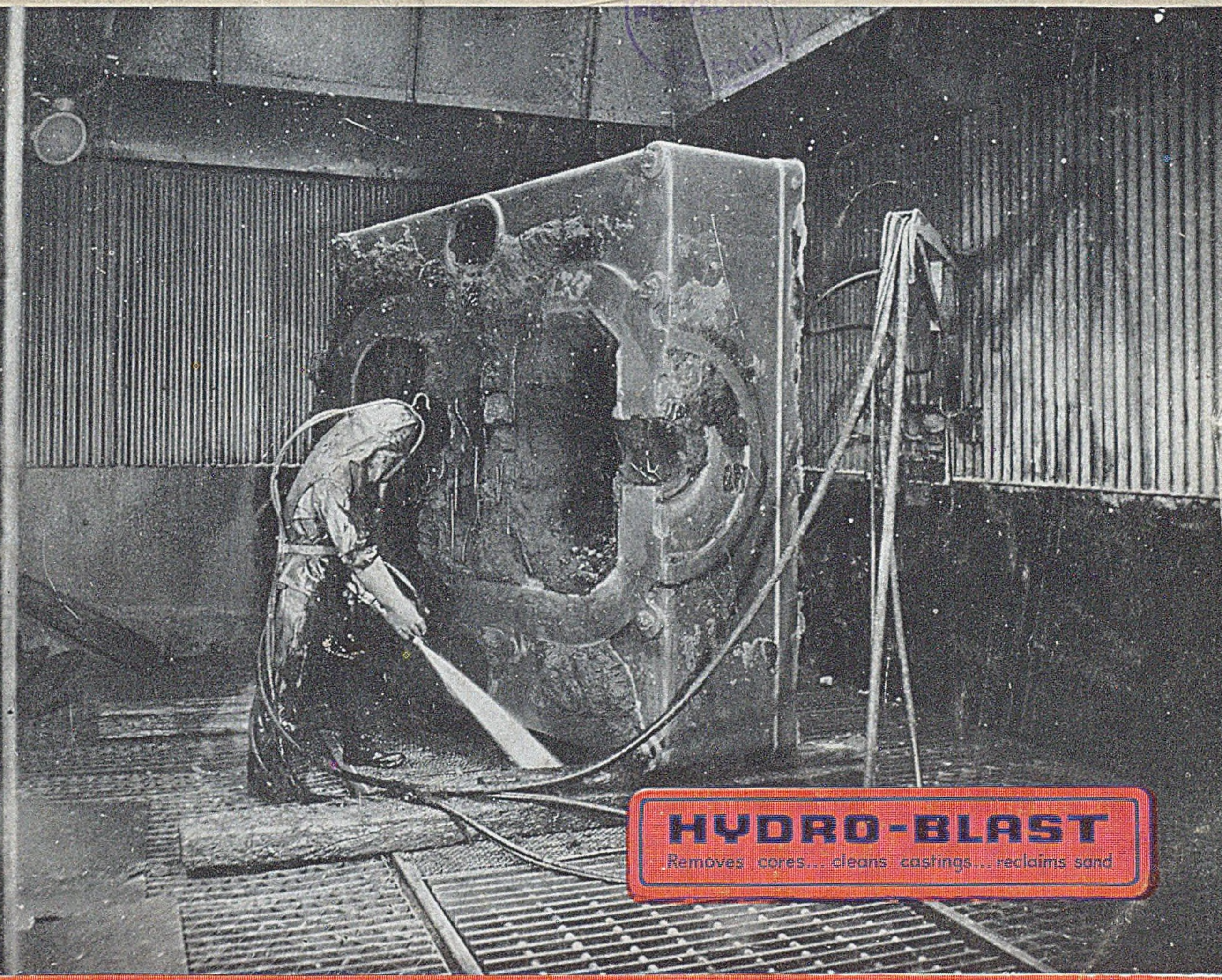

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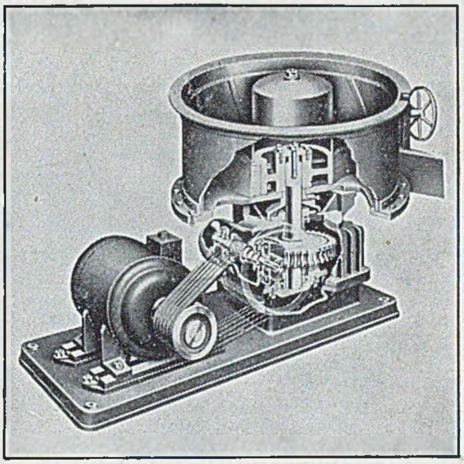
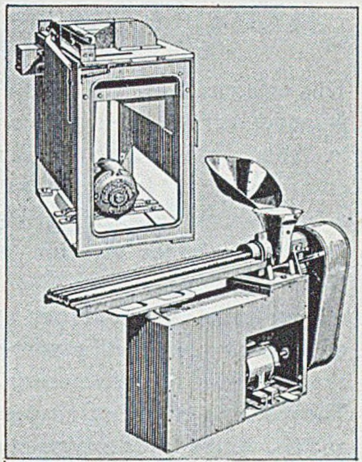
FORDATH MACHINES IN THE FOUNDRY





(ABOVE LEFT) FORDATH 'NEW TYPE' MIXING MACHINES *use the well known Fordath principle of rubbing and folding without crushing in each of the seven models in the range.*

(ABOVE RIGHT) FORDATH CUT-OFF MACHINES *have many years of satisfactory service built into them.*

The FORDATH MULTIPLE ROTARY CORE MACHINE *has an enviable reputation for accurate extrusions in foundries everywhere.*

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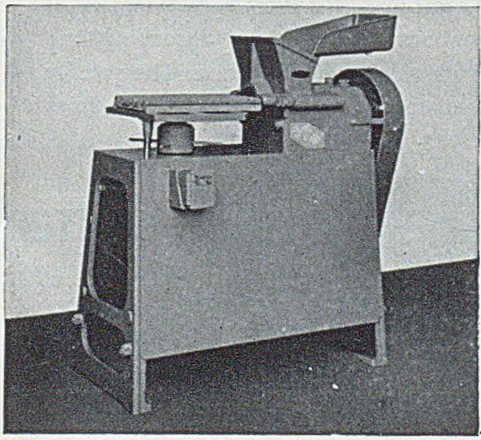

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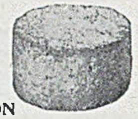
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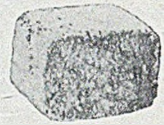
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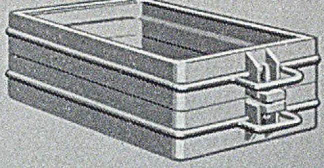
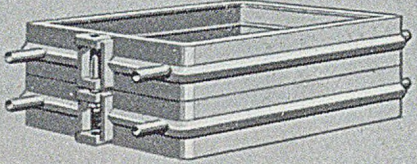
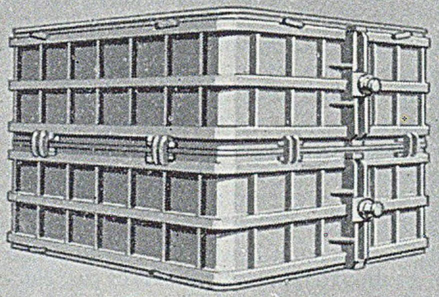


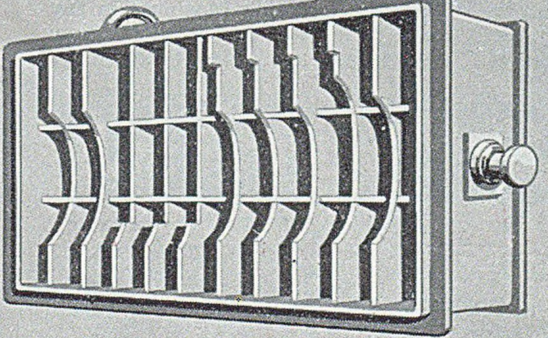
LIGHT WORK - 1 MAN LIFT



MEDIUM WORK - 2 MEN LIFT



MEDIUM WORK - CRANE LIFT



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Magnetic Moulding Machines

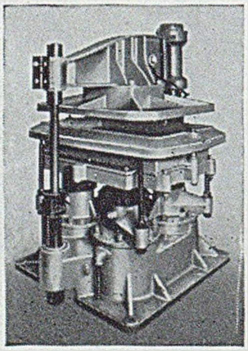
Operation and Applications

In foundries laid out for large scale repetition work moulding machines long ago proved their worth; today the advantages afforded by the Magnetic type of moulding machine are helping towards even greater efficiency and economy. These machines whilst frequently having a somewhat higher initial cost than other types of mechanical moulding machines gain by their low installation charge, negligible maintenance and the immense saving in running costs amounting to as much as £85 in twelve months.

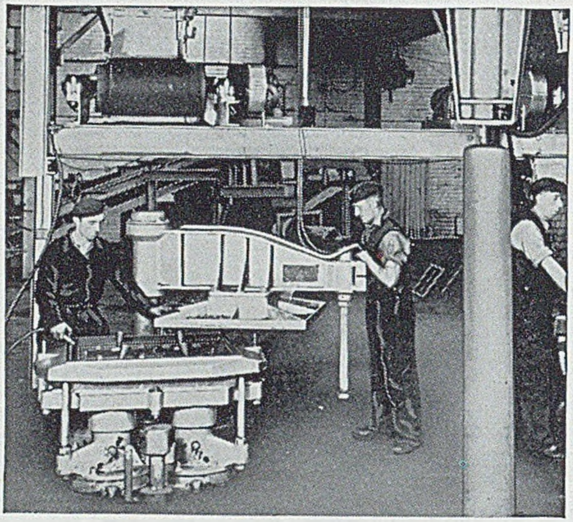
Moulding pressure in the magnetic types is applied through a D.C. solenoid. Apart from the cable connecting the machine to the power supply, there are no other connections, pipes or any exterior equipment, although a D.C. supply is of course essential. It is, in this respect, virtually self-contained, and, since there are few moving parts, requires very little maintenance.

Operation

No technical knowledge is required by the operator, for the machines are automatically controlled by a simple push-button system that is practically foolproof. When the push-button is released at the end of the pressure stroke the pattern is automatically stripped from the mould, the stripping speed being controlled by the rate of displacement of oil in the main dashpot. Electric vibrators are normally fitted which are energised momentarily immediately the "squeeze" push-button is released, to ensure that the pattern is stripped cleanly from the mould. Electric heaters (with 3-heat control switch) can be supplied to prevent the moulding sand from adhering to the pattern. The machines can usually be arranged to suit equipment already standardized for machine moulding methods. But it is, perhaps, on the evidence of power consumption-figures that the case for magnetic moulders presents its strongest argument. Unlike hydraulic or pneumatic machines where compression power must be maintained at all times throughout the shift, magnetic moulding machines only use electric power during the time the actual moulding stroke is being made—for perhaps 1½ to 2 seconds. A typical example is quoted of a magnetic moulding machine producing 350 complete moulds in boxes 20″ x 12″ x 3½″ deep, for an electrical consumption of approximately 3½ units; a remarkable figure by any comparison. When a battery of machines is in use, the electrical control includes a sequence selector device to prevent the solenoids of two or more machines being energised simultaneously, thus automatically limiting the instantaneous power demand.



Down-sand frame magnetic moulding machine.



Magnetic moulding machine producing moulds for heavy cooker-frame castings

Types of Machine and Applications

The two most popular types in current use are the "Squeeze-strip" and "Down-sand Frame squeeze strip" machines. The former has a very wide and diverse application; the latter is particularly applicable to the production of moulds for flat or shallow castings where the box depth does not exceed 6 inches.

"Double-face Boxless" and "Roll-over" types are also manufactured to meet special requirements. Slight differences in the types of machine available enable manufacturers to choose a model most suited to their particular requirements.

The field of application is wide and includes the production of moulds for the components of gas, electric and solid fuel combustion cookers and stoves; industrial and agricultural machine parts, electrical fittings and instrument components.

Magnetic Moulding Machines are made exclusively by British Insulated Callender's Cables Limited in their Prescot factory; this organization also provide the customary "After Sales Service".

For those who wish to know more about the application of Magnetic Moulding Machines in the foundry, BICC have published detailed information (Publication 276 V) which is available on request to:

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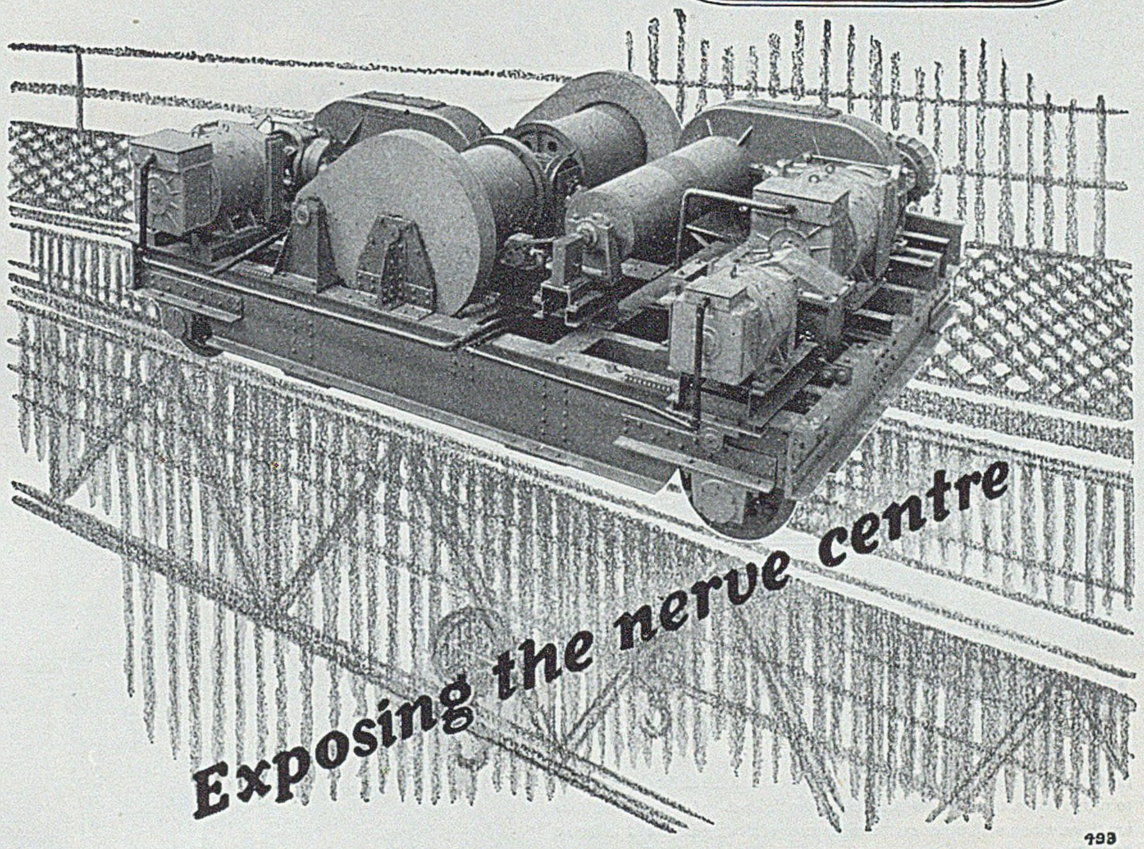

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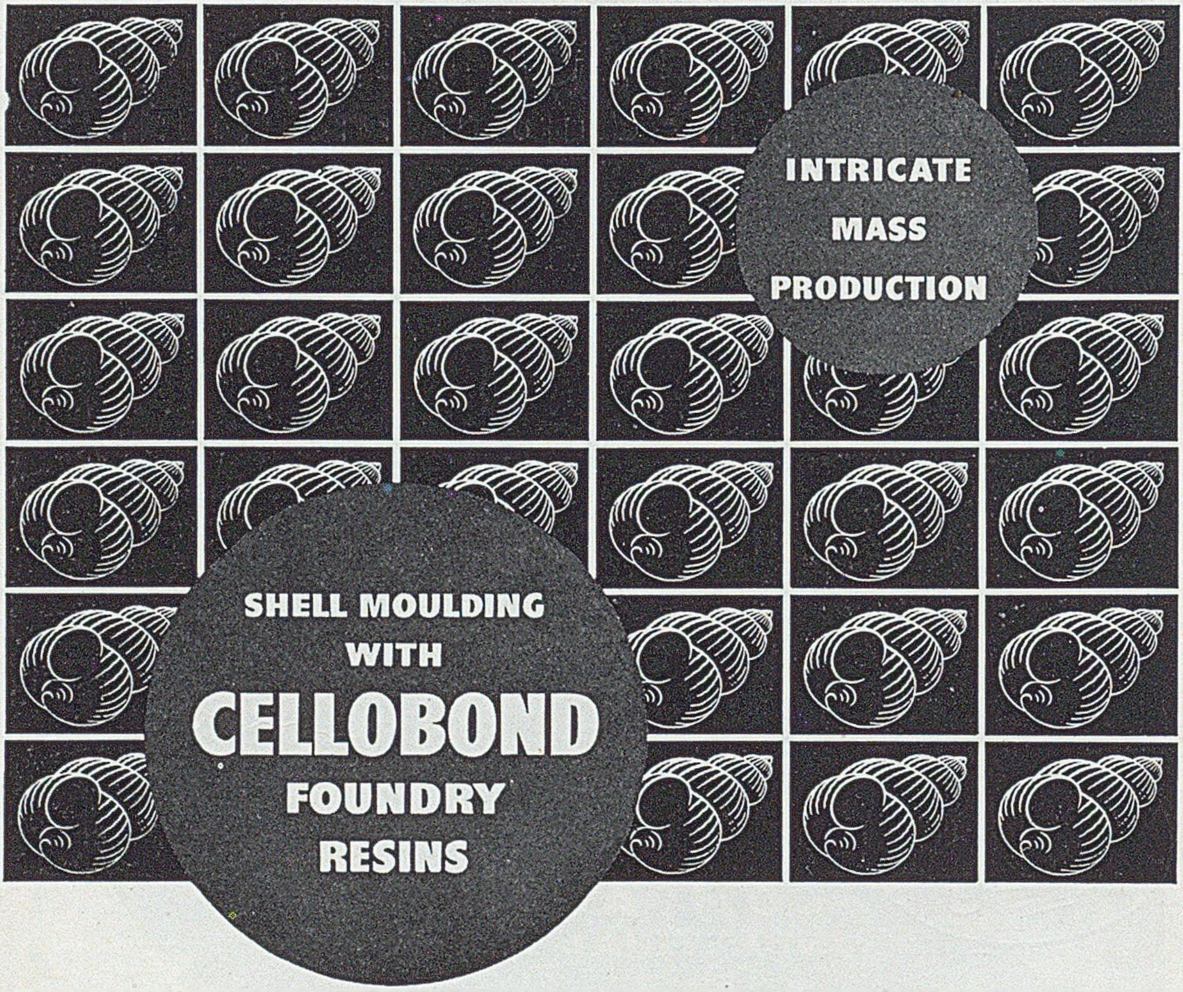

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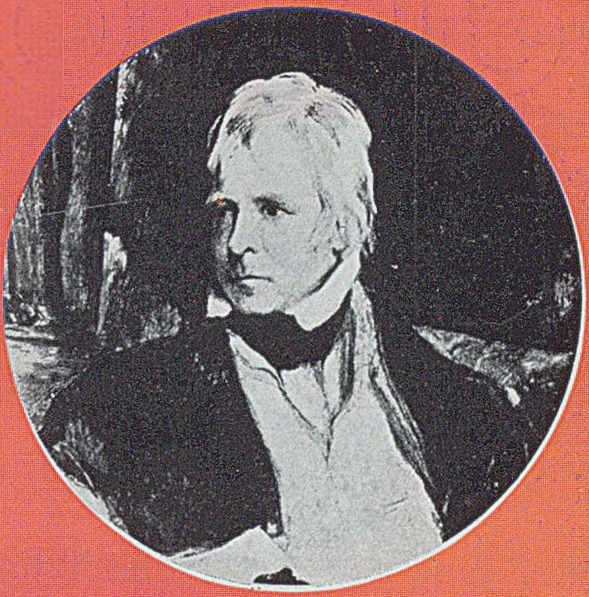

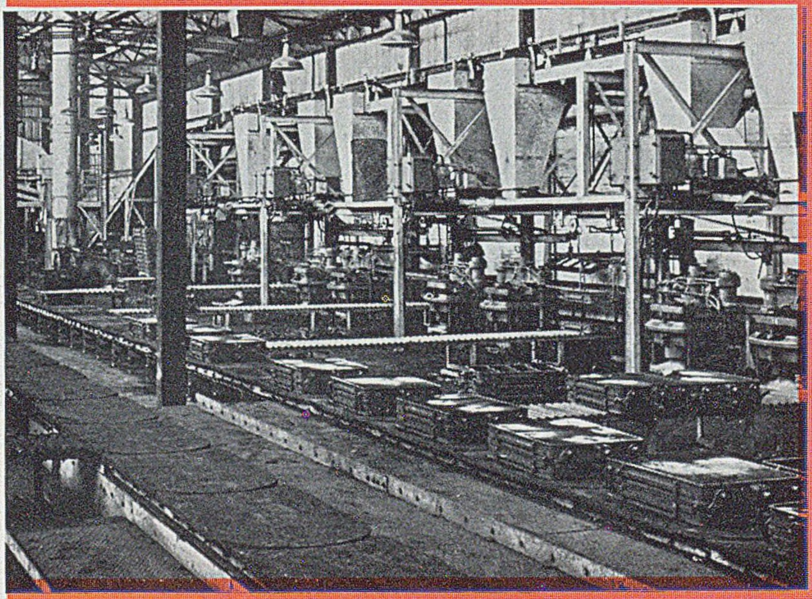

View of moulding shop, showing mould conveyor, sand distribution conveyor and supply hoppers over moulding machines.

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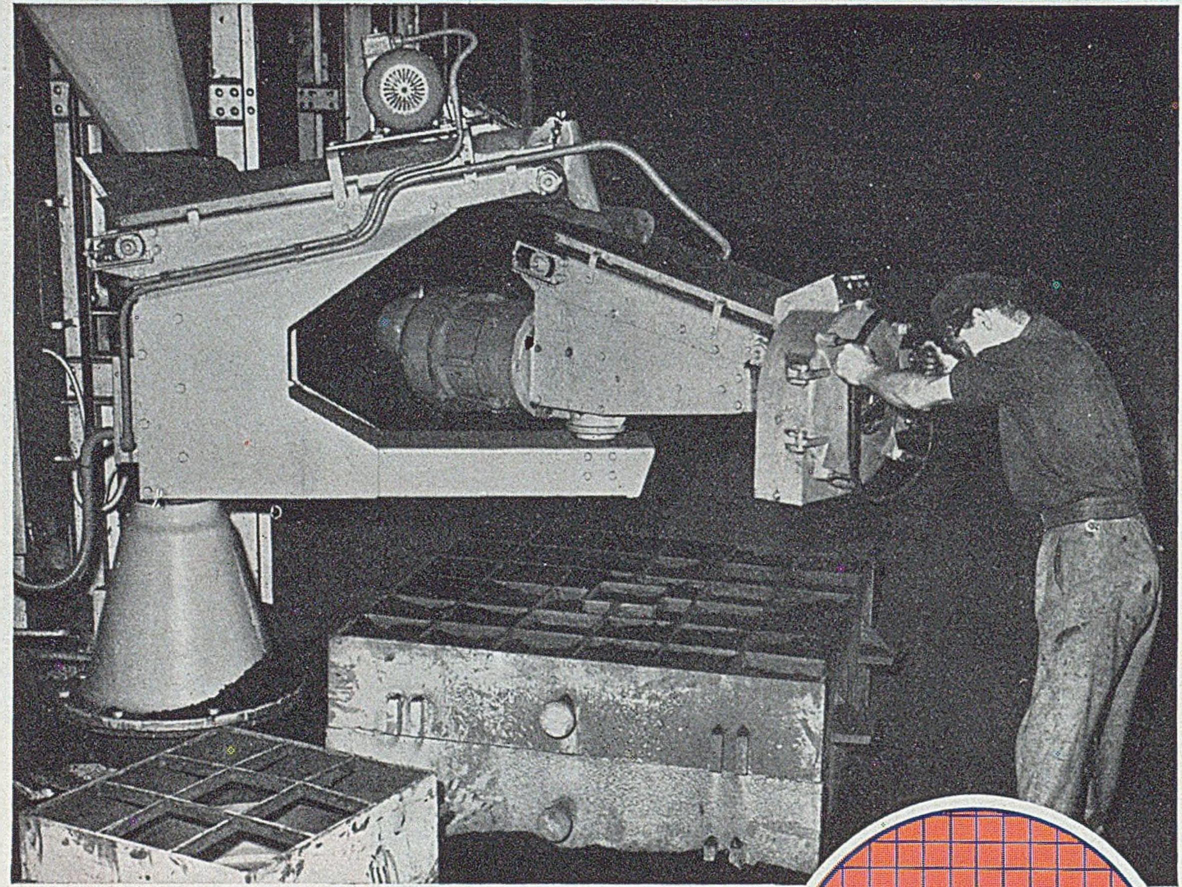

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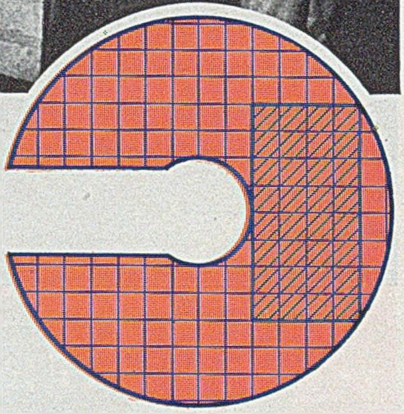

Box coverage diagram. Each division represents one square foot. Shaded area represents box 8 ft. x 4 ft.

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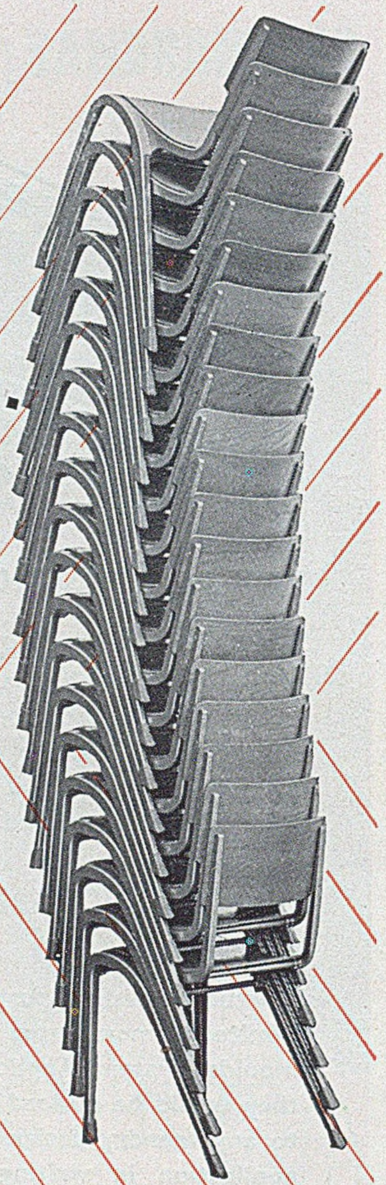

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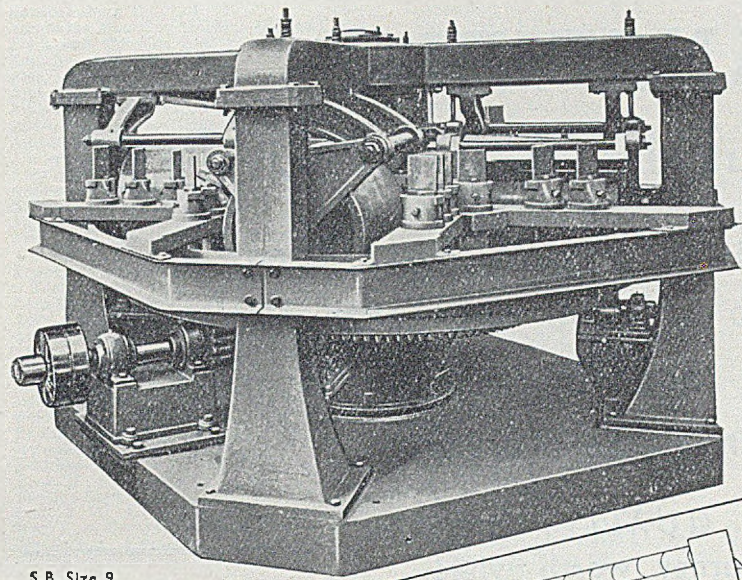

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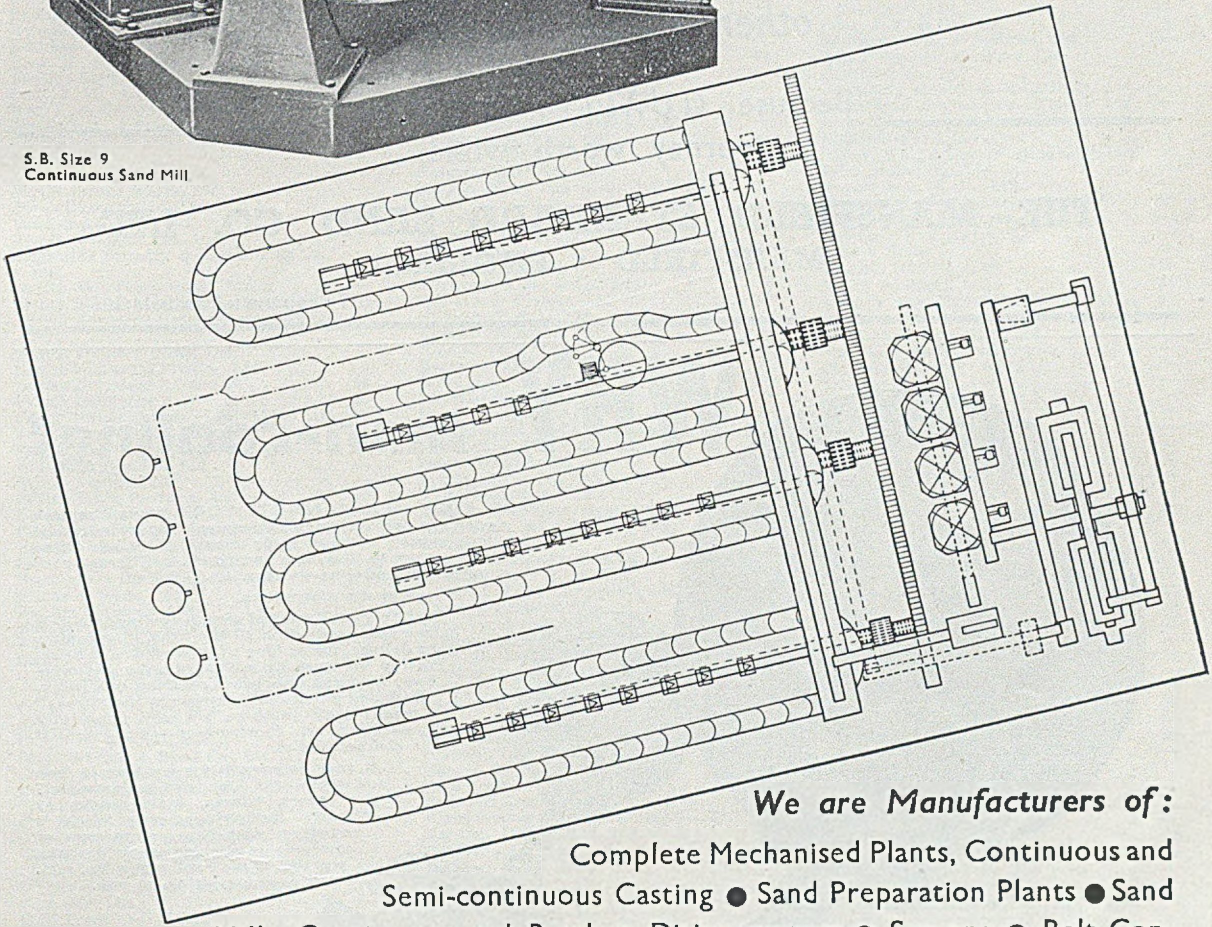

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SAND

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PRINCIPAL CONTENTS

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Paris Congress

Unquestionably, the Paris International Foundry Congress which ended in the early hours of last Sunday morning, was the greatest gathering of foundrymen held in Europe since the war. The total attendance was of the order of 1,100, of whom over 800 were drawn from some 23 countries. There were large parties from America, Germany, France, Italy, Belgium, and this country. The president of the congress, Mr. Muguet, worked strenuously for its success, but the strain was such that illness prevented his attendance at the closing banquet. Everybody will now wish him a rapid return to complete health. The chief guest was Mr. L. N. Shannon, of Birmingham, Alabama, U.S.A., as he is this year's president of the International Committee of Foundry Technical Associations. There were also in attendance the president of the American Foundrymen's Society; the president and vice-presidents of the Institute of British Foundrymen, as well as five past-presidents of the A.F.S., and three who have served the Institute of British Foundrymen in a similar capacity.

Advantage was taken of the occasion for a meeting of the International Committee and Mr. Brizon, of France, was elected president. He will be the chief guest at the next International Congress to be held at Florence, in September next year. Additionally, there were meetings of the European Committee on Foundry Productivity; the nickel licensees for spheroidal-graphite cast iron and the French Meehanite licensees, plus, of course, the committees for test-bars, foundry dictionary and foundry defects—of the International organization. On the Sunday before the Congress was officially opened, there was an excursion to the Chateau of Dompierre, which belongs to the Duke of Luynes, a member of the French foundry association, as there is a moulding-sand quarry on his estate. This visit was greatly appreciated by the guests.

Both the opening and closing ceremonies were at the Sorbonne in the traditional French manner, with the chair being taken by a minister of the State, who is accompanied on the platform by foreign and national personalities. At the latter ceremony, Mr. L. N. Shannon and Mr. P. Chevenard were presented with *Grandes Medailles d'Honneur* and Dr. Everest and Mr. Georges Delbart with *Medailles d'Or*—in reality magnificent plaques. The International Award, that of a statuette of the killing of Medusa, made by Benvenuto Cellini, was presented to Professor Portevin for his services to the foundry industry.

An exceptionally pleasing visit was made to the research laboratories of the "Centre Technique" at Sèvres. Here every branch of the foundry industry is catered for and thus it is not quite comparable with any similar institution in this country. We were impressed with the coloured projections of photomicrographs of cast iron, the colours being obtained by heat tinting; the installation of an experimental cupola having twin tuyeres, and the translations being made from technical reports—even from ideographic Japanese. The receptions accorded to the visitors by the City of Paris at the *Hotel de Ville* and by the Chamber of Commerce were a type of social event which the French do so admirably. Those who were fortunate to be official delegates were entertained to dinner at the

Paris Congress

Le Doyen restaurant in the Champs-Elysées. It was in every way a charming function. There were many other social happenings such as a mannequin parade by Christian Dior, visits to see the illuminated fountains at Versailles, a cabaret show in Montmartre, but we liked best the visit to the statuary section of the Louvre to see the two great masterpieces, the Victory of Samothrace and Venus de Milo under the effect of floodlighting. We have often seen them in the past, but (especially the former) they were exceptionally satisfying when shown devoid of all background effect.

At the closing banquet, a most important statement was made by Mr. Olivier, president of the *Syndicat Général des Fondeurs de France* (the French foundry employers' federation) that there had just been created a European foundry employers' federation to include *inter alia* France, Germany, Holland and Belgium. It is to be presided over by Mr. Olivier and it will strive to ensure the maintenance of economic prices and conduct other activities germane to the welfare of the foundry industry.

At a guess, over 50 technical papers were presented, but with the exception of a "starred" paper by Dr. Bastein, they were only available in French. This one, on hydrogen in steel, pig-iron and cast iron, was of exceptional interest, for, at least so far as the last alloy is concerned, not much is known. As for the rest of the papers, whilst often of quite a high quality, there was really nothing outstanding, and the omission of the subject of shell moulding was somewhat regretted by many of the participants.

Though this was an International Conference, it was still characteristically French, and we would not have it otherwise. There is no place for standardization in such matters, and each country has the opportunity in turn to act as hosts in their natural manner. On this occasion, with so many visitors from so many countries, the French did exceptionally well, and we thank and congratulate Mr. Muguet and his chief helpers, Mr. Debar and Mr. Delpueche on the unquestioned success they achieved. To act as hosts for more than a week is no light task and they did extremely well—*mille remerciements!*

In addition to the 42 competitors there were 33 other participants at the meeting, consisting of wives and spectators, and these added much to the enjoyment of the occasion. A special vote of thanks is due to the retiring honorary secretary, Mr. F. Arnold Wilson and his helpers for their truly magnificent organization of the whole function.

In view of the fact that the English Ladies' Golf Championship is being held at Woodhall Spa at the end of September, 1954, the ninth I.B.F. Golfing Society meeting at Woodhall Spa is to be held next year on September 18 and 19—a week earlier than usual.

Eighth I.B.F. Golf Meeting

Now well established and highly rated among the social events of the Institute of British Foundrymen, the annual meeting of the I.B.F. Golfing Society was held last week-end, September 26 and 27. This was the eighth meeting and the fifth in succession to take place at Woodhall Spa, with admirable headquarters in the Golf Hotel. The weather was perfect throughout—producing "mists and mellow fruitfulnesses," and some very fine golf scores.

Saturday morning: Stroke Competition for the I.B.F. handicap and scratch cups (42 *competitors*).

1. H. C. Hanson, 91—21 = 70; Winner handicap cup.
2. E. Arthur Phillips, 81—10 = 71; Second handicap prize.
3. H. L. Thorne, 85—13 = 72; Third handicap prize.
4. H. Oliver, 90—18 = 72.
5. E. W. Pugh, 80—6 =74; Winner scratch cup.
6. Tom Reynolds, 101—26 = 75.
7. C. S. Bosworth, 101—26 = 75.
8. W. Jones, 95—19 = 76.

11 E. C. Carrott, 99—22 = 77; Winner veterans cup.

In addition to holding the handicap and scratch cups for one year, the winners also received a tankard each, kindly presented by Dr. Cyril Dadswell, immediate past-president of the Institute. The veterans cup (challenge) a tankard presented by Mr. W. E. Asko was won after a tie with Mr. F. Arnold Wilson. The second and third handicap prizes were presented by Mr. R. B. Templeton. The branch "Coronation" challenge shield, presented by Mr. P. B. Higgins, was won by the Birmingham branch "B" team—E. W. Pugh 74, H. Thorne 72 and H. C. Hanson 70 = 216. The winners also received prizes presented by the West Riding of Yorkshire branch whose "A" team (P. G. Higgins 78, W. Jones 76 and H. Oliver 72 = 226) were themselves second in this event. The East Midlands branch team were third (228) and London fourth (234).

Saturday afternoon: Greensome foursomes v. *bogey.*

1. P. G. Pennington and F. Webster (12)—5 up.
2. R. C. Sheppherd and W. H. Richards (12) 5 up.
3. A. J. Ford and J. H. Ainsbury (12) 2 up.
4. R. S. Smeeth and A. G. Robiette (12) 1 up.

The winners received a chromium plated Lincoln imp each, kindly presented by the Lincolnshire branch. The runners-up received golf balls presented by Mr. R. B. Templeton and Mr. R. S. Darby.

Sunday morning: Four-ball foursomes v. *bogey.*

1. H. C. Hanson (21) and A. Swain (16)—7 up.
2. C. H. Wilson (22) and P. G. Pennington (12)—5 up.
3. H. Oliver (18) and W. E. Aske (20)—5 up.
4. R. C. Shepherd (15) and P. B. Higgins (8)—4 up.

The winners received ½ dizen golf balls each, kindly presented by Mr. Frank Webster.

Ladies' Competition—Stapleford.—This was held on Saturday morning, when eight competed for the ladies' Coronation rose bowl (challenge) kindly presented by Mr. E. G. Evans.

1. Mrs. Thos. Rigley (23)—28 points.
2. Mrs. R. C. Shepherd (28)—27 points.
3. Mrs. E. W. Pugh (34)—20 points.
4. Mrs. Wm. E. Aske (29)—18 points.

The runner-up received golf balls presented by Mr. J. F. Stanier.

Annual General Meeting

At the annual meeting of the I.B.F. Golfing Society, which took place on Saturday evening, with Mr. R. B. Templeton, president, in the chair, the prizes were presented by Mrs. Dadswell, wife of the immediate past-president of the Institute.

Afterwards, the following officers for next season were elected or confirmed in office:—As president, Mr. R. B. Templeton; vice-presidents, Mr. P. H. Wilson, O.B.E., Mr. V. C. Faulkner, and Mr. R. C. Shepherd; committee: Mr. E. A. Phillips, Mr. J. Bell, Mr. R. C. Shepherd, Mr. G. W. Nicholls, Mr. I. A. Menzies, Mr. F. Arnold Wilson, and Mr. P. G. Pennington (hon. secretary). The resignation of Mr. F. Arnold Wilson, who has been honorary secretary for the past five years, was accepted with much regret, and the Golfing Society were grateful to announce that Mr. P. G. Pennington had agreed to accept this office

(*Continued at the foot of col.* 1)

Feeding of Steel Castings at Greater-than-atmospheric Pressures*

By Charles W. Briggs and Howard F. Taylor

After first reviewing principles established from previous work on feeding and methods of measuring the degree of efficiency, the Authors describe apparatus and applications whereby gas pressures above atmospheric can be applied to freezing castings. A section is included on temperature effects independent of pressure. Results are analysed and critical conclusions drawn.

INTRODUCTION

Many attempts have been made to improve casting quality by modifications of the "blind"-riser technique for feeding steel castings. The insertion of a sand core in the top of riser[1] allows atmospheric pressure to exert its force on the molten steel of the riser, thus permitting more efficient feeding of the casting. Prior to the development of this technique, the performance of blind risers was unreliable. Other techniques that have been developed to improve feeding include the use of graphite rods in risers,[2,3] and the use of exothermic materials.[4] Insulating sleeves around the risers are beneficial,[5] but no completely satisfactory insulator has as yet been found for steel.

Since the force of atmospheric pressure enhances the attainment of soundness in castings, the question arises whether or not a pressure higher than that of atmospheric pressure might result in further improvement. Such use of high pressures, if practicable, might also permit the use of a small riser accomplishing efficient feeding with a saving of metal. The purpose of this investigation was to determine the effects of the application of greater-than-atmospheric pressures in the risers of steel castings.

Blind Risers

A "blind riser" is defined as a riser which is entirely surrounded by sand, and does not extend to the atmosphere. It can, therefore, be placed at any position in the mould. Its shape is usually a cylinder with a spherical segment top. (For a typical blind riser, see Fig. 3, and for complete details concerning the feeding mechanism of the "atmospheric pressure riser," consult reference 6.)

Many attempts have been made to improve casting quality by modification of the original technique in which atmospheric pressure was employed. The use of a pressure greater than atmospheric, applied to a riser while the steel is still molten, has been proposed by several foundry engineers. In November, 1945, Jazwinski and Finch[7] published the first article on the use of high pressures in the risers of steel castings. Their preliminary work included a study of shrinkage cavities in both blind and open risers. Open risers, which are fed by the force of gravity, have carrot-shaped cavities which extend deeply into the riser, and usually contain considerable secondary shrinkage. Blind risers, fed by atmospheric pressure, show similar cavities with a slightly more globular shape, and less secondary shrinkage. Their conclusion is that "The height of a feeder-head necessary is determined by the length of shrinkage cavity, and consequently, if the cavity is globular instead of carrot-shaped, a constant volume of casting will require less of head height, and will result in an increase in yield." From a series of experiments, they found that the size and type of shrinkage cavity formed in the blind riser was proportional to the applied pressure. They stated that if the pressure was high enough to force the metal from the blind riser into the casting so as to form a flat-bottomed cavity, the riser could be reduced to a minimum size, thereby producing a high casting yield.

Application of Pressure to Blind Risers

It has been stated by Jazwinski and Finch that to produce sound castings with a high yield, two conditions must be fulfilled:—(1) Pressure must be applied; and (2) the blind riser must be kept liquid as long as possible. These conditions are met by Jazwinski and Finch by introducing into the riser cavity (before closing the mould) a material which, after a surface skin has formed in the riser, creates a gas-pressure to act upon the liquid metal and force it into the casting. In addition to the gas-forming constituent, there is introduced an exothermic compound to create heat to make up for losses resulting from convection and radiation. This pressure and heat-forming material, called "Kayell" compound, is contained within a refractory or metal container to withstand the heat from the liquid steel until a skin has formed over the entire surface of the riser. Then the combined effect of the pressure and heat results in a globular cavity, claimed to improve feeding of the casting. The "Kayell" mixture is introduced into the riser by means of a core suspended from a wire attached to a core-print in the mould. As soon as a thin skin is formed in the riser, the exothermic reaction gives off heat to keep the riser metal liquid, and the gas given off is trapped in the riser, thus forcing feed metal into the casting.

*This report, which was presented at the fiftieth annual meeting of the Institute of British Foundrymen, was prepared from a research study carried on at Massachusetts Institute of Technology for the Steel Founders' Society of America and is published with the permission of Steel Founders' Society of America. The Authors are technical and research director, Steel Founders' Society of America, and associate professor, Dept. of Metallurgy, Massachusetts Institute of Technology, respectively.

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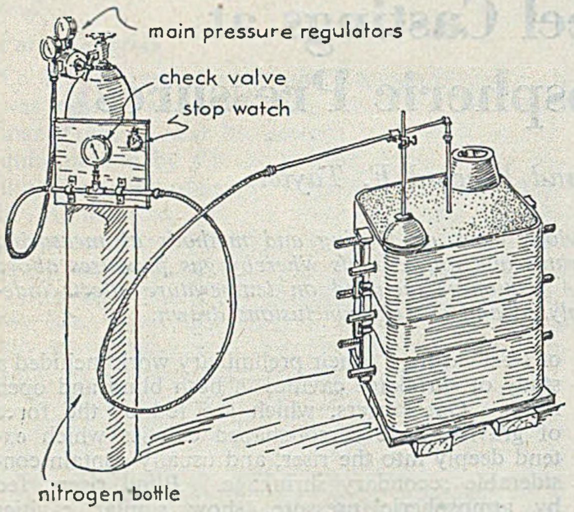


FIG. 1.—*Sketch of Apparatus used for the Application of External Gas Pressures to Castings.*

Jazwinski and Finch developed several methods of delaying the pressure action: by enclosing the compound in a steel or copper tube, or by coating with a thick refractory paint. These coverings delay the gas and heat formation by varying degrees to accommodate different sized risers in order that sufficient skin may first be formed at the riser/sand interface. They also gave examples of sound castings which they produced by this method, and claim that the yield is increased over that when simple atmospheric pressure or gravity feeding is used.

Centrifugal Pressure

Many attempts have been made to obtain improved feeding of castings by applying pressures of a high order by centrifugal means. To date, it has not been found possible to improve feeding markedly by pressures exerted in this manner. Once bridging dendrites form across the centreline, or path of feeding of the solidifying casting, they establish a barrier to the passage of molten metal from the riser. Since the spaces between the dendrites are extremely small, calculation readily shows that pressures of a fantastic order would be required to move metal of reduced fluidity through them. In fact, the centrifugal pressure method of feeding, as contrasted to the ordinary gravity methods, permits only a slight increase in the ability of feeding heavy sections through light sections. "Directional solidification,"[3] to prevent dendritic bridging, remains as the consideration of paramount importance, and it is for this reason that certain castings can be produced centrifugally with fewer risers than can be produced statically with equal soundness. Hence, it does not seem probable that such pressures as might be developed practically in a riser cavity would prove greatly beneficial over ordinary atmospheric methods.

Estimation of Feeding Efficiency

It seems logical that any attempt to assess feeding efficiency on the basis of size or shape of riser cavity might lead to erroneous conclusions. The only dependable criteria of casting soundness are transverse radiography or magnetic inspection of sectioned castings.

The flat-bottomed cavities, with uniform walls shown in the sectioned risers of the Jazwinski and Finch publications, indicate that the molten metal forced out of the riser went elsewhere than to compensate for shrinkage of the casting. The extremely uniform wall of the cavity indicates clearly an instantaneous displacement of metal, a condition incompatible with the progressive feeding required for riser efficiency. The metal could only be displaced by (1) enlargement of the casting, (2) penetration of metal into the sand of the mould, or (3) forcing of metal back out of the downgate. Without such an instantaneous displacement, these unnatural shrinkage forms can only be obtained when a large quantity of exothermic or carbonaceous materials is used in the riser.

Experience indicates that the amount of exothermic material required for such a condition would be far more than could be packed into the riser, and still leave room for feed metal. A highly exothermic reaction would cause release of gas-pressure by remelting of the solidified skin. Furthermore, the uniform wall could not be obtained, if highly exothermic material were used.

Practical Considerations

The rate and extent of feed demand of castings are functions of casting shape and volume. Some castings have early and others late feed demand requirements. It is obvious that gas-forming capsules must possess great latitude of performance. Also, the selection of the capsules would be critical. It seems almost too much to expect that an inexpensive capsule could be provided which would:—

(1) Possess exactly the delayed action necessary for the riser (*a*) to build up sufficient skin-strength to support the gas pressure, and (*b*) to accommodate wide variations in the feed demand of the casting as it solidifies. (These variables are influenced by pouring temperatures, mould material, size and configuration of the casting, and by the rate of filling of the mould cavity.)

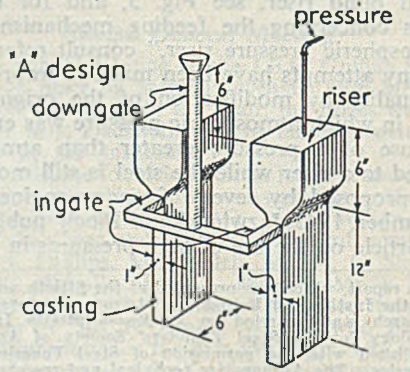


FIG. 2.—*Design "A" Experimental Casting.*

(2) Develop a low pressure, early on, and an increasingly higher pressure with time, as the molten metal loses fluidity and the feed demand becomes greater. This is particularly difficult, because the temperature of the riser is falling, and gas pressure tends to decrease when it should be increasing. The development of such a graduated series of capsules would have to be done by trial and error methods, as no data exist upon which to base performance required.

Finally, it is doubtful if the limited decrease in riser size possible with an ideal capsule behaving in an efficient manner would be sufficient to pay for the cost and inconveniences entailed in its use.

In spite of the above reasoning, there still remains the possibility of obtaining sounder castings by pressure feeding. It was the object of the present investigation to explore this possibility further, having always in mind both facets of the problem.

EXTERNAL APPLICATION OF GAS PRESSURE TO BLIND RISERS

Materials

Eight patterns were used in the experimental work. Green- and dry-sand moulds were first used in the tests, but, after it was found that pressure caused undue penetration in green-sand moulds, dry-sand moulds only were used. The steel was melted in a 1½-ton "Lectromelt" electric arc furnace, and poured from a bottom-pour ladle. All the castings were poured from either plain carbon or low-alloy steel of the following approximate composition:—

	Per cent.	
	Low alloy.	Plain carbon.
Carbon	0.35	0.27
Manganese	1.10	0.75
Silicon	0.40	0.50
Nickel	0.55	—
Chromium	0.60	—
Molybdenum	0.25	—
Sulphur	0.030	0.030
Phosphorus	0.030	0.030

Method of Application of Pressure

A diagram of the method of applying pressures is shown in Fig. 1. Pressures were regulated from a valve at the nitrogen tank, and check readings were made at an intermediate pressure gauge. Gas-tight connections led to an L-shaped pipe extending into the riser mould cavity. Pressure was applied within the riser at a predetermined time after the metal was poured. Dry sand was packed into the end of the tube projecting into the riser cavity to prevent metal flowing into the tube. Because of the ability to regulate the amount and time of application of pressure at will, it was felt that such a system would be far superior in latitude and dependability to cut and try methods than using pressure-forming capsules. The variables which could be controlled were (1) the amount of gas pressure applied, (2) the time of application of pressure, and (3) sequences of varying amounts of pressure with time.

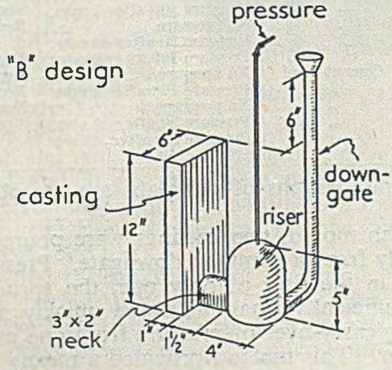


FIG. 3.—*Design "B" Experimental Casting.*

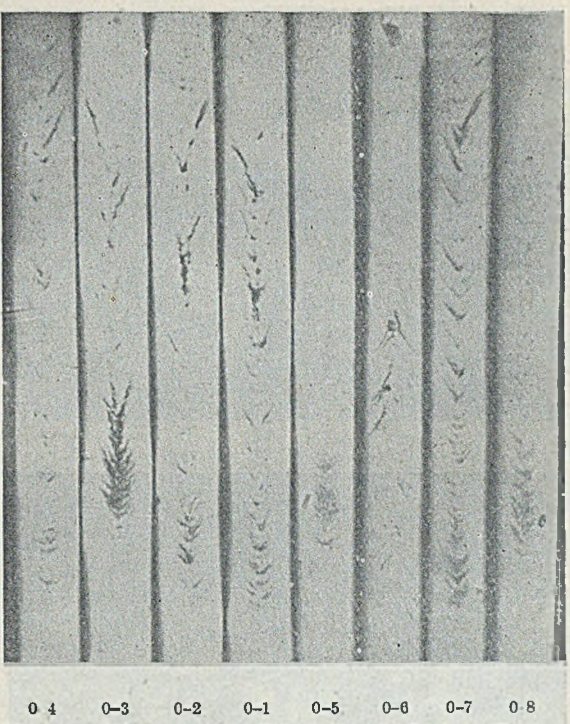


FIG. 4.—*Transverse Radiographs of Casting Designs "A" and "B,"*

Preliminary Tests

The first problem was to design a casting upon which effect of pressures could best be studied. It was felt that any beneficial effect of pressure would

TABLE I.—*Summary of Preliminary Tests, Designs "A" and "B" (Figs. 2 and 3).*

Test No.	Type of mould.	Conditions.
0-1	Green-sand	No pipe eliminator.
0-2	Green-sand	Non-exothermic pipe eliminator.
0-3	Green-sand	Exothermic compound added.
0-4	Green-sand	Open riser blinded.
0-5	Dry-sand	No pipe eliminator.
0-6	Dry-sand	Non-exothermic pipe eliminator.
0-7	Dry-sand	Exothermic compound added.
0-8	Green-sand	Blind riser (design B).

FIG. 5.—*Sectioned Blind Top Risers of " A " Design, 1 to 8, without External Gas Pressure. 1A to 8A with External Gas Pressure.*

be most easily discernable in a casting which is difficult to produce sound, using ordinary foundry techniques. Upon this basis, design A, Fig. 2, was selected. When top risers and normal techniques of gating are used for this particular casting, it is very difficult, if not impossible, to produce the casting without some centreline shrinkage.

A group of preliminary tests were made with the "A" design, the conditions for which are listed in Table I. Each test was carried out in an individual mould. In No. 0-8, a blind riser was used, as in design " B," Fig. 3. This is the only casting made from this design.

The downgate, ingate, and riser were removed and the riser cut in half with an oxygen torch. A specimen $\frac{3}{8}$ in. thick was removed from the centre of the remaining 12 by 6 by 1-in. slab with a cut-off wheel. Radiographs were taken of the section with a 150-kv. X-ray unit using standard technique. Fig. 4 shows prints of the transverse radiographs, and Fig. 5 illustrates a few representative sectioned risers.

All of the radiographs in the preliminary tests show the expected characteristic centreline shrinkage,[8] manifested by a pattern of chevron-shaped voids which point away from the direction of feeding. The least shrinkage was found in the slab fed with a blind riser at the bottom, in which temperature gradients were most favourable (casting 0-8).

All castings having top, open risers showed essentially identical widespread shrinkage. The slab is too thin to permit reorientation of temperature gradients by insulation, or even by heat applied in the riser. Since the casting was so difficult to produce sound when top risers were used, it was felt that if pressure feeding were effective, it would show up to best advantage in this type.

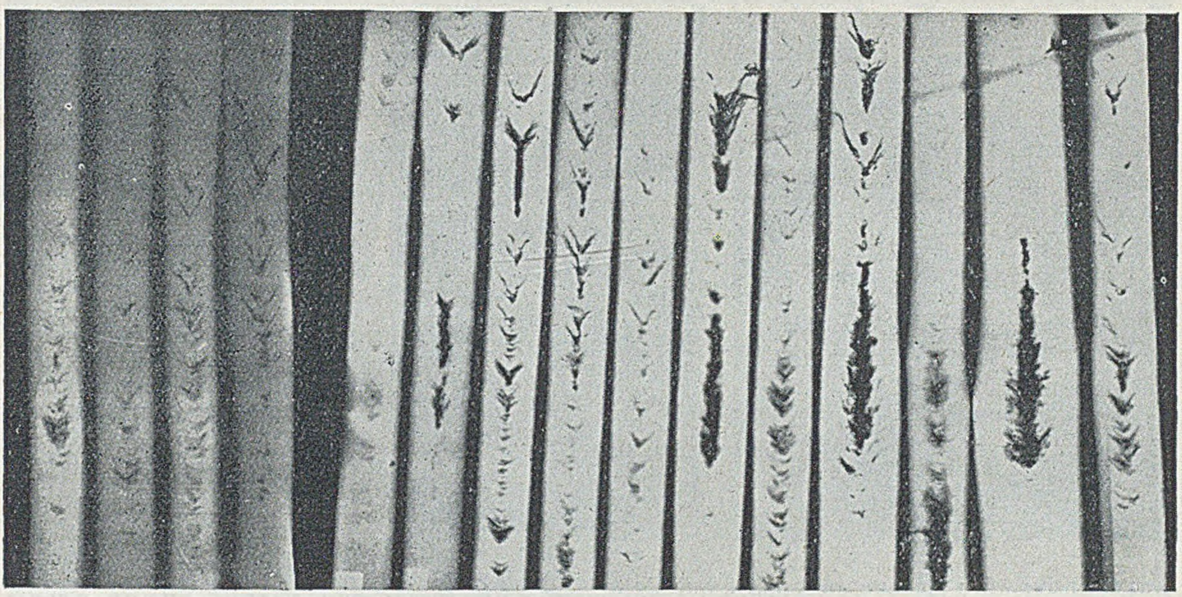
Pressure Feeding using Design "A"

The first pressure tests were conducted using the " A " design. Pressure was applied as previously described. A summary of the results is shown in Table II, photographs of typical risers are shown in Fig. 5, radiographs of the slabs are reproduced in Fig. 6.

TABLE II.—*Summary of Tests 1-20, Design " A " (pressures in lb. per sq. in.).*

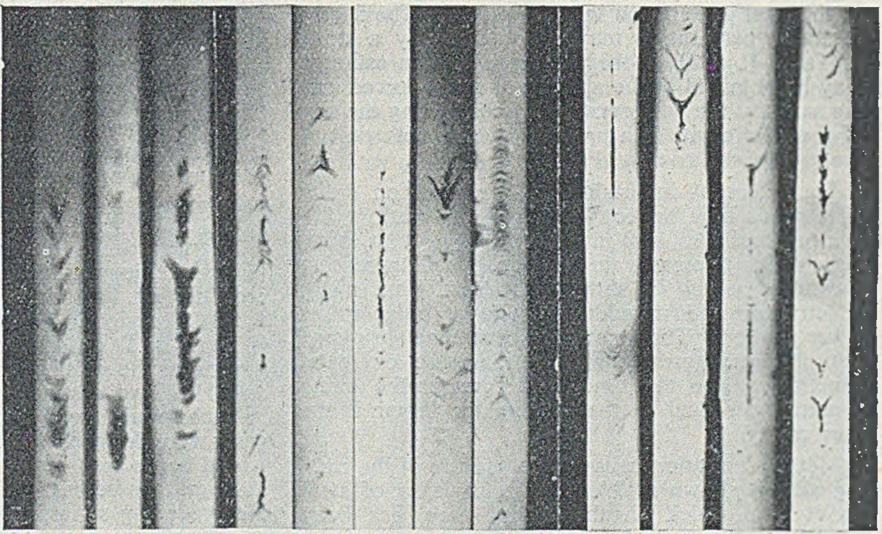
Test.	Type of mould.	Conditions.	Penetration.
1	Green-sand ..	No pressure	None
1A	,, ..	Pressure 50 after 30 secs. —steel blew out	$\frac{1}{8}$ in.
2	,, ..	No pressure	None
2A	,, ..	Pressure 50 after $1\frac{1}{2}$ min.	0 to $\frac{3}{16}$ in.
3	,, ..	No pressure	None
3A	,, ..	Pressure 50 after 2 min.. .	0 to $\frac{1}{8}$ in.
4	,, ..	No pressure	None
4A	,, ..	Pressure 100 after 2 min.	Little
5	,, ..	No pressure	None
5A	,, ..	Pressure 50 after $1\frac{1}{2}$ min.	0 to $\frac{1}{8}$ in.
6	,, ..	No pressure	None
6A	,, ..	Pressure 5 after 30 secs.. . Pressure 20 after 60 secs. Pressure 50 after 90 secs.	 0 to $\frac{1}{2}$ in. Centre bulge
7	,, ..	No pressure	None
7A		Pressure 15 after 60 secs. Pressure 50 after 90 secs. Pressure 100 after 120 secs.	 $\frac{3}{8}$ to $\frac{5}{8}$ in.
8	,, ..	No pressure	None
8A	,, ..	Pressure 100 after $2\frac{1}{2}$ min.	Broke through mould
10	,, ..	No pressure	None
10A	,, ..	Pressure 80 after $2\frac{1}{4}$ min. Metal did not fill riser	None
11	,, ..	No pressure	None
11A	,, ..	Pressure 50 after 1 min.. .	$\frac{3}{16}$ to $\frac{1}{4}$ in. Lower bulge
12	,, ..	No pressure	None
12A	,, ..	Pressure 10 at once .. Pressure 15 after 45 secs.	— None
13	,, ..	No pressure	None
13A	,, ..	Pressure 20 after 30 secs.	None
14	,, ..	No pressure	None
14A	,, ..	Pressure 20 after 1 min.. .	None
15	,, ..	No pressure	None
15A	,, ..	Pressure 100 after 2 min.	None
16	,, ..	No pressure	None
16A	,, ..	Pressure 135 after $2\frac{1}{2}$ min.	None
17	Dry sand ..	No pressure	None
17A	,, ..	Pressure 100 after 2 min.	Slight
18	,, ..	No pressure	None
18A	,, ..	Pressure 20 after 30 secs. Pressure 100 after 2 min.	 Slight
19	Cement-sand	No pressure	None
19A	,,	Pressure 100 after 2 min.	None
20	,,	No pressure	None
20A	,,	Pressure 20 after 30 secs. Pressure 100 after 120 secs.	Slight

In each mould, two castings were poured simultaneously from a common downgate. Pressure was applied in the riser of only one, the sprue system being sufficiently small to freeze quickly and prevent any carry-over of pressure from one casting to the other. This method provided a means of comparison of a pressure-fed and a gravity-fed casting,



1 1A 2 2A 3 3A 4 4A 5 5A 6 6A 7 7A 8

FIG. 6.—*Transverse Radiographs of Castings of Design "A" with and without the Application of Gas Pressure. Letter "A" designates Gas-pressure Application.*



10A 11 11A 12A 13A 14A 15A 16A 17A 18A 19A 20A

both poured at the same time under identical conditions except for pressure. Throughout the experiments, the pressure fed castings were designated by a number plus the letter "A," and the corresponding gravity-fed casting by the number only.

At a predetermined time after pouring (as observed with a stop watch), the pressure was applied by adjusting the valve on the nitrogen tank. The reading of the gauges on the tank and on the board were always compared and at no time were discrepancies between the readings found. Gas pressure was maintained in the riser for several minutes until the casting had solidified.

In the first casting, made by applying a pressure of 50 lb. per sq. in. (1A), the steel blew out the downgate immediately after the pressure was applied. The gas pressure was released at once until a weight could be placed upon the downgate, after which the pressure was re-applied. This loss of metal may be seen by observing the large riser cavity (1A) Fig. 5. To prevent such further hazardous conditions, a 50-lb. steel weight was placed always on the downgate before applying gas pressure.

All castings of the "A" design, with or without gas pressure, contained centreline shrinkage. The effect of gas pressure applied to the risers may be seen from radiographs of 1 and 1A, 2 and 2A, etc., Fig. 6. In most cases, a pressure-fed casting shows even more centreline shrinkage than its corresponding gravity-fed mate. The gravity-fed castings always showed the same shrinkage conditions, so only the pressure-fed castings were cut and radiographed, after No. 8, to save machining time.

Penetration of steel into the green-sand moulds

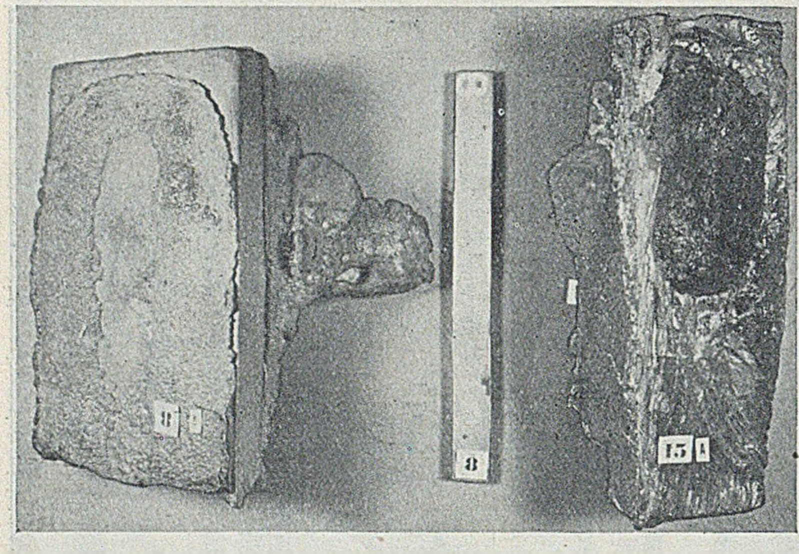


FIG. 7.—*Metal Penetration into the Sand Mould, caused by Gas Pressure.*

was extensive when pressure was applied quickly to the risers. Since the metal penetrated rather uniformly into the sand on both sides of the plate casting, the thickness of the plate is a rough measure of the steel penetration into the mould. The degree of metal penetration may be obtained by a study of Table II or from the radiographs. An estimate may be obtained of the amount of metal forced into the sand by the gas-pressure, by comparing the size of the riser cavity in a pressure casting with that of the gravity-fed casting, Fig. 5.

The effect of increasing gas-pressures on metal penetration may be seen by comparing castings 4A, 5A, 6A, and 7A. The radiographs show that metal penetration increases in the order of increasing pressure, casting 7A showing at least ½ in. metal penetration, and in addition, a large bulge in its lower portion. The amount of centreline shrinkage also increases greatly with an increase of metal penetration into the sand. The greater the metal penetration found in the casting, the larger is the riser cavity.

Metal penetration caused by a rupture of the casting skin is shown in 8A, Fig. 7. A layer of steel about ¼ in. thick on the casting face, has been forced into the mould. Also, at one corner of the casting, the sand gave way, and the metal penetrated several inches into the mould. The riser for casting 8A, Fig. 5, shows a large, smooth cavity resulting from the metal being forced into the mould.

It was decided to resort to lower pressures after finding that the high pressure used in examples 1A to 8A, design "A," added little except trouble. It was also decided to ram the moulds very hard in order to decrease penetration. Instead of using gas-pressure of 50 to 100 lb. per sq. in., lower pressures of 10 to 20 lb. per sq. in were used, but were applied at an earlier time. In group 11A to 16 A, Fig. 6, metal penetration into the sand was almost eliminated by especially hard ramming. An examination of the radiographs shows that the centreline shrinkage was somewhat less than had been obtained previously, but it had not been eliminated.

In order to reduce further the penetration of the metal into the sand, dry-sand and cement-sand moulds were used. Castings 17A and 18A were made in dry-sand; 19A and 20A in cement-sand moulds. The radiographs show that the penetration and bulging has been eliminated, but the characteristic centreline shrinkage is still present. This series of tests indicates that it is not possible to improve the feeding of top-risered plate castings 1-in. thick by using gas-pressure in the risers. The slab of the "A" design is too thin for attainment of directional solidification when top-risered.

A final attempt was made to feed the "A" design casting by using 15 lb. of highly exothermic pipe-eliminator. Steel was poured into the mould to about 1 in. above the riser/casting junction, after which exothermic material was added to the molten steel. A radiograph of the plate casting is shown in Fig. 11, casting No. 30. Centreline shrinkage was markedly improved over that obtained when gas pressure was applied, but was not eliminated.

Pressure Feeding using Design "C"

The next design chosen for study was a rectangular parallelopiped, 12 in. high, with a 3½-in. square cross-section. A sketch of the casting is shown as the "C" design in Fig. 8, a summary of conditions is given in Table III, and photographs and radiographs of the castings are illustrated in Figs. 9, 10 and 11. Two castings were poured simultaneously in each mould from a common downgate. The ingates were designed to solidify quickly, so that there would be no transfer of pressure to the gravity-fed castings. These castings are numbered similarly to the preceding series, since the same choice of gas pressures were used. The subscript "C" indicates the "C" design.

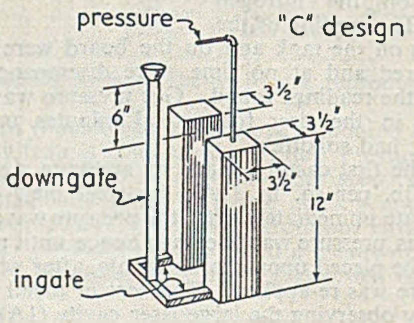


FIG. 8.—*Design "C" Experimental Casting.*

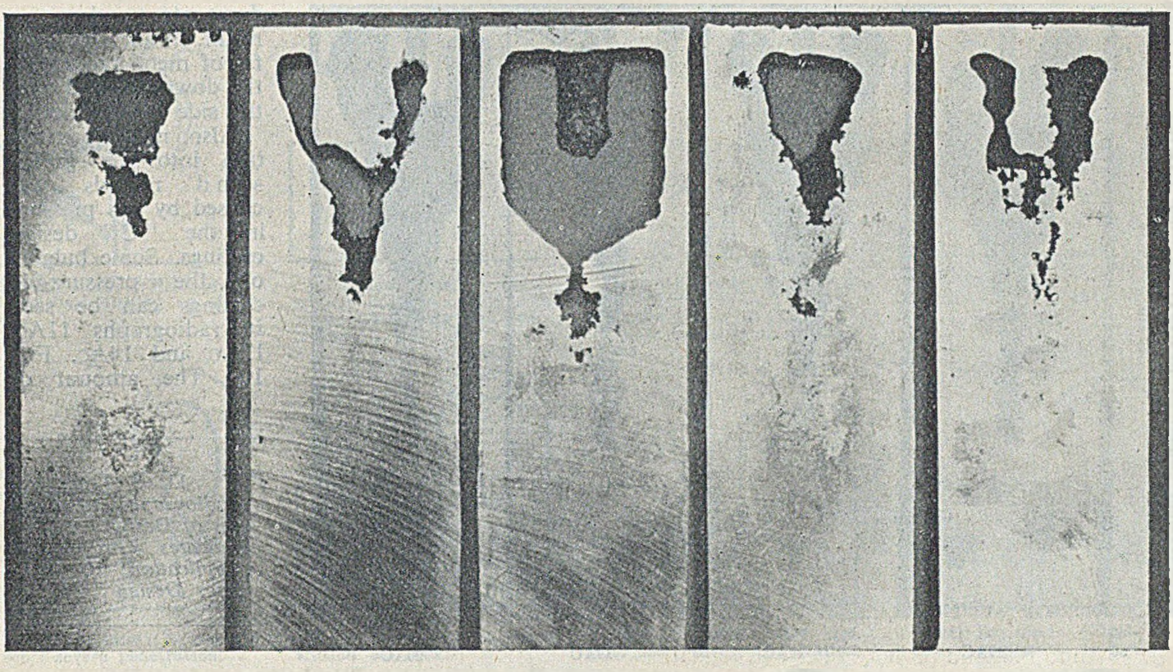


FIG. 9.—*Sections from the "C" Design Castings.*

Gas pressure was applied as before by means of a pipe extending 2 in. into the cavity. The heavy weight was used on the downgate to prevent loss of metal from the mould. As there was no riser, as such, the upper one-third of the section may be considered riser, and the lower two-thirds the casting to be fed. This design was chosen to ensure the same rate of build-up of skin thickness in the riser (pressure chamber) as in the casting. The chief purpose of these tests was to determine the type of

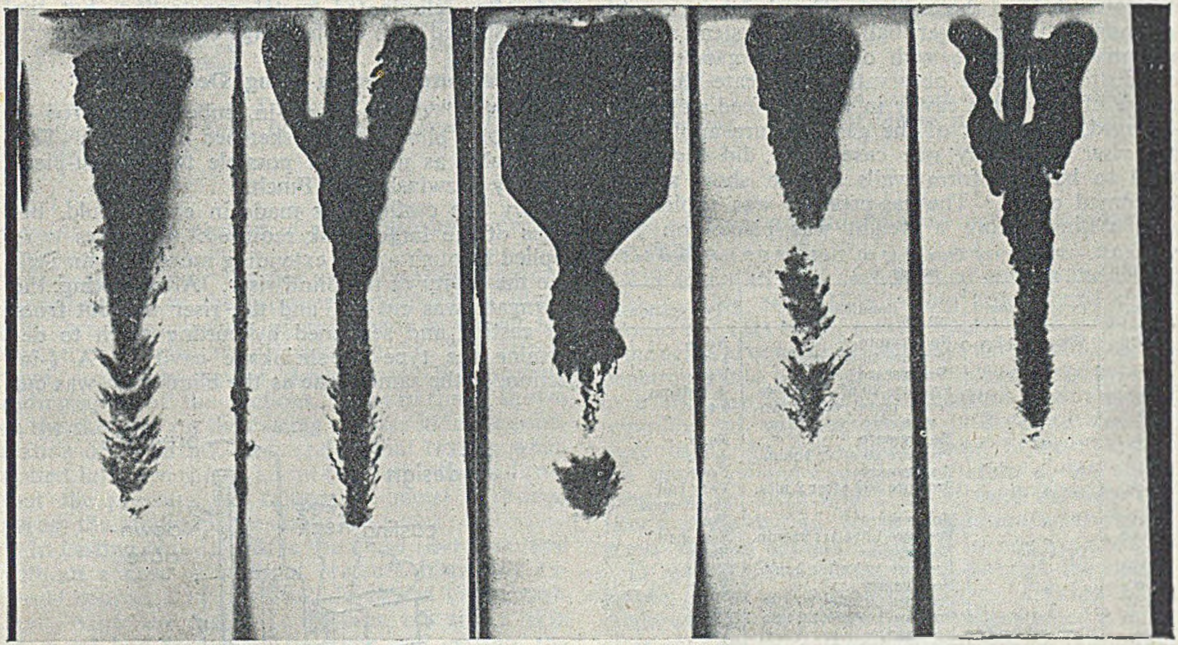
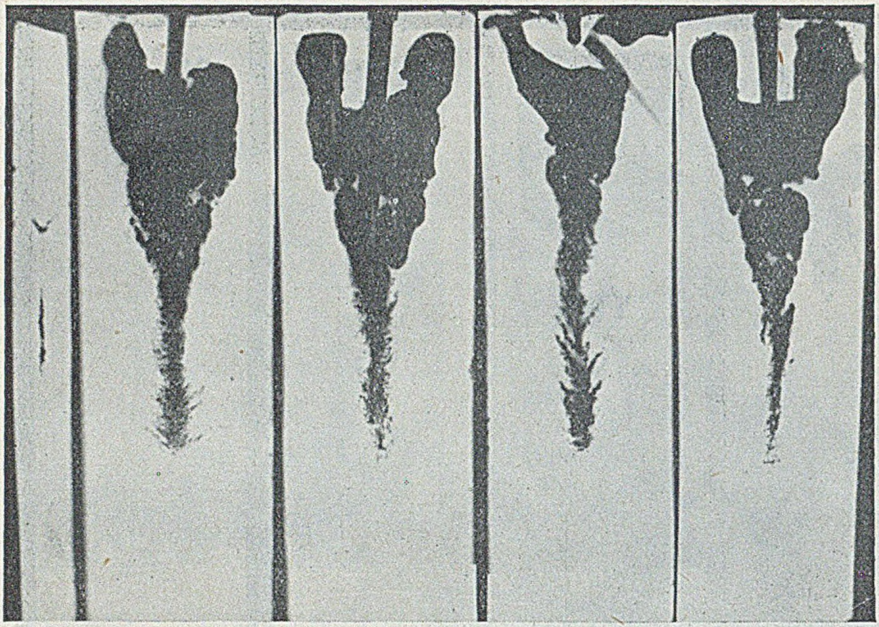


FIG. 10.—*Transverse Radiographs of Castings of Design "C." A indicates Gas-pressure Application; C indicates Design "C."*



30 17AC 18AC 19AC 20AC

Fig. 11. — *Transverse Radiographs of Castings of Design "C"; A indicates Gas-pressure Application; C indicates Design "C."*

downgate, and as a result, about one cupful of metal ran out of the downgate and over the side of the mould. Also, metal penetration into the green-sand moulds was caused by gas pressure in the "C" design castings. Some bulging of the pressure-fed castings can be seen in radiographs 11Ac, 13Ac and 14Ac, Fig. 10. The amount of shrinkage cavity obtained with the application of greater-than-atmospheric pressure in a large cross-section.

Sections $\frac{1}{8}$ in. thick were cut from the centre of the casting and radiographed. The shrinkage cavity had a characteristic carrot-shape when the casting was produced without gas-pressure (see 11c, Fig. 9), showing some secondary shrinkage extending into the lower half of the casting. The shrinkage cavity extends into the lower half of the system and is essentially the same with or without gas-pressure application. These observations indicate that the shape of shrinkage cavity in normal feeding is not changed, regardless of the gas pressure applied in the riser. In only one case, 13Ac, did the riser tend to have uniform walls and to show a flat-bottomed cavity. The gas-pressure was applied to this casting before a weight was placed on the penetration is given in Table III. When a pressure of 100 lb. per sq. in. was applied two minutes after pouring, the green-sand gave way, metal penetrated 2 in. into the mould as shown in 15Ac, Fig. 7, and a large cavity was produced. With 120 lb. per sq. in. pressure applied after two and a half minutes, metal also penetrated very badly into the sand. The use of dry-sand and cement-sand moulds reduced and often eliminated metal penetration, but the carrot-shaped type of shrinkage cavity persisted.

Table III.—*Summary of Tests 11 to 20, Design "C" (pressures in lb. per sq. in.).*

No.	Type of mould.	Conditions.	Penetration.
11c	Green-sand ..	No pressure	None
11Ac	,, ..	Pressure 10 at once ..	$\frac{1}{8}$ in.
13c	,, ..	No pressure	None
13Ac	,, ..	Pressure 20 after 30 secs. Some metal out downgate	$\frac{1}{16}$ bottom 0 top
14c	,, ..	No pressure	None
14Ac	,, ..	Pressure 20 after 1 min...	$\frac{1}{16}$ in.
15c	,, ..	No pressure	None
15Ac	,, ..	Pressure 100 after 2 min.	Very bad Burnt open
16c	,, ..	No pressure	None
16Ac	,, ..	Pressure 120 after $2\frac{1}{2}$ min.	Very bad
17c	Dry-sand ..	No pressure	None
17Ac	,, ..	Pressure 100 after 2 min.	Slight
18c	,, ..	No pressure	None
18Ac	,, ..	Pressure 20 after 30 secs. Pressure 100 after 2 min.	Slight
19c	Cement-sand	No pressure	None
19Ac	,,	Pressure 100 after 2 min.	None
20c	,,	No pressure	None
20Ac	,,	Pressure 20 after 30 secs. Pressure 100 after 2 min.	None

Pressure Feeding using Design "D"

The "D" design is a 4-in. cube casting, fed by means of a blind riser, as sketched in Fig. 12. This was scaled as nearly as possible to the test-piece used by Jazwinski and Finch.

Only one casting was made in each mould, because of the larger flask required. Pressures were applied through a pipe extending more than an inch into the cavity of the blind riser. After casting, the downgate was cut off, and the riser was cut from the casting and sectioned by cutting torch to determine the type of shrinkage cavity. A $\frac{1}{8}$-in. section, in the same plane as the blind riser, was cut

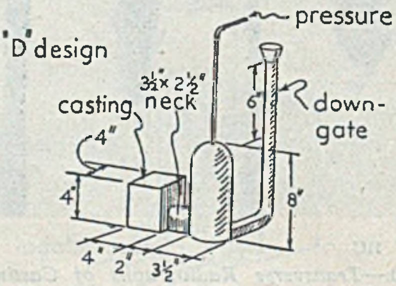
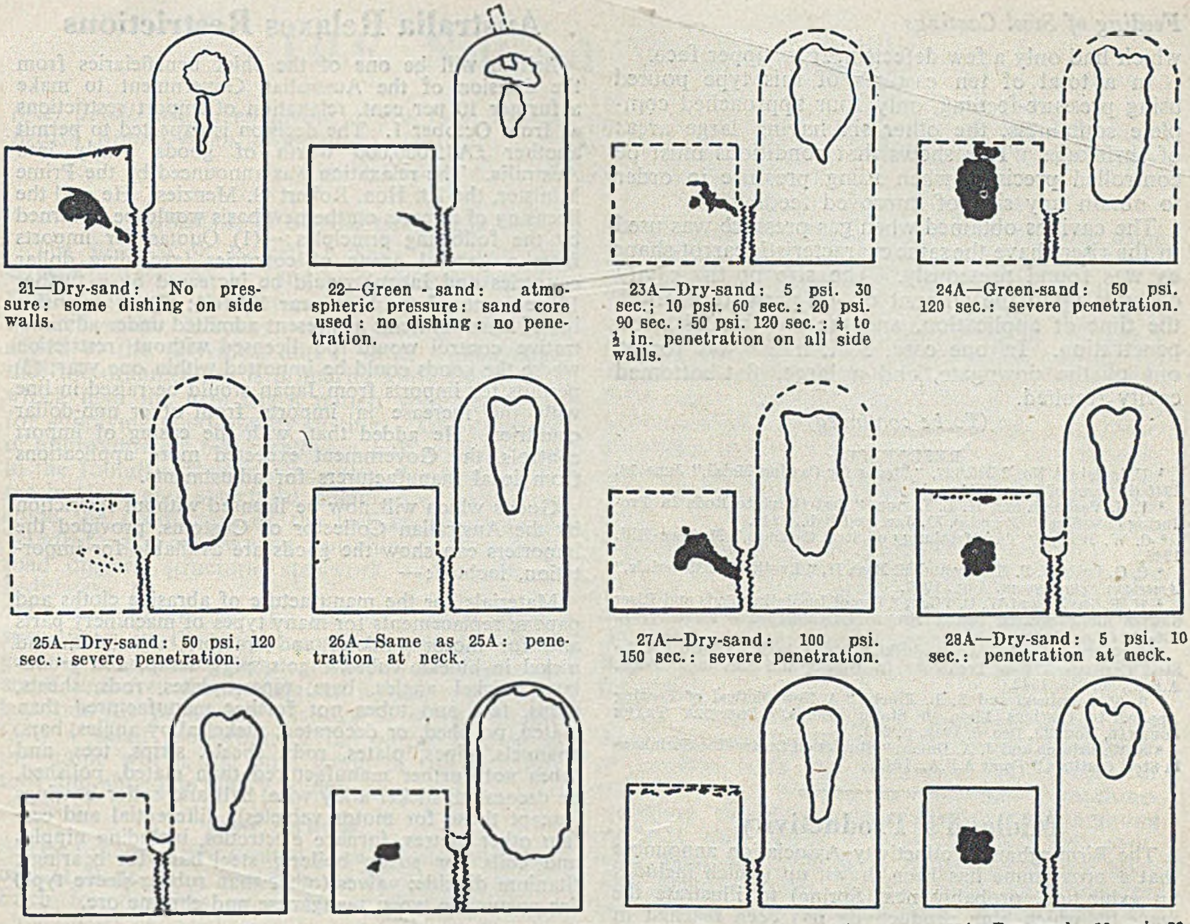


Fig. 12.—*Design "D" Experimental Casting.*



21—Dry-sand: No pressure: some dishing on side walls.

22—Green-sand: atmospheric pressure: sand core used: no dishing: no penetration.

23A—Dry-sand: 5 psi. 30 sec.; 10 psi. 60 sec.: 20 psi. 90 sec.: 50 psi. 120 sec.: $\frac{1}{4}$ to $\frac{1}{2}$ in. penetration on all side walls.

24A—Green-sand: 50 psi. 120 sec.: severe penetration.

25A—Dry-sand: 50 psi. 120 sec.: severe penetration.

26A—Same as 25A: penetration at neck.

27A—Dry-sand: 100 psi. 150 sec.: severe penetration.

28A—Dry-sand: 5 psi. 10 sec.: penetration at neck.

29A—Dry-sand: 10 psi. 10 sec.: severe penetration.

30A—Dry-sand: 10 psi. 10 sec.: metal forced out of sprue: severe penetration.

31A—Dry-sand: 10 psi. 120 sec.: slight penetration.

32A—Dry-sand: 10 psi. 30 sec.: slight penetration.

FIG. 13.—*Sketches of Transverse Radiographs of "D" Design. Dotted lines indicate Areas of Metal Penetration. Solid Black Areas show Shrinkage in the Casting. Outlined Areas show Shrinkage in the Riser.*

from the central portion of the cube with a mechanical saw.

Sketches of riser cavities and of casting sections reproduced from the transverse radiographs, along with brief descriptions of the conditions used for this series of tests, are given in Fig. 13. The defects were accurately scaled down from the original radiographs of the sections. Dotted lines shown in the sketches on the casting or riser indicate penetration of metal into the sand in that region; when dotted lines are shown about the neck, they indicate that the pressure has forced the metal to bridge across the sand gap just above the neck.

In casting No. 21, where the blind riser was used without a core or without pressure from any external source, a large shrink developed in the casting. After the ingate had frozen off and a skin of metal had formed in the riser and casting, the partial vacuum within the system and the force of atmospheric pressure from the outside caused a "dishing" or indentation effect upon the faces of the cube.

The insertion of a vertical sand core in the blind riser (casting No. 22), allowing atmospheric pressure to exert its effect, greatly improved the casting, although the cope defect was not eliminated. Metal penetrated into the sand at some place in the system in every case in which gas-pressure was applied, regardless of whether green- or dry-sand moulds were used. In some cases, metal bridged across the sand gap and caused penetration at the neck, even though there was 2 in. of sand between the riser and the casting. More penetration was found in green- than in dry-sand moulds, as was expected.

In several of the pressure-fed castings, the radiographs show very little shrinkage. Casting 25A, made with 50 lb. per sq. in. pressure applied 2 min. after pouring, showed very little shrinkage, although penetration was severe. With a pressure of 10 lb. per sq. in. after 2 min., a casting resulted (31A)

Feeding of Steel Castings

which had only a few defects near its upper face.

In a total of ten castings of this type poured using pressure-feeding, only four approached complete soundness, the other six having large areas of shrinkage. This shows that conditions must be controlled precisely when using pressure in order to obtain any sign of improved feeding.

The cavities obtained when gas pressure was used in the risers have the same characteristic carrot-shape as was found previously. The size of the cavity depends upon the amount of gas-pressure exerted, the time of application, and the amount of metal penetration. In one case, 30A, metal was forced out of the downgate, and a large, flat-bottomed cavity resulted.

(*To be continued*)

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Midland's Productivity

The Birmingham Productivity Association announces that a programme has been drawn up (which includes an exhibition, probably next Spring) to illustrate the ways by which high productivity has been reached in many Birmingham factories. Individual industries are to be encouraged to set up their own productivity committees, inter-works visits are to be arranged, and the Association will help management, technical and scientific bodies to serve their members and recruit new members.

Individuals are to be encouraged to give advice in their own special fields by becoming associates of the organization and members of an advisory panel of specialists. A "clearing house" to deal with questions on productivity problems is to be set up at the Birmingham Chamber of Commerce, where the Association will have an office and permanent staff. A number of firms are already giving the Association financial help to supplement the small grant it receives from the British Productivity Council.

Film Review

"The Stockton Test."—This short film has been produced by Allied Ironfounders Limited to illustrate how reasonably-well-built sub-standard houses can be converted into decent little homes by the installation of modern heating, washing, bathing and cooking appliances. The producer of the film was lucky in having Mr. W. T. Wren as the representative of the enlightened landlords, as he is so obviously "at home" on the screen, but he was not so fortunate in the other characters (with one quite good exception—"grandma") as it just so happened that they were not natural actors. Nevertheless, the message of the film rose superior to the cast and was incisive in its presentation.

Australia Relaxes Restrictions

Britain will be one of the chief beneficiaries from the decision of the Australian Government to make a further 10 per cent. relaxation of import restrictions as from October 1. The decision is expected to permit another £A45,000,000 worth of goods yearly into Australia. The relaxation was announced by the Prime Minister, the Rt. Hon. Robert G. Menzies. He said the licensing of imports on the new basis would be governed by the following principles:—(1) Quotas for imports from a general group of countries (excluding dollar countries and Japan) would be increased by a further 10 per cent. of the base year 1950-51; (2) an extensive list of essential items at present admitted under administrative control would be licensed without restriction where the goods could be imported within one year; (3) permits for imports from Japan would be raised in line with the increase in imports from other non-dollar countries. He added that, with the easing of import controls, the Government expected more applications from local manufacturers for adjustments.

Goods which will now be licensed without restriction by the Australian Collector of Customs, provided the importers can show the goods are available for importation, include:—

Materials for the manufacture of abrasive cloths and papers; replacements for many types of machinery parts and for motor vehicles and tractors; aluminium and nickel in blocks, cubes, ingots, pigs, scrap, and granulated, nickel angles, bars, pipes, plates, rods, sheets, strips, tees and tubes not further manufactured than plated, polished, or decorated; nickel alloy angles, bars, channels, pipes, plates, rods, sheets, strips, tees, and tubes not further manufactured than plated, polished, or decorated; nickel alloy wire, ball and roller bearings (except those for motor vehicles); differential and certain other metres, furnace electrodes, including nipples and coils for sugar boilers; steel balls for bearings; titanium dioxide; valves (other than rubber-sleeve type) for pneumatic tyres; manganese and chrome ore.

U.K. Trade in August

Exports from the United Kingdom in August, which contained only 25 working days and was affected by industrial holidays, were valued at £198,100,000; imports were also low, at £249,200,000. The best comparison with earlier periods is obtained by taking July and August together. The average of exports for the two months was £216,300,000, compared with an average of £210,000,000 in the second quarter of the year and £208,500,000 in the first. The average of imports, £271,100,000, was 7 per cent. lower than the level of the second quarter and slightly below the level of the first quarter.

Re-exports in August totalled £8,800,000 and the excess of imports (c.i.f.) over exports and re-exports (f.o.b.) was £42,300,000. In July and August the excess averaged £46,200,000.

U.K. exports to North America in August declined to a provisional total of £24,500,000, exports to Canada accounting for £11,800,000 and exports to the U.S.A. for £12,700,000. The average for July and August together, at £27,300,000, was 8 per cent. below the level of the second quarter, although well above that of the first quarter. Exports to the U.S.A. in July and August were maintained at the second quarter's average of £13,900,000, but exports to Canada averaged £13,300,000 a month, 15 per cent. below the high level of the second quarter.

I.B.F. National Works Visits

Brief details are given below of the four other foundries to be visited by parties of the Institute of British Foundrymen to-morrow. Particulars of the remainder of the foundries which are to receive members were given in last week's JOURNAL.

S. RUSSELL & SONS, LIMITED

The firm of S. Russell & Sons, Limited, was started in Leicester in 1864 as a brass foundry by Samuel Russell, grandfather of the present generation of senior directors. Ironfounding was soon added to the activities, and it is as ironfounders that the organization is primarily known to-day, in which field the firm has a nation wide reputation for supplying good-quality castings. Out of a total of approximately 600 employees, half are employed in the foundry departments; other departments are mechanical and structural engineering (which include the production of the well-known range of "Hydrofeed" cold-sawing machines), couplings, road diggers, structural steelwork and fabricated bedplates.

In their foundries, the company have always specialized in the production of castings for the general engineering trade, where quantities are small, and even the mechanized section is primarily laid out for producing castings in small batches. Only a small proportion of the output is used in the home works, the bulk going to the machine-tool and shoe-machinery trades.

Four Sections

The foundries are located in two separate works, one at Bath Lane, and one at Bonchurch Street. Each foundry has two sections; the Bath Lane foundries consist of: (*a*) A general foundry using the normal methods of production for hand-moulded castings ranging from a few ozs. up to 2 tons in weight, by green- and dry-sand processes, the metal being melted by a cupola, and (*b*) a foundry devoted to making alloy-iron castings for which the metal is melted by a 1-ton creosote-pitch-fired rotary furnace. This foundry uses ordinary hand-moulding methods, but also has a machine-moulding section. The products of this foundry include high-duty cast irons up to 24 tons per sq. in. tensile, Ni-Resist, Ni-Hard and other compositions. A basic-lined cupola has recently been installed, but is still in the experimental stage.

The company are licensees for the manufacture of S.-g. cast iron, and rapid strides are being made in its production. Also at Bath Lane are situated a well-equipped laboratory, a test house and heat-treatment shop. These serve the whole of the foundries.

The Bonchurch Street foundries have been developed over the last 30 years for the production of castings with the minimum employment of skilled labour. Starting as an ordinary machine-moulding foundry, using mainly hand-ramming methods, this section is now equipped with overhead sand distribution, a fully-mechanized floor with nine machines, making boxes up to 16- by 14-in., and a semi-mechanized section with six machines making boxes up to 46- by 28-in. The coreshop contains core-blowers, and the layout of the fettling department is of special interest to visitors. Unit-type synthetic sand and resin-bonded cores are used throughout this section.

The other section at Bonchurch Street is concerned with making machine-tool castings which are too large for the mechanized plant, and which may go up to 2-tons each. Here all the moulds are made by a travelling impellor-type ramming machine (Fig. 12), with automatic sand feed. The moulds are dried at present completely, but experimental plant for skin drying is installed. The whole of the Bonchurch Street foundry is supplied with metal from a pair of 36-in. dia. cupolas, running all day (alternately). The charge collection method and weighing system here is worthy of particular examination by the visiting party.

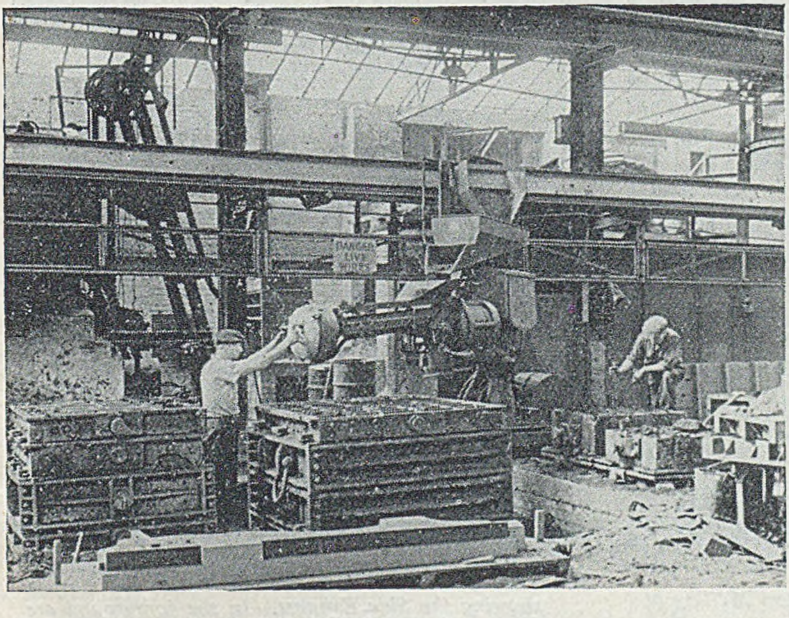


FIG. 12.—*Motive-type Impellor Ramming Machine for Heavy Moulds at the Bonchurch Street Foundry of S. Russell & Sons, Limited.*

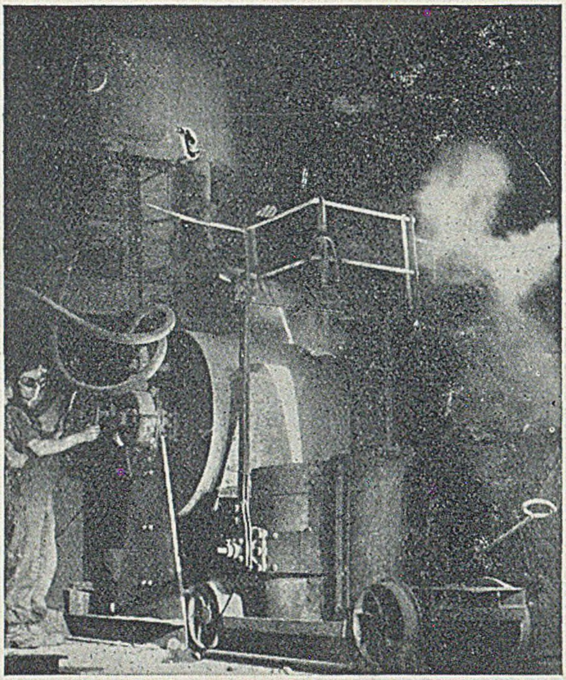


FIG. 13.—*Metal being delivered from the Cupola to a Barrel-type Receiver and in turn to a Teapot Ladle at Lloyds (Burton), Limited.*

LLOYDS (BURTON), LIMITED

Lloyds (Burton) Limited is a subsidiary company of F. H. Lloyd & Company Limited, of Darlaston. The foundry was built by the Ministry of Supply during the last war for the casting of carbon and manganese steels but was not used as such until early in 1945. For two years, the production was entirely devoted to steel, but in 1947 it was decided to change to high-duty irons. The market trends have again dictated a change and at present high-duty and spheroidal-graphite irons, and alloy- and carbon-steel castings are being manufactured.

The melting plant consists essentially of (*a*) two 6-tons per hour cupolas with tilting receivers for the high-duty irons (Fig. 13), and (*b*) one 3½-ton electric-arc furnace for steel castings (Fig. 14), and one Tropenas converter for use as a stand-by. Metal is transported by monorail or overhead crane to the casting point, in bottom-pour ladles for steel and in teapot-spout ladles for the iron.

Moulding and Coremaking

The moulding sand is knocked out over Sterling shakers (Fig. 15), and carried by belt conveyors through magnetic separators and screen to a desilting plant, where it is cooled and the "fines" are drawn out. From here it passes through storage hoppers to the Simpson mills and then through a "Royer" to the moulding machines. The moulding machines are mainly of the shockless jolt-squeeze type for pin-lift moulds, with Pneulec roll-overs and an impellor/rammer for the heavier boxes. All moulds are transported on roller con-

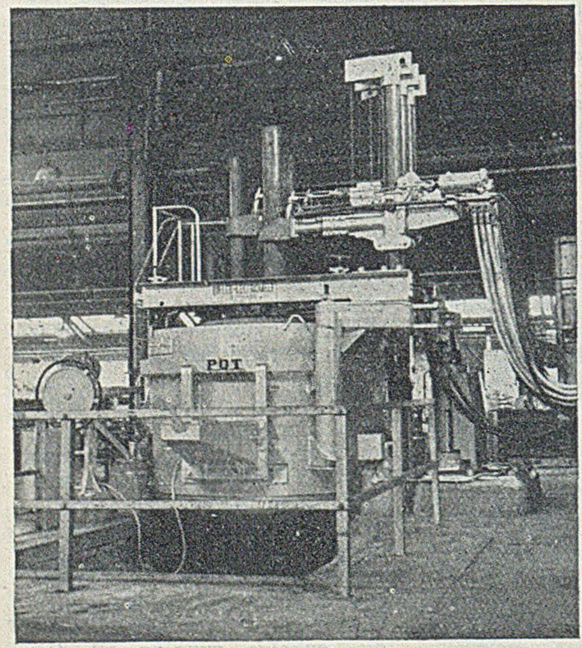
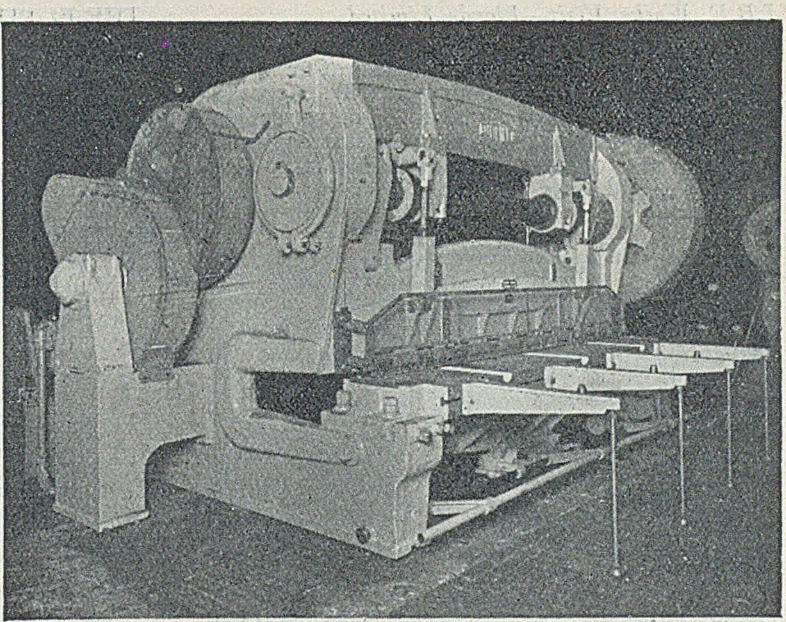


FIG. 14.—*Electric-arc Furnace for Steel Melting at Lloyds' Foundry.*

FIG. 15.—*One of the Knock-out Points at Lloyds, showing the Side Exhaust. In the foreground are Hooks of the Pendulum-type Casting Conveyor.*

FIG. 17.—*Guillotine Shears, capacity 11 ft. by ⅝ in., manufactured by the Butterley Company for New Zealand. This Job, which weighs 30 tons, is representative of the Firm's Products.*



veyors and after casting are lifted by a "humper" from which they run by gravity to the shake-out.

The core-shop has undergone a major change in the last few years and the majority of the cores are now being blown. Women operate most of the core-blowers and have acquired a very high degree of skill. The cores are carried to the vertical, tray-type core-stoves by a pallet conveyor, which also returns the core plates and drying shells to the operators. Castings are taken from the shake-out by pallet conveyor and after cooling are carried by a pendulum conveyor (Fig. 16) into a Wheelabrator chamber where they are shot-blasted by four impellor wheels while revolving slowly. After grinding and chipping, the steel castings are heat-treated in a bogie-hearth furnace fitted with quenching tank, and are then inspected, ready for transport.

Castings in iron and steel of up to 3½ tons have been made in the foundry for use in the automobile, agricultural and general-engineering industries, and quantity production or jobbing work is equally catered for. Reorganization and expansion is taking place continually and plans are in hand for installing addition sand plant, extending the core-shops and main foundry bays, erecting a shell-

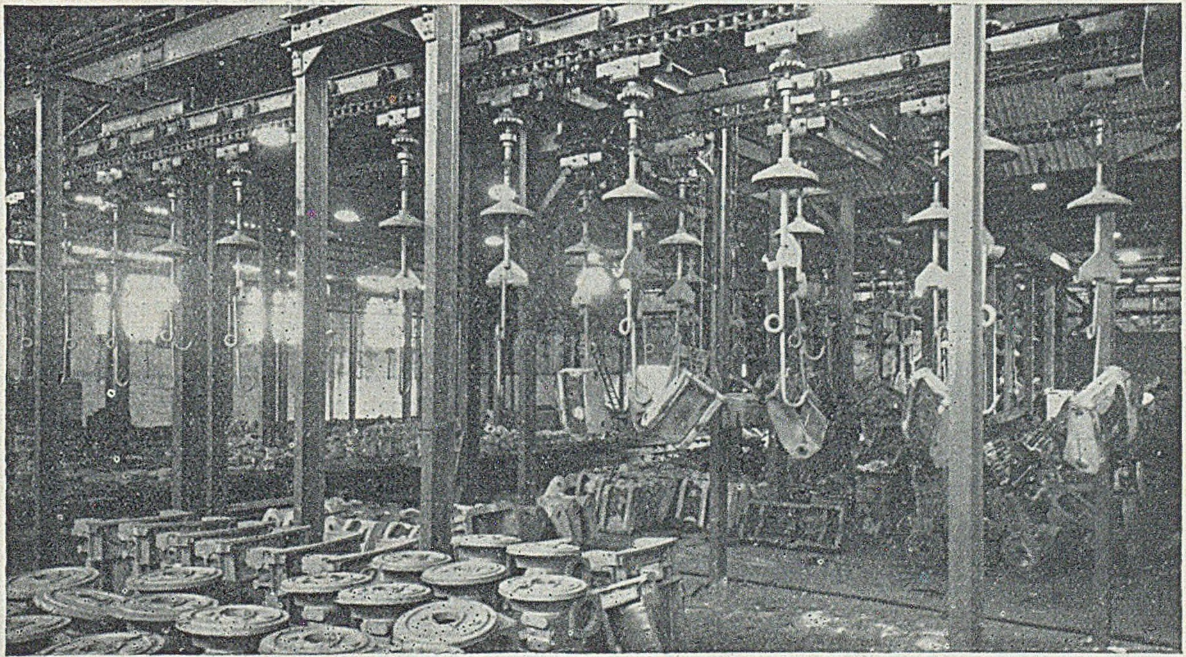


FIG. 16.—*View of Part of the Pendulum Conveyor at Lloyds, taking Cooled Castings continuously through the Wheelabrator Chamber.*

I.B.F. Works Visit—Lloyds Limited

moulding shop, installing additional heat-treatment stoves and increasing machining capacity. Approximately 500 workers are employed on day and night shift, and are provided with adequate canteen, washing and shower-bath facilities, whilst first-class sports field and other recreational facilities are also provided.

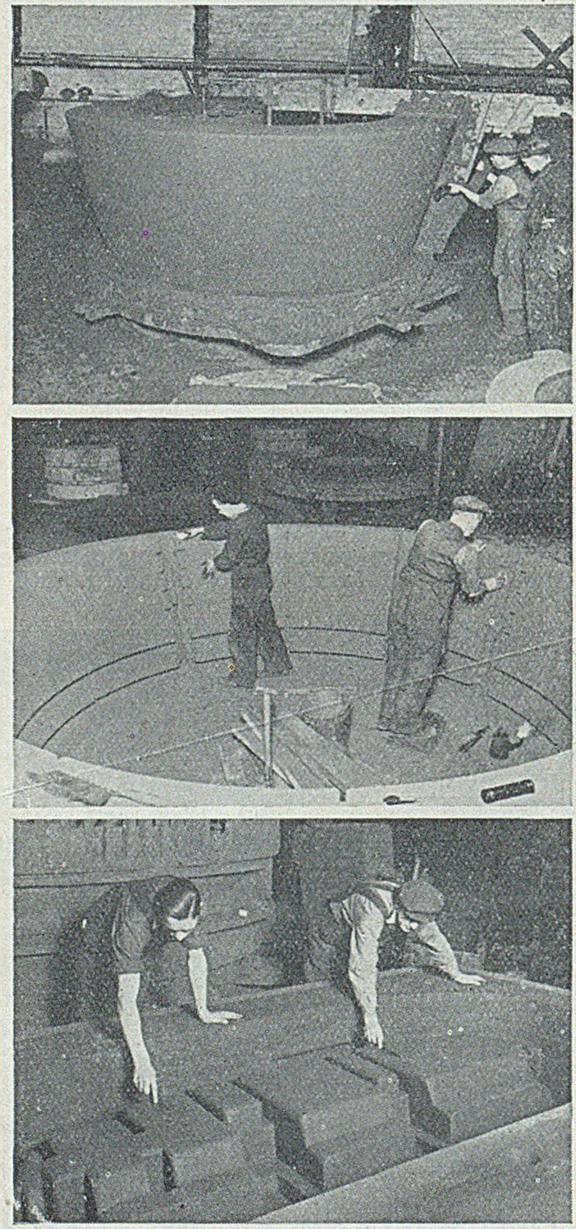


FIG. 18.—*Views of Three Large Moulds in the Course of Construction at Butterley Foundry. In each case, a Young Apprentice is working with and receiving instruction from a Highly-skilled Moulder.*

THE BUTTERLEY COMPANY LIMITED

The Butterley Company was founded in 1790 to operate coal workings on the Butterley estate, then recently acquired by Francis Beresford and Benjamin Outram. Two years later the Butterley Ironworks were erected, and at the beginning of the 19th century had already reached considerable proportions. The original members of the company were Benjamin Outram, William Jessop, Francis Beresford, and John Wright. Outram spent his life in the construction of roads, canals, and railways (*i.e.*, wagon-ways where, to facilitate its passage, the wagon ran on some form of smooth, hard surface), by substituting his own invention of the flanged plate of cast iron for the wooden ways previously in use, so that the flat wagon wheels were kept to the track. Jessop, of Butterley Hall, the engineer of the Cromford Canal, improved upon Outram's invention in his edge rail, which was introduced to avoid the objection to Outram's outstanding flanges where a road was crossed. Jessop reversed Outram's system, attaching the flange to the wheel, so inventing the flanged railway wheel which is now standard practice throughout the railways of the world. Both Outram and Jessop were close associates of Telford in many enterprises, notably the Shropshire Canals, with their famous cast-iron aqueducts, in the Caledonian Canal, and in a project to replace the old London Bridge by an iron bridge with a single span of 600 ft., and in inventions concerning pipes for conveying water. Wright, another of the founder members of the company, took a part in another transport development—the steam railway.

Notable Work

The mid-years of the century saw a considerable growth both of the plant and the scale of its products. In 1833 a record of the locality states that the employees of the company then numbered 1,500. At the Great Exhibition of 1851 were exhibited rails of 75 lb. section and 108 ft. long, and at about the same period iron beam-plates were made 7 ft. wide, 30 ft. long, and $2\frac{3}{4}$ in. thick—no mean achievements for their day. The early association of The Butterley Company with all forms of transport has been reflected in many of its notable engineering feats. Among these are the cast-iron work for (the first) Vauxhall Bridge, the great roof over the quay and other work at the West India Docks; bridges and lock-gates of the Caledonian Canal; cast-iron work for the dockyard of Sheerness, and for the harbours and docks at Dublin and Leith. Butterley also produced the large main pipe for Edinburgh's early water and gas undertakings. Pipes laid in Stamford in 1825 were raised for inspection 111 years later and found to be perfect. The famous roof of St. Pancras Station stands out as a unique achievement of the firm. The company made important contributions to many war-time engineering and constructional feats, including products ranging from gun carriages and mountings to track links for tanks, 150-ft. span bridges, and trench mortar bombs. It is noteworthy that both cannon and cannon balls were produced for the Crimean war.

Present-day Activities

By the nationalization of the company's extensive colliery undertakings a few years ago, the company suffered a severe curtailment of some of its activities, but in the outcome this released energies and funds which were soon directed into other channels, by developing a number of subsidiary and associated undertakings, including Hughes & Lancaster, Limited; Butterley-Goodall, agricultural machinery; Bradley & Craven, sheet-metal machinery; and the acquisition of Kelvin Construction Company, Limited, Glasgow, and A. H. Causer, Limited, Leamington Spa. The company's latest development of great interest to foundrymen is the acquisition of the manufacturing licence for oxygen generating plant from Air Products, Inc., of Allentown, Pa., U.S. The licence covers the supply of oxygen generators to the British Commonwealth and certain European countries. Many bulk users of oxygen in the United States produce their own supplies.

The company to-day has approximately 3,500 employees. In addition to the newer enterprises just described, the main engineering works at Butterley, near Derby, comprise iron foundries for the manufacture of castings up to 20 tons in weight (Fig. 18) and a modern mechanized foundry capable of high output of smaller castings. The products of the iron foundries include hydraulic-press castings and other pressure-resisting castings, chemical and civil engineering castings, compressors, and large castings for turbine and other mechanical plant. The company are licensees of the Meehanite process. In this same plant are also made "Tripedal" unit system of cast-iron flooring tiles.

In the associated machine-shops at Butterley, the manufacture of electric overhead travelling cranes, colliery haulage gears, and also the machining of large castings and mechanical equipment are carried out. Some of the machine tools are of large size and can machine castings and welded fabrications which are beyond the capacity of the customers' machine-shops (Fig. 17).

G. PERRY & SONS, LIMITED

The patternmaking business of G. Perry & Sons, Limited, was founded in Leicester in 1889 by George Perry, and over sixty-five years it has developed from a one-man business to a company employing two hundred craftsmen making all types of foundry patterns. It is the policy of the company to undertake all classes of patterns, large and small, in wood or metal. The foundrymen's visit will be to the main works at Hall Lane, Leicester, where one hundred and fifty men are employed over a floor space of approximately 50,000 sq. ft.

At these works will be seen all types of wood and metal patterns in course of construction. Pine patterns for all types of castings will be on view (Fig. 19) and one bay of the factory has been specially constructed to cope with the very largest patterns—a pattern recently made was for a casting weighing over 150 tons. Also, mahogany patterns for the aircraft, motor and other industries are well catered for. In particular the visitors will

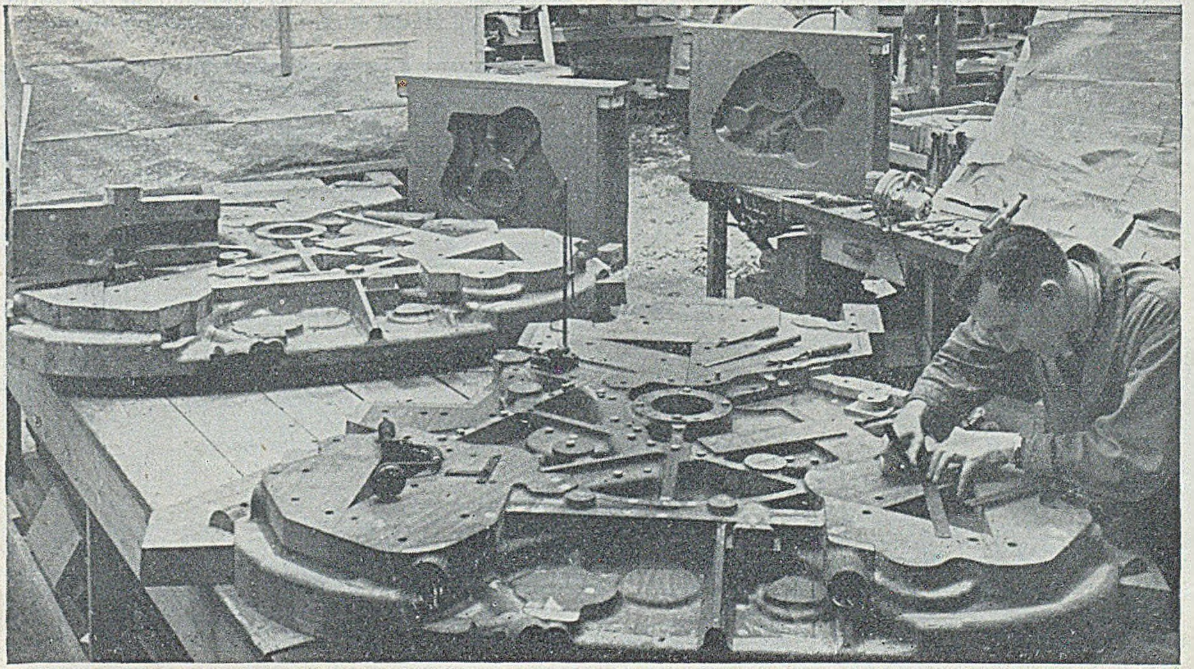


FIG. 19.—*Large Pine Pattern and Corebox in the Course of Manufacture at Perry's Hall Lane Works.*

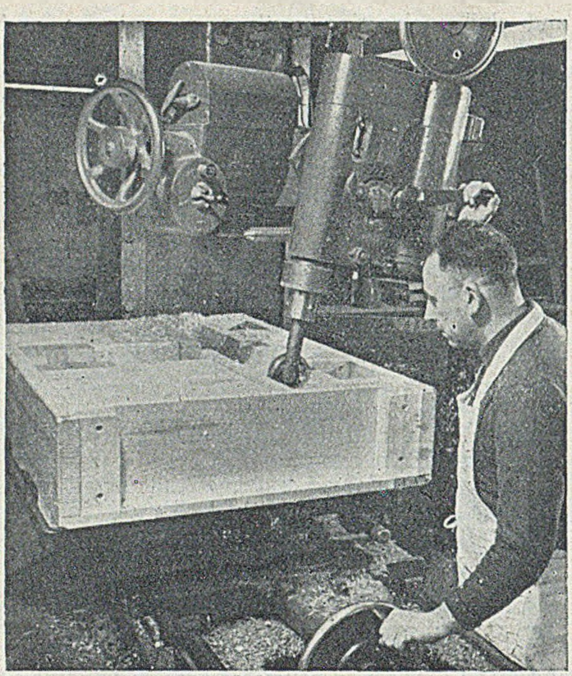


FIG. 20.—*Wadkin Pattern Miller engaged on a Corebox at the Works of G. Perry & Sons, Leicester.*

see how extensively modern wood-working machinery is used (Fig. 20).

Approximately half the capacity of the works is devoted to the making of metal patterns, the emphasis being on accurately-machined metal equipment. Forty machine-tools are in daily use making equipment in cast iron or aluminium. Fig. 21 shows a copying machine at work following the contour of a wooden model. More recently a proportion of this work has been designed for shell moulding.

Own Foundries

Nearby, the company runs two small foundries—a sand foundry for making aluminium pattern castings and a pressure-casting foundry for making pressure-cast patternplates. These foundries will not be visited on this occasion, but the various types of pressure-cast plates will be seen in the metal patternshop being checked, drilled and generally inspected before despatch. The company also has two smaller patternshops in the centre of the city, about three miles away, but there will not be time for these to receive a visit.

The main Hall Lane factory is sectionalized into groups for the various classes of work undertaken, each under separate foremen. The men in these groups, along with their foremen, have been trained particularly for that certain type of work. There is a separate inspection and finishing department, where fully-qualified operators check all completed pattern equipment. In the well-equipped works canteen, it is expected to entertain the visiting foundrymen to luncheon.

Other foundries to be visited. The five other foundries to be visited by parties of members of the Institute on October 2 are:—Herbert Morris Limited, Loughborough; Ley's Malleable Castings Company Limited, Derby; Qualcast Limited, Derby; Bamfords Limited, Uttoxeter; and Stanton Ironworks Company Limited at Stanton and Melton Mowbray.

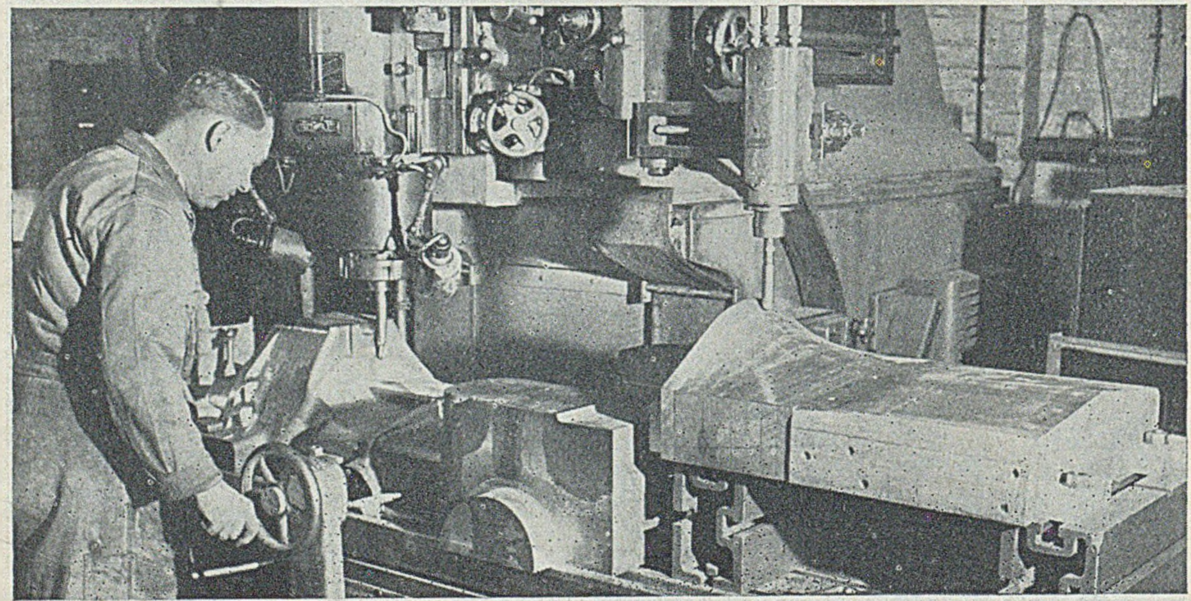


FIG. 21.—*Cast-iron Pattern being machined by Copying from a Wooden Model at Perry's. This Half-pattern and its Moulding Plate weighed One Ton when completed.*

Notable Steel Castings

Three out-of-the-ordinary steel castings which are currently in the news are illustrated in this article. Size, complexity and novelty of purpose are the special features revealed. The castings described well substantiate the contention that a modern trend is for designers to specify still larger and more complicated castings, making even more exacting demands upon the ingenuity of the steelfounder.

Difficult Mine Casting

Details of the first two castings were given by Usines Emile Henricot, of Court St. Etienne, Belgium. Fig. 1, which was kindly supplied by the Editor of *La Fonderie* (Belgium), shows a sealing door made from steelcastings. Here it is understood that concrete is normally used for such purposes in the coal-mining monopoly. The casting illustrated is shown during erection and the door is employed in cases of a sudden inrush of water into the mine to isolate the workings thereby abandoned, so that the rest of the vital parts of the pit can be protected from flooding, much as a bulkhead door is employed in ship construction. The casting, which is provided with a doorway 4 ft. 7 in. by 6 ft. 6 in., is designed to withstand a 1,300-ft. head of water. It is made up of a frame of four separate castings and a combined shutter strongly ribbed on the side not shown in the illustration. The thickness of the door is one inch. The joint-tightness between the shutter and the frame is assured by casting lead into the groove of the frame. Under test, this method has proved entirely efficacious.

Assembly

The four castings of the frame are assembled by bolting, using ⅛-in. sheet lead between the contact faces, so that seepage may be stopped, as this could come about through the concrete in which the door is almost completely embedded. So as to help the rapid installation of the seal in case of need, it is provided with double hinges on which it pivots. Four screws are used to lock the door at the start of the damage, when the volume of water is insufficient to ensure pressure-tightness of the joint.

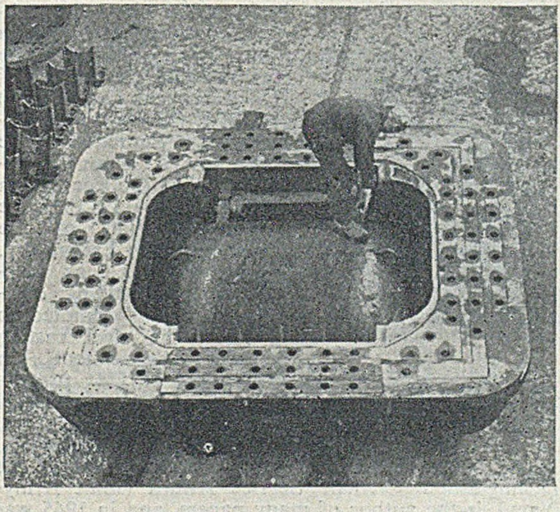


FIG. 1.—*Steel Sealing-door Assembly for use in a Coal Mine, size 4 ft. 7 in. by 6 ft. 6 in. and designed to withstand* 1,300 *ft. head of water.*

The steel used, made in the electric furnace, has a breaking strength of 31.7 to 34.9 tons per sq. in., an elastic limit of 19.0 to 20.0 tons per sq. in., and a minimum shock resisting strength of 10 kgs. per sq. cm. under Mesnager-type testing.

In spite of the difficulties associated with the moulding of such an assembly, the pressure tests carried out in the works revealed no porosity in the walls. Designed and carried out by the steel foundry to the wishes of the client, this door is a good example of the co-operation between the research staff and the foundry personnel—a condition which nowadays should invariably exist.

Bathyscaphe Castings

The French Bathyscaphe, illustrated in Fig. 2, was manufactured in 1947 for the first attempts of Professor Piccard. The depth attained of 2,100 m. (6,400 ft.) proves sufficiently that the casting was perfectly sound and watertight. The Bathyscaphe weighs about 13 tons and was manufactured in two halves in special alloyed steel of Cr/Ni/Mo, self-hardening type. This steel, known under the name of "*Infatigable,*" is manufactured by Usines Emile Henricot, under licence of the French firm, Société Delachaux. This metal had to give a very high tensile strength with sufficient ductility, but in this particular case, perfect homogeneity of the casting was the most important feature.

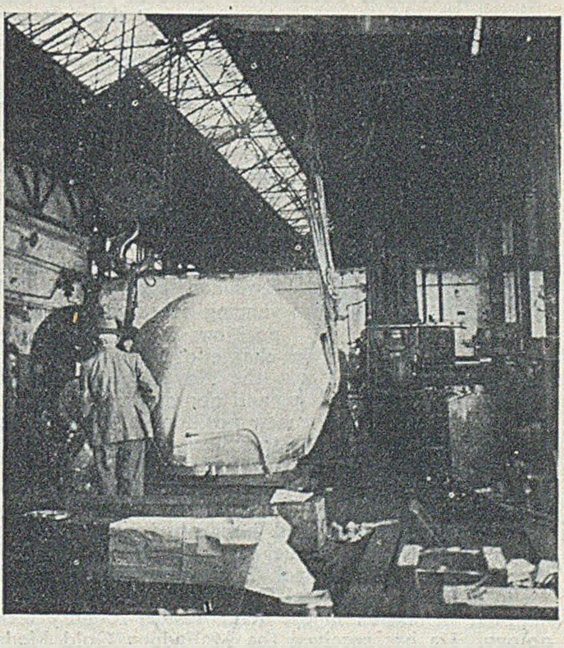


FIG. 2.—*The Bathyscaphe, manufactured for Professor Piccard, weighing about* 13 *tons, pictured leaving the works of Usines Emile Henricot in* 1947.

Notable Steel Castings

Manufacturing control was, of course, very strict, and radiographic examination was used to prove that in spite of the difficulty of casting the half spheres, they were perfect. The thickness of the casting varied from 90 mm. (3½ in.) to 150 mm. (6 in.) where the holes were located. Preliminary tests made on small-scale castings had shown the correlation of theoretical calculations and practical results.

Manufacturing processes were followed with utmost care by the firm which succeeded in manufacturing a casting of accurate shape and which machined well.

Mammoth Steel Casting

The mammoth steel casting, illustrated in Fig. 3, weighs 185 tons, and is believed to be the largest ever made in Britain. It was made at the Grimesthorpe Foundry of the English Steel Corporation and is for export to America, where it will be built into a 35,000-ton press. It is the first of four castings of the same size, and in addition the order covers two 164-ton castings and two smaller ones.

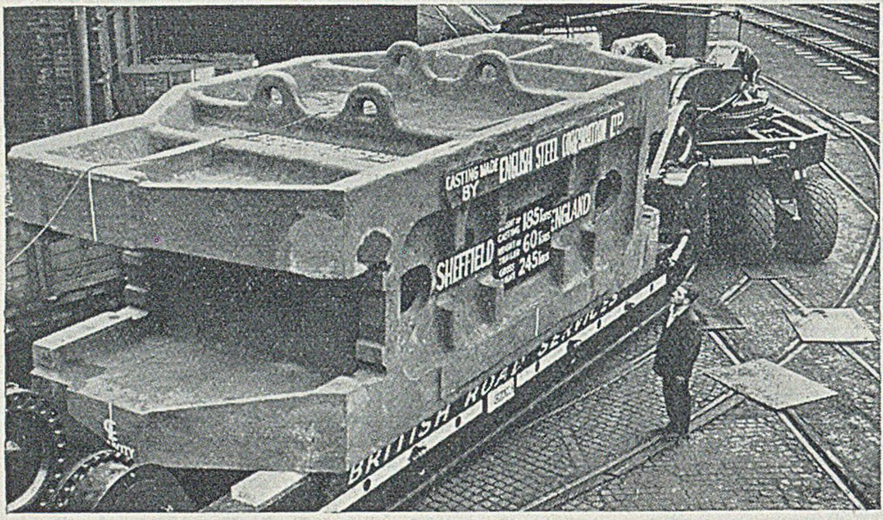


FIG. 3.—*Britain's Heaviest Steel Casting,* 185 *tons, is illustrated here, leaving the Grimesthorpe Foundry of the English Steel Corporation, Limited, Sheffield.*

Conference Paper Authors

Charles Willers Briggs, joint Author of the Paper "Feeding of Steel Castings at Pressures Higher than Atmospheric," the first part of which appears in this issue, received his formal education at Stanford University, California, after which he became research metallurgist for the Standard Oil Company of California. He left this position to become a member of the staff of the Naval Research Laboratory, Washington, D.C., where he remained eight years, advancing through different positions to senior physical metallurgist. He was in charge of the steel casting research section, and was the Navy's consultant on steelmaking, steel castings, and non-destructive testing. In 1938, he accepted the new position of the technical and research director of the Steel Founders' Society of America, the trade association of the industry. He is an officer of the Society, and directs all of its technical activities.

Mr. Briggs has published numerous technical articles on subjects relating to steel-casting production. He is the author of the "Steel Castings Handbook" and "The Metallurgy of Steel Castings," and has an international reputation in the field of steel foundry technology. He has received the McFadden Gold Medal of the American Foundrymen's Society, the Mehl Gold Medal of the Non-Destructive Testing Society, and the Electric Furnace Steel Conference Award of the American Institute of Mining and Metallurgical Engineers. He is a member of the American Institute of Mining and Metallurgical Engineers, American Society of Metals, American Foundrymen's Society, American Society for Testing Materials, American Society of Mechanical Engineers, the Society of Naval Engineers, and the Non-Destructive Testing Society.

Professor H. F. Taylor, M.I.B.F., joint Author with Mr. Briggs, was born in 1913, and received his technical education at Michigan States College, where he was awarded the degrees of B.S. (Chemical Engineering) and M.S. (Metallurgical Engineering). Subsequently, he was employed as an instructor at the College from 1936 to 1937. In 1937, he joined the staff of the Naval Research Laboratory, Washington, D.C., as assistant to the welding engineer, and was promoted to head of the steel casting research department in 1938, which position he relinquished in 1945 to take the appointment of associate professor of Mechanical Metallurgy at Massachusetts Institute of Technology. In 1952, he was promoted professor of Mechanical Metallurgy. Professor Taylor, who has received the Distinguished Civilian Service Award (Joint Army-Navy), is the author of many papers, and in 1945 was awarded the Simpson Medal by the American Foundrymen's Society. He is a member of a number of American metallurgical societies.

Templates in Patternmaking

By F. H. Wakeham

The use of templates on certain types of patterns is essential to obtain accurately the shape given on a blueprint. In the case of the casting shown at Fig. 1, great care must be exercised, not only in the use of the template, but also in the handling of the patternmaking tools, for one reckless cut may undo two or three hours' work, and a repair to such a pattern is not very satisfactory. Especially is this so if the pattern is to be mounted on a moulding-machine plate, where the bumping it will receive may soon loosen an inlaid piece until it stands above or below the true profile.

In the example shown, the pattern is parted through the centre and moulded in a two-part box. The pattern in the first instance is formed of two blocks of timber dowelled together, and the views as marked out on the layout board are transferred to the respective faces of the pattern, thus giving the position where the pattern has to be cut down to the various levels—parallel to the pattern joint. Once the levels are cut, the shape of the bosses and ribs can be scribed in their respective positions. Such bosses and ribs are better left until the main profile, as shown in the section drawing at *AA*, is cut down by means of the template.

The carving of the shape should be carefully executed and the template used frequently until it finally touches all points of the pattern and at the same time coincides with the joint line of the pattern. The template, in all the operations, should be worked backwards and forwards parallel to the centre line of the bore, so ensuring a profile which is parallel at all points to the pattern joint. Furthermore, the template should be crayoned or chalked frequently to register the high and low points.

The tools used in forming such a pattern are mainly short-bend spoon gauges, which will carve the filleted portions, and short-bend chisels to finish the flat portions. Particular care should be taken that all tools used are in perfect cutting condition; this will eliminate all finishing except that done with fine glass paper. A good pattern cannot result from badly sharpened tools, no matter how much glasspapering it eventually receives; this is particularly true of the example shown, which has comparatively deep and constricted pockets.

Template as a Master Gauge

In some turned patterns, a template can be made which will dispense altogether with the use of inside and outside callipers, contraction rule, straight-edge or depth gauge; such an example being shown in section at Fig. 2. The only conditions which must be observed are, (*a*) the wooden faceplate should be larger than the largest diameter of the pattern, (*b*) it must be faced perfectly true, and (*c*) the template must follow exactly, the section on the layout board.

Again, care must be exercised when turning the job in the lathe, so as not to take too heavy a cut when, from the template, it can be seen to approach the finished shape. A further important point that must be observed when turning by template only is that it must be a full template that is provided, so that it touches the face-plate on either side of the pattern and locates on the face of the pattern at the same time.

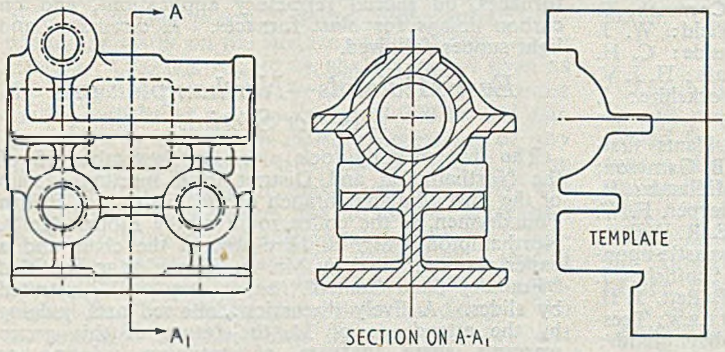


FIG. 1.—*Drawings of a Pattern and a Suitable Template for Checking the Profile during Manufacture at the Position shown in the Half-section at AA_1.*

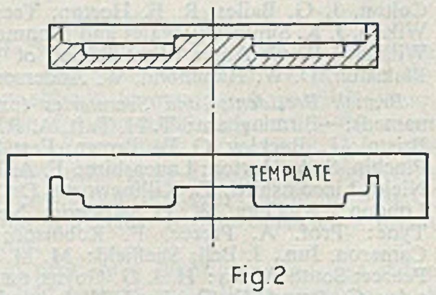


FIG. 2.—*Symmetrical Pattern, which can be made by Turning in a Lathe, and a Template for providing all the Gauging Required.*

The Council of Ironfoundry Associations will hold a conference on foundry health and safety early next year. Among the subjects to be discussed will be the Iron and Steel Foundries Regulations, and arrangements will be made for contributions to be presented showing how compliance with the Regulations may be achieved. This is a preliminary notice only, and although no applications should be made at this stage, member-firms who may wish to take part are invited to reserve the dates. The conference will be held at Ashorne Hill, from March 1 to 3, 1954.

The first of a series of concentrated residential courses designed to include all aspects of management is being launched by the British Institute of Management and will take place at Management House, 8, Hill Street, London, W., from November 1 to 28, 1953, under the general direction of the Director of Studies, Mr. Norman C. Rimmer. The syllabus, methods, and organization of work of these courses are explained in the Executive Development Programme, which, with application forms, may be obtained from the director of studies at the above address.

I.B.F. Constitutional Representation

Probably very few of the newer or prospective members of the Institute of British Foundrymen realize on what truly democratic lines the business of the Institute is organized. For this section of JOURNAL readers the following list of current officials may be useful:—

Council Members

As a result of the elections at the Institute's annual general meeting in June and changes in branch representation, the Council of the Institute is now constituted as follows:—

Ex-officio Members: E. Longden, M.I.MECH.E., president; John Bell, senior vice-president; A. B. Everest, PH.D., junior vice-president, and N. P. Newman, J.P., hon. treasurer.

Past-presidents: J. Cameron, J.P.; V. C. Faulkner, F.R.S.A.; J. T. Goodwin, M.B.E.; S. H. Russell; J. E. Hurst, C.B.E., D.MET.; C. W. Bigg; R. Miles, M.ENG.; D. Sharpe; J. W. Gardom, F.I.M.; D. H. Wood; P. H. Wilson, O.B.E.; R. B. Templeton, M.I.MECH.E.; N. P. Newman, J.P.; J. J. Sheehan, B.SC.; Colin Gresty, and C. J. Dadswell, PH.D.

Members elected by Ballot: J. Blakiston; E. M. Currie; V. Delport; H. G. Hall, F.I.M.; R. L. Handley, B.SC.; J. Hird; A. E. Peace; G. R. Shotton; P. A. Russell, B.SC., and R. Yeoman.

Branch Representatives:—Birmingham: T. H. Gameson, G. M. Callaghan, J. L. Francis, E. R. Dunning; Bristol: D. F. B. Tedds; East Midlands: F. G. Butters, G. L. Harbach, D. W. Berridge, J. Hill; Lancashire: D. Fleming, H. Haynes, J. Jackson, C. R. van der Ben; Lincolnshire: J. Burrell; London: L. G. Beresford, F. Arnold Wilson, Barrington Hooper, C.B.E., M. Glenny; Newcastle: C. W. Stewart; Scottish: J. Cormack, T. Shanks, R. R. Taylor, A. Marshall; Sheffield: W. J. Colton, J. G. Bailes, R. F. Horton; Tees-side: C. H. Wilson, J. K. Smithson; Wales and Monmouth: H. J. V. Williams, R. G. Amos; West Riding of Yorkshire: J. Blakiston, D. W. Hammond, W. Anderson.

Branch Presidents and Secretaries (presidents first-named):—Birmingham: T. H. Taft, A. R. B. Gameson; Bristol: L. Buckley, G. W. Brown; East Midlands: H. Pinchin, S. A. Horton; Lancashire: F. A. Harper, F. W. Nield; Lincolnshire: D. Killingworth, Dr. E. R. Walter; London: B. Levy, W. G. Mochrie; Newcastle-upon-Tyne: Prof. A. Preece, F. Robinson; Scottish: J. Cameron, Jun., J. Bell; Sheffield: M. M. Hallett, J. H. Pearce; South Africa: H. J. G. Goyns, S.E.I.F.S.A.; Tees-side: G. Brand, F. Shepherd; Wales and Monmouth: G. McKinley, A. S. Wall; West Riding of Yorkshire: C. S. Johnson, H. W. Griffiths.

Section Presidents and Secretaries (these officers are invited to attend Council Meetings):—Burnley: J. Jackson, H. J. W. Cox; East Anglian: H. S. Ward, L. W. Sanders; Falkirk: J. Ferguson, A. Bulloch; Slough: J. P. P. Jones, P. Hoesli; Southampton: V. W. Meager, Dr. O. P. Einerl; West Wales: B. Godber, C. G. Jenkins; North-East Scottish Section: H. J. M. Conacher, R. Leeks; Cape Town: acting hon. secretary, W. A. McLaren.

Co-opted Members: J. G. Pearce, O.B.E., M.SC., M.I.MECH.E., F.INST.P.; G. L. Bailey, C.B.E., M.SC., and J. F. B. Jackson, B.SC.

Secretary: T. Makemson, M.B.E.

Honorary Corresponding Member of Council. Australia: W. T. Main.

Technical Council

At the meeting held on July 1, the Technical Council was reconstituted as follows for the year 1953-54:—

Chairman: A. E. Peace; *deputy chairman:* Dr. A. B. Everest. *Ex-officio Members:* E. Longden, M.I.MECH.E., J. Bell.

Branch Representatives:—Birmingham: G. R. Shotton; Bristol: G. W. Brown; East Midlands: C. A. Payne; Lancashire: C. R. van der Ben; Lincolnshire: F. Dunleavy; London: F. Hudson; Newcastle-upon-Tyne: G. Elston; Scottish: J. McPheat; Sheffield: H. S. W. Brittain; Tees-side: L. Johnson; Wales and Monmouth: A. H. Bevan; West Riding of Yorkshire: G. W. Nicholls. *Co-opted Members:* J. Blakiston, L. W. Bolton, C. Gresty, J. W. Gardom, A. Logan, R. W. Ruddle, P. A. Russell, and A. Tipper.

In addition, the following sub-committee chairmen are *ex-officio* members of the Technical Council: F. J. McCulloch (T.S.24), M. M. Hallett (T.S.32), E. M. Currie (T.S.35), J. E. O. Little (T.S.37), F. C. Evans (T.S.38), W. J. Colton (T.S.39), A. Logan (T.S.40), C. H. Kain (T.S.41), Dr. Brynmor Jones (T.S.42), E. S. Renshaw (T.S.43), S. J. Sargood (T.S.44), A. Logan (T.S.45), J. Hird (T.S.46), R. W. Ruddle (T.S.48).

Notes from the Branches

Australian—Victoria

At a general meeting of the Australian—Victoria branch of the Institute of British Foundrymen, held at the Metallurgy School, Melbourne Technical College in August, members and their guests heard a Paper, "Refractories in the Foundry," by Mr. J. H. Myrtle, M.I.B.F. Mr. Myrtle is managing director of the Morgan Crucible Company (Aust.) Pty., Limited. He spoke on the application of refractories in melting furnaces, on special refractory applications, and on carbon linings for blast furnaces. A discussion and light supper followed.

East Midlands—Northampton and District Section

The first meeting took place on September 18 of the Northampton and District local meetings group of the East Midlands branch of the Institute of British Foundrymen, in the coffee room of the Plough Hotel, Northampton. Mr. B. Hird was in the chair and a paper was presented by Mr. A. Tipper, M.SC., entitled "Foundry Sand Control," being very well illustrated by slides. A lively discussion followed and, judging by the attendance of 34, the future of this group warrants some measure of optimism. Acting as honorary secretary is MR. W. D. FORD, A.M.I.MECH.E., Morris Motors, Limited (Engines Branch), Nuffield Foundry, Wellingborough, Northants.

Early Iron Working. Mr. F. W. Tobias, and Dr. D. J. Smith of King's College, Newcastle, have discovered large lumps of clinker believed to have come from iron workings used by the Romans, near Corby's modern blast furnaces. Dr. Smith believes that a Roman villa there, the site of which is being excavated, may have been the house of the manager of the local iron works. The theory is strengthened by the discovery of an early coin of the reign of the Emperor Vespasian. It is known that during his reign, the production of iron in this country was developed and his coins are often found in the iron-bearing areas.

Cast Iron for Enamelling*

Cast-iron ware which is to be subsequently enamelled must be made from suitable material. Troubles of one sort or another can arise and then disappear again before one has had time to determine their cause.

The moulding sand used is of considerable importance. To obtain a clean, smooth finish on the surface of the casting the particle size of the sand must be carefully controlled as follows:—

Particle size mm.	0·3,	0·3–0·2,	0·2–0·1,	0·1–0·05,	0·05
Proportion per cent	0·9	6·9	60·5	13·9	6·3

The sulphur content of the sand should be under 0.029 per cent. To obtain a high degree of permeability, some silica sand may be substituted for the ordinary moulding sand. The water content of the moulding sand should not exceed 7 per cent.; sand which is too damp and dense leads to the formation of patches of rust. These rust patches can always be cleaned off, but after a short time they will always re-appear on the surface. This defect may also be due to other causes, for instance, the casting remaining too long in the mould; too high a sulphur content in the iron; too high an iron content in the moulding sand, or poor quality of coal dust.

Knock-out Precautions

It is advisable to remove the casting from the mould as soon as possible. The longer it remains in the damp mould so the greater is the likelihood of the steam (which is generated by the evaporation of water during pouring) being condensed and deposited as water on the surface of the casting during cooling. Castings should be shaken out as soon as the metal is "black-hot." This ensures that the casting will be at a temperature of 300 to 400 deg. C., which is enough to cause evaporation of any moisture which comes into contact with it. The view that the casting, if shaken out too early, will be too hard is mistaken, for no further alteration in the structure of the casting takes place at a temperature below 500 deg. C. The casting should not be left overnight in the foundry, but transported into the fettling shop, since the damp in the air of the foundry when the furnaces are out can be considerable and can moisten the moulding sand still clinging to the surface of the casting.

Iron in the Sand

Moulding sand itself can be a cause of rust formation if it contains too much iron, whether this be in the form of iron oxide, iron hydroxide, or iron silicate—an iron content of over 4 per cent. should not be tolerated. A similar state of affairs is caused if the iron itself is too high in sulphur. In this case it is possible that the iron and manganese sulphides on the surface of the casting are attacked by the moisture in the sand and form acids which in turn leads to the formation of rust.

*Translated from an article appearing in *Giesserei Praxis*

The sulphur content of the iron should not be over 0.1 per cent.

Regarding the addition of coal dust an addition of 3 to 5 per cent. by volume should be made to the moulding sand, when making thin-wall castings. The coal dust should be well mixed into the sand. During pouring, a uniform gas film is formed between the casting and the moulding sand. This gas film leaves behind a thin film of grease on the surface of the casting and, if impregnated with tar from the coal dust, this acts as a protection against rust.

Gummation of Optimum Conditions

In general, therefore, to avoid the formation of rust, a high gas permeability of the moulding sand is required and sulphur should be absent. The moisture and metallic iron content of the sand must be low and the casting should be knocked out quickly and the iron also must not contain more than a certain amount of sulphur.

The quality of mould dressings should also be watched, such material should be free from sulphur and silica. In places where a dressing becomes detached, brown flecks appear on the metal surface and the enamel will come off. With castings having an abrupt change of section, there is always the danger that the casting will "tear" during enamelling. Such failures are often wrongly attributed to breakage during annealing, especially where proper inspection at each stage is not undertaken.

Microstructure

The belief that enamelling grades of cast iron should possess the same structure as an iron designed for machining is wrong. A pearlitic structure is the best for machinability, but is the most unsuitable type of structure for enamelling-quality iron. The iron undergoes a change of structure during the enamelling process and, as in the case of full annealing, a ferritic structure replaces much of the pearlite.

In order to procure a ferritic casting, the value of the combined carbon and silicon contents must amount to or exceed 6 per cent. According to the manner in which iron is cooled, the structure may be made either white or grey. With rapid cooling, the structure becomes white, consisting chiefly of cementite and pearlite. Grey iron consists of ferrite and graphite and results from slow cooling. The critical cooling speed is determined by the alloying elements in the iron and the thickness of the casting section—manganese tends to form white-iron structures while silicon makes for the formation of grey iron. There are, therefore, two systems which result:—I. Iron/carbide, the less-stable system; and II. iron/graphite, the stable system.

Pearlite is not a stable component. At an enamelling temperature of 700 deg. C., pearlite

Cast Iron for Enamelling

decomposes into ferrite and graphite. Therefore, no flake-graphite iron of high tensile strength is suitable for enamelling, as during the latter process the structure is destroyed. Enamel is best applied to a ferritic cast iron. To bring about the change from pearlite to ferritic constitution, the iron emits a certain quantity of gas, and this has to escape through the enamel. In doing so it can force the enamel away from the metal surface.

Enamelling should therefore only be undertaken after the casting has been subjected to an annealing treatment, and if failures still appear, then these are due to some other cause. A good enamelling iron is one of the following percentage composition:—C, 3.4 to 3.8; Si, 2.6 to 3.1; Mn, 0.5; P, 0.8 to 0.9, and S, $<$0.09.

Enamels cling better to a ferritic iron because the graphite flakes on the surface of the casting can act as little bonding points. During fettling, also, it is not enough merely to remove the adherent sand; a jagged-edged shot should be used which can at the same time roughen the whole surface of the casting. Round shot does not do this, but tends to close the otherwise porous surface. If the iron contains too much sulphur, the skin of the casting is made hard and again it cannot be satisfactorily roughened. In addition, ferrous sulphate can be formed on the surface and the enamel erupts into a series of small blowholes and will not bond at all satisfactorily. If blue or brown flecks are seen on the surface of the casting after the enamel has peeled off, this is a sign that the sulphur content of the iron is over 0.12 per cent. Such castings should be annealed until no further decomposition takes place, but this will generally raise the enamelling cost.

Other Precautions

The analysis of the iron must be adjusted if necessary after tapping and before pouring. The silicon content can be estimated by taking a "wedge" sample and breaking for viewing the fracture. The formation of blowholes during enamelling is aggravated if the iron is overheated or held too long at a high temperature, and pyrometers should be used to control casting temperature.

It is important that the castings be properly dried after the deposition of the first coat of enamel. The drying bogie should only carry a certain number of castings, then, by the time it is loaded, the first casting to be sprayed have not been exposed to dampness for sufficient time for there to be a danger of re-penetration of moisture into the iron.

There are, thus, a number of ways in which enamelling may be defective. The most general cause of failure is an unsatisfactory composition of the cast iron. For each cast, the charge must be carefully computed and a particularly careful watch must be kept on the analysis of the return scrap (heads, risers, etc.). If control cannot be maintained over every single cast, then samples should be taken every so often, and, by the use of hematite iron, the sulphur and phosphorus contents of the metal may be kept under control.

Book Reviews

Coke-burning Appliances Handbook. Published by the Gas Council (Coke Department), 1, Grosvenor Place, London, S.W.1. Price 12s. 6d.

The book was launched recently at a meeting which was addressed by Mr. H. V. Skelton, chairman of the British Ironfounders Association. In it he stressed the need for a *va piano* approach to the question of smokeless areas on the grounds that there was insufficient suitable fuel at the present time to fill normal domestic requirements. Rather should recourse be had to the installation in existing homes of efficient and cleaner appliances now available. These are described and illustrated in full detail in this book, which in addition gives technical data on coke and lists the coke-burning appliances which have been approved and much other matter germane to the subject. The book, as a work of reference will be invaluable to architects, builders and allied trades and professions.

Electric Resistance Heating. Published by the British Electrical Development Association, 2, Savoy Hill, London, W.C.2. Price 9s., post free.

The foundry industry is a large user of electric-resistance furnaces and appliances for melting metal, heat-treatment, patternplate warming—to cite but a few. This book is well worth careful examination as here and there applications new to the reviewer are revealed. For instance, the very last paragraph tells of an electrically-heated riddle, for handling sand drying. Then there is a long chapter (No. 8) on electric ovens and infra-red heating. However, no mention appears of portable electric mould-driers—fairly new to this country, but thought to be in use in Switzerland. Naturally, in a book of this type there is information about application to the manufacture of paper, stockings and a host of other trades.

Das Giessereiwesen in gemein fasslicher Darstellung. 3rd edition. Published by Giesserei-Verlag G.M.B.H., 27, Breite Strasse, Düsseldorf 22a. Price 24 D Marks.

The title of this book could be translated as foundry practice set out in simple language. It is a very comprehensive work, written by experts, and covers both the technical and economic activities of the foundry industry, and in doing so unfolds to the student or layman all the problems to be associated with the casting of metals. Clarity of presentation has made the fundamental scientific principles governing foundry practice easy of assimilation. Obviously, there is no need to rely on foreign books for the common technology of the industry, for it is available in the English language, yet this book is of great interest from the historical and economic aspects. It contains, for instance, the British output of ferrous castings for 1936 (3,147,000 metric tons)—a useful figure when making comparisons. Then an insight is given to the German approach to standardized costing—dating back to 1919—a section well worth study in this country.

A section the reviewer much appreciates is a series of pictures of all sorts of castings ranging from a simple bath tub to examples of works of art. Such matter should be included in all books of this character, as it is the best means of showing the layman the wide boundaries of the industry.

The book is thoroughly up to date and includes a few paragraphs on shell moulding, but above all it is well balanced. Those who can read German will welcome this addition to their libraries.

News in Brief

At the Butterley foundry and engineering works near Ripley, and Codnor Park forge and rolling mill, near Ironville, about 150 employees are over the age of 65.

A residential course for foremen, organized by the Midland area training committee of the British Iron and Steel Federation, is being held at Moreton Paddox, Warwickshire, from September 28 to October 2.

An information course for executives in the iron and steel industry is to be held by the Midland-area Training Committee of the British Iron and Steel Federation at the Dudley and Staffordshire Technical College this winter.

W. T. Henley's Telegraph Works Company Limited announce that their Glasgow branch moved to more commodious premises on September 29 at 149/153, North Street, Glasgow, C.3., Telephone—Central 1771.

The directors of Jowett Cars, Limited, Bradford, have announced that, because arrangements for the continued supply of bodies have still not been made, the company is to suspend the manufacture of Javelin cars and Bradford commercial vehicles.

A course of ten lectures on precision measurement in engineering will start at the Birmingham College of Technology on October 15. Designed for senior inspection staff, the course has been arranged in conjunction with the Institution of Production Engineers.

An Outbreak of Fire at the premises of J. Sagar and Company Limited, manufacturers of woodmaking machinery, Halifax, recently, originated in the wood wool and pattern store. The blaze was confined to the immediate area and little other damage was caused.

In an explosion in the heat-treatment department of the Aeroplane & Motor Aluminium Castings, Limited, Erdington, Birmingham, on September 17, a furnaceman was seriously injured. An oven was blown open and about 25 sq. yds. of asbestos and glass roofing was shattered.

Kelvin & Hughes, Limited, instrument manufacturers, have introduced a most appropriate award for their successful craft and technical apprentices. As an annual prize, an "Outward Bound" or "Moray Sea School" course is made available to the successful candidate (as selected by the training panel).

The paddle steamer Duchess of Fife, which has carried holidaymakers on the Firth of Clyde for half a century, is now in the hands of the shipbreakers. She took part in the Dunkirk evacuation. She was built at Fairfields, Glasgow, in 1903, and was taken out of service in June.

Craven Bros., Limited, Stockport, have completed what is claimed to be the largest machine-tool ever made in Great Britain—a 650-ton 40-ft. vertical boring and turning mill—for John English & Company, Toronto. The machine, which occupies a floor space of 3,700 sq. ft. and cost £180,000, took two years and a half to design and build.

Midland industrialists should take some quantity of open-cast coal as a precaution in view of the likely shortage of large coal and the smaller stocks compared with a year ago, according to the regional director of the Ministry of Fuel and Power. He also advises domestic consumers, if possible, to take unrationed fuel as a safeguard.

Mr. Walter C. Puckey, president of the Institution of Production Engineers, gave an address to members of the Derby section of the Institution at the Midland Hotel, Derby, on September 21. His subject was "What we think of the Future," which embraces industry's relationship with politics, defence obligations, financial difficulties, and technological tasks.

Bradley Methodist church (Staffs) treasures a pulpit cast in iron by John Wilkinson, the famous Bilston ironmaster. No longer used, it stands near the modern pulpit of the church and is grained over to give it the appearance of wood. The pulpit is all that is left of the "iron" chapel built by Wilkinson, in which he used the metal for every fitting possible in the building.

The annual ball of the Midlands Area of the Royal Metal Trades Pension and Benevolent Fund is to be held at the Grand Hotel, Birmingham, on October 15. As a result of last year's Ball, more than £700 was handed to the fund, bringing the total raised by this annual event to £6,269. Chairman of the Area Council is Mr. A. H. Wilson, of Evered & Company, Limited, Smethwick.

A new approach to Britain to join the European Coal and Steel Community as an associate, even if not a full member, is to be made by the High Authority and the six countries of the community. This was stated recently at the National Coal Board Summer School at Oxford by Mr. D. J. Ezra, N.C.B. representative on the United Kingdom permanent delegation to the High Authority of the community.

Delegates from Great Britain, the United States, France, and Western Germany, including the world's acknowledged experts in the industrial phosphating field, met in conference last week at the Pyrene Company, Limited, Great West Road, Brentford, Middlesex, for an exchange of technical information and to discuss future developments of the internationally known range of industrial phosphating processes.

Vauxhall Motors, Limited, who are celebrating their golden jubilee this year, hope to achieve a record output and to produce over 100,000 vehicles for the first time in their history. In 1903, the output was one car every 12 days. The first Vauxhall car, a 5-h.p., single-cylinder model, was built in September 50 years ago. Its top speed was 25 m.p.h., and petrol consumption 35 to 40 m.p.g. In 1905, the firm moved from London to Luton and in 1925 General Motors Corporation of America acquired the ordinary shares of the company.

Decisions on six applications for planning permission to work limestone in the Peak District National Park, all of which were the subject of local inquiries, have been announced by Mr. Harold Macmillan, Minister of Housing and Local Government. Two applications to open new quarries and one to reopen an old one have been refused. Three applications for work in existing quarries have been granted; two are for limited periods, and all three are subject to conditions designed to deal with aspects open to objection.

The Pakistan Government has allowed the Industrial Development Finance Corporation to extend bank guarantees to their businessmen placing orders overseas for machinery on a deferred-payment basis. An official notification states that, under the recent trade agreement with Japan, importers in Pakistan can place orders for machinery on a deferred-payment basis. Similar facilities are being extended by the United Kingdom and other countries. The Government is also understood to have granted importers an extension of foreign exchange cover.

(*Continued on page* 438)

News in Brief

(*Continued from page* 436)

THE TWENTY-THIRD MEETING of the Iron and Steel Engineers' Group of the Iron and Steel Institute will be held at 4, Grosvenor Gardens, London, S.W.1, on Wednesday, October 28, and a buffet luncheon will be held in the library in connection with the meeting. At 10.30 a.m. there is to be presentation and discussion of a paper on "Roll-design Research as Applied to Rolling Mill Development," by B. Robinson and W. A. Lugar, and, in the afternoon, of "Manipulating Equipment, Guides, Guards and Strippers for Rolling Mills," by W. Bailey, will be presented and discussed.

IN A CIRCULAR issued to stockholders of the British Aluminium Company, Limited, the directors announce that the difficult trading conditions have shown little sign of improvement, and they wish to emphasize that the maintenance of the interim dividend on the ordinary stock at 4 per cent. in respect of the year ending December 31, 1953, should not be taken as an indication that the total distribution for the year will necessarily be the same as in recent years. For each of the two preceding years the total was made up to 12 per cent., less tax, with a final of 6 per cent. and a bonus of 2 per cent.

THE ORIGINAL cast-iron bridge, built by the Horseley Bridge Company and erected in 1848 at Shifnal to carry the Paddington-Birkenhead line, is to be reconstructed because of its age and deterioration. It is to be replaced by a new structure based on four steel girders, each weighing 22 tons, and made by the Horsehay Works Company at Wellington, and topped by a pre-cast reinforced concrete deck to a total weight of 120 tons. It says much for the soundness of design and construction of the early cast-iron bridge that it has outlasted a century of service under conditions of traffic scarcely envisaged at the time of manufacture.

SIR LEONARD BROWETT, director of the National Union of Manufacturers for the past eight years, who is to retire shortly, presented an illuminated address in a silver casket to Mr. William Blackwell, chairman of the Midland area of the Union since 1943 and now its president, at a dinner in his honour in Birmingham on September 23. Sir Leonard was deputising for Sir Patrick Hannon, a vice-president of the area association, who was prevented by illness from attending. Tributes to Mr. Blackwell were paid by the speakers, who included the Lord Mayor of Birmingham (Alderman G. H. W. Griffith), Aldermen A. G. B. Owen, and A. Paddon Smith, Councillor Harry Weston and Mr. Norman Tiptaft. Mr. A. Stephens, chairman of the Midland area presided.

MEMBERS from as far as New York, Nairobi, Southern Rhodesia and the Sudan travelled to attend the fourth residential school of the Institute of Cost and Works Accountants at St. Catharine's College, Cambridge, from September 21, for one week. The president of the Institute, Mr. F. W. H. Saunders, opened the proceedings and Dr. J. M. S. Risk, chief accountant to the Southern Region Gas Board, gave the first of a series of papers, his subject being "Financial Control of Large-scale Organizations." At later sessions, Mr. A. D. Coventry, of the Industrial and Commercial Finance Corporation, spoke on "Finance and the Cost Accountant," and Mr. R. T. Kennedy, cost accountant of Winsor & Newton, Limited, addressed the school on "Comparable Costs." Mr. Harold Wincott gave the final address entitled "Some Reflections on Modern Capitalism."

Personal

MR. H. P. GLENNIE has been appointed a director of J. A. Prestwich Industries, Limited.

LORD HIVES, chairman and joint managing director of Rolls-Royce, Limited, Derby, has been made an Honorary Fellow of the Royal Aeronautical Society.

MR. D. H. ARMITAGE, lately chief development engineer with the British Steel Castings Research Association, has resigned and joined the Board of P.I. Castings (Altrincham), Limited.

MR. F. DONALD RUSHBROOKE has been appointed chairman of the Halford Cycle Company, Limited, in succession to his father, the late Mr. F. W. Rushbrooke. He also retains his position as joint managing director.

MR. C. WHITEHOUSE has relinquished his appointment as foundry superintendent of Lloyds (Burton), Limited, to take up duties of foundry manager of John Hill & Sons (Iron Founders), Limited, Wolverhampton to-day.

MR. W. TWADDLE, of Dunstable, has joined the technical staff of the Coleman-Wallwork Company, Limited. Mr. Twaddle is well known in the foundry industry, where he has been associated with the mechanizing of some of the largest plants in the country.

MR. CECIL F. HURST has been appointed deputy chairman of Samuel Osborn and Company Limited, steel founders and tool manufacturers, Sheffield. Mr. Hurst has been with the firm for 30 years, and was a departmental works manager before becoming a director in 1938.

IT IS ANNOUNCED that Wing-Commander J. M. Aiton, chairman and managing director of J. Aiton & Company, Limited, pipe founders, of Stores Road, Derby, will relinquish the command of the Derbyshire Wing of the Air Training Corps in February, owing to pressure of business.

JOHN S. KIDD, who has been 59 years an iron moulder, 52 of them with R. & A. Main, Limited, Falkirk, retired on his 70th birthday. For the last 20 years he has been foreman moulder and very popular with his workmates. He was presented with the latest model electric razor by the moulders and coremakers, while the staff gave him a mahogany grandmother clock.

MR. F. LONSDALE MILLS is to retire on March 31, 1954, from the post of Director of Education for Wolverhampton, which he has held since 1945, being previously deputy director. Associated with his duties is the office of clerk to the governors of the Wolverhampton and Staffordshire Technical College. Throughout his career in Wolverhampton, Mr. Mills has been closely associated with industry and with technical and trade education.

MR. J. A. WADHAMS, head of the department of applied science at Wolverhampton and Staffordshire Technical College, has been invited to speak in November at the second international conference on pneumoconiosis at Münster University, Germany, on the work being done by his department on dust research. A group of research students has been at work for a year on problems arising from atmospheric dust, especially in industry. The foundry industry has a close interest in research of this nature, which is also going on at centres in Germany, Switzerland and France.

Raw Material Markets

Iron and Steel

Production of pig-iron keeps pace with the current requirements of most consumers. Producing furnaces are supplied regularly with the necessary raw materials to maintain outputs at recent levels. Any fears which the furnaces may have had on the question of sufficiency of coke have so far been allayed, as supplies, although none too plentiful, have been at hand to enable capacity outputs to be obtained. Ore deliveries are good and the tonnages available not only meet current needs, but provide ample stocks. Increased deliveries of coke to augment stocks would make the raw-material position still more secure.

The steelworks are well provided with basic pig-iron, and the supply of scrap is on a much better level. Although preference in pig-iron production is given to the needs of the steelworks, which utilize about three-quarters of present outputs, the foundries have, in the main, no difficulty in securing the grades and tonnages they require. Apart from hematite, production of which is below needs in some areas, all the iron they are at present specifying is coming forward, although some of the engineering and speciality foundries would prefer a larger intake of the low- and medium-phosphorus irons. Most of these foundries are obtaining good outputs of castings, but the light-casting trades and some of the jobbing foundries are still very short of work. The demand for high-phosphorus pig-iron has recently shown some improvement. This is due in some measure to a slight improvement in trade in light castings, but the chief reason is that the foundries' stocks of pig-iron have been reduced to such an extent that they now find it necessary to obtain tonnages to implement the orders on hand. Many of the light foundries have not taken deliveries of pig-iron for some months, and this has compelled the furnaces to take supplies into stock. The demand for the refined grades of pig-iron is below the output level.

Ample supplies of steel semis are now available, chiefly because re-rollers are taking up less than their normal tonnages.

With new business on the quiet side, producers of finished-steel products are effecting a big reduction of their backlogs and forward commitments for heavy joists and sections, with the result that consumers are finding conditions a little easier in certain sizes, although the demand for the more popular sections continues to be heavy. While the plate mills are working to capacity, little headway seems to be made in reducing their heavy bookings and new orders for medium thicknesses are still very difficult to place.

Non-ferrous Metals

Price movements on the copper market last week were erratic, but certainly not lacking in interest, for the settlement price on Thursday was established at £242 10s., which is the highest level reached since the market opened on August 5 last. At the same time, three months touched £224, also a new high level for this post-control market, but this was not held, and at the close of business on Friday there were sellers of the forward position of £222 10s. Cash fell by £5 on the last day of the week's trading, the close being £237 10s. Once again it was a matter for comment that the Government broker did not seem to be a very keen seller, although at £240, which is equal to 30 cents, it might have been supposed that the Ministry would not have been averse from getting rid of some of its large stocks. There certainly appears to be a persistent demand in some directions for early copper, but whether this can be ascribed to greater activity in the non-ferrous industry is a question. In view of the price uncertainty, consumers have undoubtedly been sticking very much to a hand-to-mouth policy and they may have cut things a little too fine. On balance the cash price showed no change in comparison with the previous Friday, but three months was up by £4 10s. The backwardation stood at £15.

Both zinc and lead closed below the best, the former, however, being £1 17s. 6d. better on balance for September and 15s. December. The backwardation which developed early in the week and reached £3 15s. at one time was reduced to £2 on Friday. Lead was fairly steady, gaining £1 for September and 10s. for December. Tin fluctuated considerably and finished £4 10s. down for cash and £7 lower for three months.

Figures issued by the Copper Institute in New York for the month of August show that production of crude copper in the U.S.A. was 82,700 short tons, against 88,100 tons in July, while output of refined was 106,800 tons, compared with 112,600 a month earlier. Deliveries to domestic users were 107,000 tons, against 104,500 tons in July. Stocks of refined copper in producers' hands at 78,825 tons were up by about 1,000 tons, compared with July 31. Outside the United States output of crude copper was 124,500 tons, compared with 128,800 tons in July. Production of refined copper in August was 90,300 tons, compared with 96,400 tons in the previous month, while stocks of refined copper at August 31 stood at 209,200 tons, an increase of 43,000 tons. Deliveries to consumers fell by 24,200 tons to 43,900 tons.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* September 24, £237 10s. to £242 10s.; September 25, £235 to £237 10s.; September 28, £232 10s. to £237 10s.; September 29, £232 10s. to £235; September 30, £235 to £237 10s.

Three Months: September 24, £224 to £224 10s.; September 25, £221 10s. to £222; September 28, £221 10s. to £222; September 29, £222 to £223; September 30, £221 10s. to £222.

TIN, Standard—*Cash:* September 24, £622 10s. to £625; September 25, £610 to £612 10s.; September 28, £607 10s. to £610; September 29, £612 10s. to £615; September 30, £615 to £617 10s.

Three Months: September 24, £607 to £608; September 25, £599 to £600; September 28, £597 to £598; September 29, £605 to £606; September 30, £606 to £607 10s.

ZINC—*September:* September 24, £70 15s. to £71; September 25, £69 5s. to £69 15s.; September 28, £70 15s. to £70 17s. 6d.; September 29, £71 10s. to £71 15s. *October:* September 30, £69 15s. to £70.

December: September 24, £68 10s. to £69; September 25, £67 15s. to £68 5s.; September 28, £68 5s. to £68 10s.; September 29, £68 10s. to £68 15s. *January:* September 30, £68 5s. to £68 10s.

LEAD—*September:* September 24, £92 15s. to £93; September 25, £91 10s. to £91 15s.; September 28, £92 10s. to £92 15s.; September 29, £93 10s. to £94. *October:* September 30, £92 7s. 6d. to £92 12s. 6d.

December: September 24, £88 15s. to £89; September 25, £87 15s. to £88; September 28, £88 to £88 10s.; September 29, £89 to £89 5s. *January:* September 30, £88 10s. to £88 15s.

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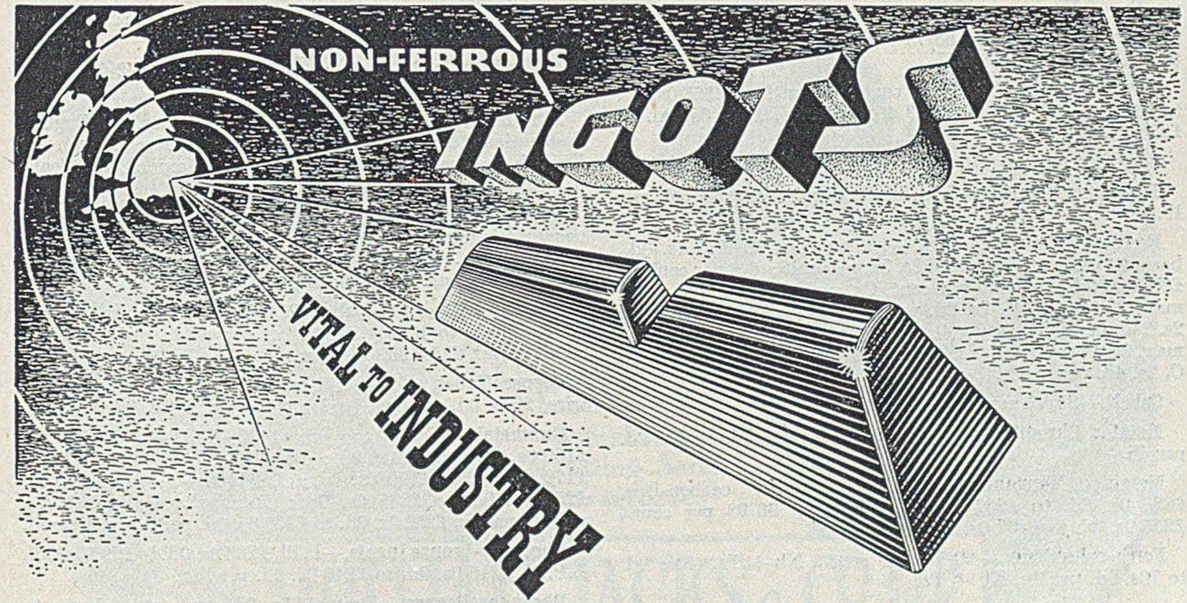

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

September 30, 1953

PIG-IRON

Foundry Iron.—No. 3 Iron, Class 2:—Middlesbrough, £13 18s. 0d.; 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. 0d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £18 3s. 0d.; South Zone, £18 5s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £19 3s. 0d.; 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. 0d.; Scotland (Scotch iron), £16 18s. 6d.; Sheffield, £17 13s. 0d.; 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., £53 10s. 0d., basis 45 per cent. Si, scale 21s. 6d. per unit; 70/84 per cent., £82 10s. 0d., basis 75 per cent. Si, scale 23s. per unit.

Ferro-vanadium.—50/60 per cent., 23s. 8d. to 25s. 0d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 10s. 0d. to 11s. 0d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £165 0s. 0d. to £181 0s. 0d. per ton; 38/40 per cent., £229 0s. 0d. to £235 0s. 0d. per ton.

Ferro-tungsten.—80/85 per cent., 20s. 0d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 23s. 3d. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent. C, £85 4s. 0d., basis 60 per cent. Cr, scale 28s. 3d. per unit; 6/8 per cent. C, £80 17s. 0d., basis 60 per cent. Cr, scale 26s. 9d. per unit; max. 2 per cent. C, 2s. 2d. 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. 0d. per lb.

Metallic Chromium.—98/99 per cent., 6s. 3d. to 6s. 9d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £225 0s. 0d. to £232 0s. 0d. per ton; 96/98 per cent., £255 0s. 0d. to £262 0s. 0d. per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 40s. 0d. to 70s. 0d. 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 0s. 0d.; silico-manganese, £33 16s. 0d.; free-cutting, £28 16s. 6d. Siemens Martin Acid: Up to 0.25 per cent. C, £32 12s. 0d.; case-hardening, £33 0s. 0d.; silico-manganese, £34 17s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic soft up to 0.25 per cent. C, £29 16s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £30 16s. 0d.; acid, up to 0.25 per cent. C, £33 0s. 0d.

Sheet and Tinplate Bars.—£25 11s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast). £30 6s. 6d.; boiler plates (N.-E. Coast), £31 14s. 0d.; 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. 0d.; galvanized corrugated sheets, 24 g., £49 19s. 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. 9d. per basis box.

NON-FERROUS METALS

Copper.—Cash, £235 0s. 0d. to £237 10s. 0d.; three months, £221 10s. 0d. to £222 0s. 0d.; settlement, £237 10s. 0d.

Tin.—Cash, £615 0s. 0d. to £617 10s. 0d.; three months, £606 0s. 0d. to £607 10s. 0d.; settlement, £617 10s. 0d.

Zinc.—October, £69 15s. 0d. to £70 0s. 0d.; January, £68 5s. 0d. to £68 10s. 0d.

Refined Pig-lead.—October, £92 7s. 6d. to £92 12s. 6d.; January, £88 10s. 0d. to £88 15s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £99 7s. 6d.; rolled zinc (boiler plates), all English destinations, £98 2s. 6d.; zinc oxide (Red Seal), d/d buyers premises, £87 0s. 0d.

Other Metals.—Aluminium, ingots, £150 0s. 0d.; magnesium, ingots, 2s. 10½d. per lb.; antimony, English, 99 per cent., £225 0s. 0d.; quicksilver, ex warehouse, £64 15s. 0d.; nickel, £483 0s. 0d.

Brass.—Solid-drawn tubes, 22¼d. per lb.; rods, drawn, 32d.; sheets to 10 w.g., 239s. 0d. per cwt.; wire, 29⅞d.; rolled metal, 235s. 9d. per cwt.

Copper Tubes, etc.—Solid-drawn tubes, 27½d. per lb.; wire, 267s. 0d. per cwt. basis; 20 s.w.g., 296s. 0d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £160 0s. 0d. to £170 0s. 0d.; BS. 1400—LG3—1 (86/7/5/2), £170 0s. 0d. to £190 0s. 0d.; BS 1400—G1—1 (88/10/2), £252 0s. 0d. to £285 0s. 0d.; Admiralty GM (88/10/2), virgin quality, £252 0s. 0d. to £300 0s. 0d. per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £265 0s. 0d. to £295 0s. 0d.; L.P.Bl, £215 0s. 0d. to £240 0s. 0d. per ton.

Phosphor Bronze.—Strip, 351s. 6d. per cwt.; sheets to 10 w.g., 373s. 3d. per cwt.; wire, 44½d. per lb.; rods, 38¾d.; tubes, 37d.; chill cast bars: solids 40d., cored 41d. (C. Clifford & Son, Limited.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × .056, 3s. 0¼d. per lb.; round wire, 10g., in coils (10 per cent.), 3s. 5¼d.; special quality turning rod, 10 per cent. ½ in. dia., in straight lengths, 3s. 4¼d. All prices are net'

Forthcoming Events

OCTOBER 5

East Midlands Metallurgical Society

Presidential address by Dr. H. K. Lloyd. "Hydrogen in Steel," 7.30 p.m. in the Nottingham and District Technical College, Shakespeare Street, Nottingham.

Institute of British Foundrymen

Sheffield branch:—Smoking Concert. Presidential Address by M. M. Hallett, "Communications" at the Royal Victoria Station Hotel.

Institution of Works Managers

Paisley group:—"Management Ethics for Foremen," by W. H. Bower, 7.30 p.m., in the canteen of Eadie Bros. and Company, Limited, Paisley.

OCTOBER 6

Incorporated Plant Engineers

London branch:—"Patterns, Castings and Foundrywork," by B. Levy, president of the London branch of the Institute of British Foundrymen, 7 p.m. (preceded by tea at 6.30) at the Royal Society of Arts, John Adam Street, Adelphi, Strand.

OCTOBER 7

Incorporated Plant Engineers

Southampton branch:—"Oxygen in Industry," by E. Ryalls, 7.30 p.m. at the Polygon Hotel.

Purchasing Officers' Association

Tyneside branch:—"Purchasing—the Profession and the Association," by P. J. H. Bailey, 7 p.m., Crown Hotel, Clayton Street West, Newcastle-upon-Tyne.

OCTOBER 8

Institute of British Foundrymen

Lincolnshire branch:—"C Process," by J. Fallows, 7.15 p.m., at Lincoln Technical College.

Institution of Works Managers

Wembley sub-branch:—"Work Study as a factor in Industrial Efficiency," by A. G. Northcott, 12.45 p.m., at the Century Hotel, Forty Avenue, Wembley.

OCTOBER 10

Institute of British Foundrymen

Scottish branch:—Presidential address, followed by "Investment Precision Casting without an Expendable Pattern," a paper by A. Dunlop, 3. p.m., at the Royal Technical College, Glasgow.

Obituary

THE DEATH is announced of Miss Dora Ostroff, president of the foundry concern of Thomas Paulson & Son, Inc., of Brooklyn, New York. Miss Ostroff was a member of the American Foundrymen's Society and she died in Paris while participating in the International Foundry Congress last week.

THE DEATH HAS OCCURRED of Dr. Th. Geilenkirchen, who was editor of *Die Giesserei*—the German foundry journal—between the two wars. He organized the International Foundry Congress held in Düsseldorf in 1936. He was also secretary of the *Verein Deutscher Giessereifachleute*, and well known in international foundry circles.

MR. PERCY BUTLER, director and general manager of Bruce Peebles & Company, Limited, engineers, Edinburgh, has died. Born at Normanton, Yorks. in 1896, he gained his early experience with Rhodes & Company, Limited, Wakefield. After service in the first world war he took his B.Sc. degree in electrical engineering at Leeds University and joined the Metropolitan Vickers Electrical Company, Manchester, and became a transformer designer. In 1926 he was appointed senior transformer designer to Bruce Peebles & Company, Edinburgh, and was promoted manager of the transformer and rectifier departments in 1943; joint general manager in 1952, and a director of the company later in the same year.

NOTICE

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

SITUATIONS WANTED

YOUNG FOUNDRY CHARGEHAND (Mechanised Iron) seeks progressive position. Five years' indentured apprenticeship. City and Guilds certificates. Patternmaking and foundry practice.—Box 3777, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER, aged 38, M.I.B.F., City and Guilds, experienced, ferrous and non-ferrous, loose pattern and mechanised, used to complete control, buying, selling, and production, excellent references.—Box 3787, FOUNDRY TRADE JOURNAL.

NON-CORROSIVE Steel Foundryman wide administrative experience, seeks supervisory position with progressive company.—Box 3786, FOUNDRY TRADE JOURNAL.

PRACTICAL REPRESENTATIVE, M.I.B.F., 30 years' experience in all branches as Works Manager and Technical Representative, requires position. Well known to Foundry Managements, particularly North England and Scotland. Fully capable of demonstrating where necessary. —Box 3785, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN/SUPERINTENDENT, 45, desires position, 30 years' experience in all classes of ferrous foundry practice, mechanised, jobbing, etc., A.M.I.B.F.—Box 3790, FOUNDRY TRADE JOURNAL.

STEEL FOUNDRY METALLURGIST (35) desires change. D.A. and H.F. Furnaces. Ingots and castings. Experienced modern foundry methods and draughtsmanship.—Box 3791, FOUNDRY TRADE JOURNAL.

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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.

FOUNDRY in S.W. London requires active full-time sales representative in the Midlands with connections in the trade. Capable of organising sales effort and preferably with working knowledge of up-to-date foundry practice. Progressive position and adequate salary to successful candidate.—Box 3745, FOUNDRY TRADE JOURNAL.

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FIRST-CLASS MOULDERS used to Machine Tool castings and having served apprenticeship, wanted for Machine Tool Foundry in provincial town in North Wales (castings up to 5 tons). Good rates of pay plus bonus. Houses available for suitable applicants.—Write Box 3788, FOUNDRY TRADE JOURNAL.

FOUNDRYMAN required for India (Bombay Area) with considerable experience of Automobile Engine Castings preferably having specialised in Cylinder Blocks. Good salary according to experience, free passage. Willing consider man in late fifties with long experience in this kind of work. Apply in confidence giving full details of experience to—Box 3792, FOUNDRY TRADE JOURNAL.

DRAUGHTSMAN required for Foundry Consultant's Office. Foundry experience essential. Experience of Mechanical Handling an advantage. Able to work with minimum supervision. Apply stating salary, age, experience, etc., to—P. C. FASSOTTE, Trevelyan Chambers, Boar Lane Leeds, 1.

MANAGER required to take full control progressive iron and non-ferrous foundry capable of producing 100 tons monthly. Preston district. Applicants should have foundry and office training. State full particulars and experience.—Box 3784, FOUNDRY TRADE JOURNAL.

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WANTED—*contd.*

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WANTED.—2 tons, or thereabouts, Electric Arc Steel Melting Furnace. Age not important. Hand-operated electrodes accepted.—Box 3733, FOUNDRY TRADE JOURNAL.

WANTED.—Pallet Conveyor Tracks. Approximately 250 ft.—Box 3779, FOUNDRY TRADE JOURNAL.

WANTED.—RD.5 or BT.5 Jolt Squeeze Turnover Moulding Machine.—Particulars of price, condition, etc., to HENRY WALLWORK & CO., LTD., Red Bank, Manchester, 4.

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Pallett Conveyor, plates about 3 ft. by 2 ft.
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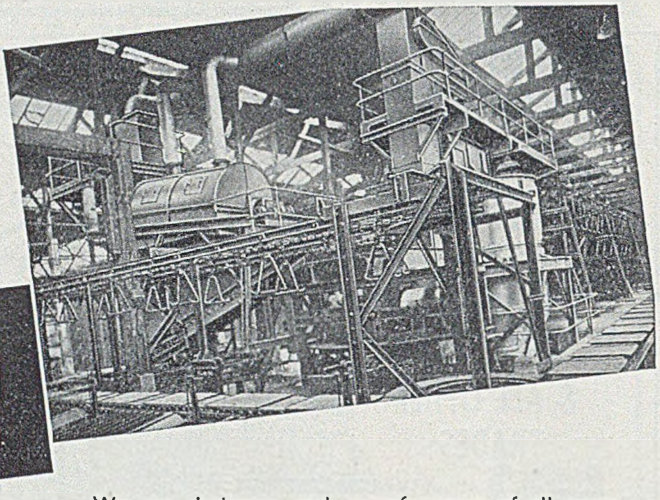

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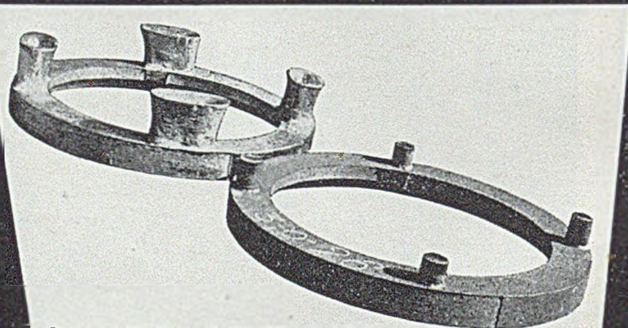

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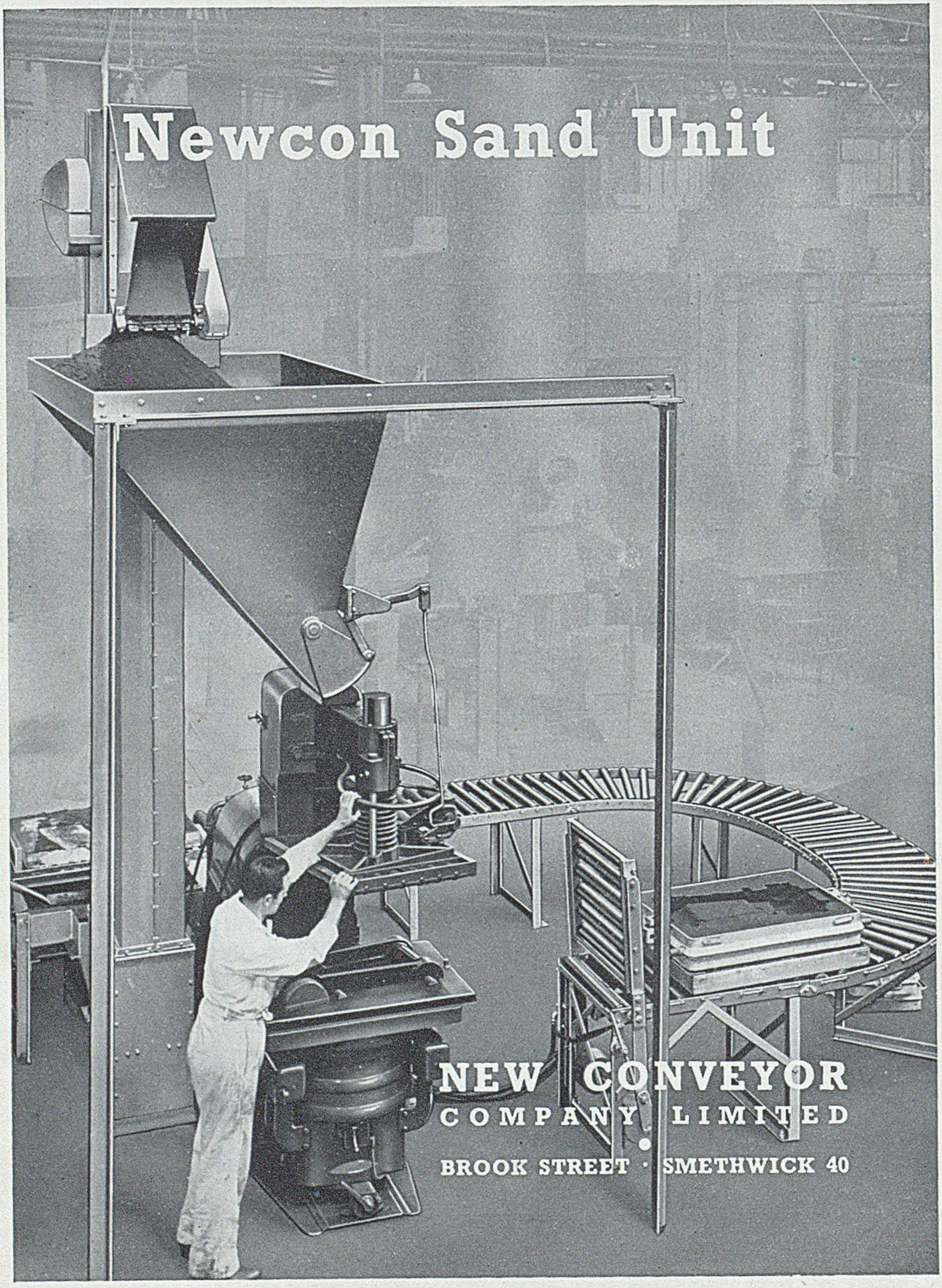
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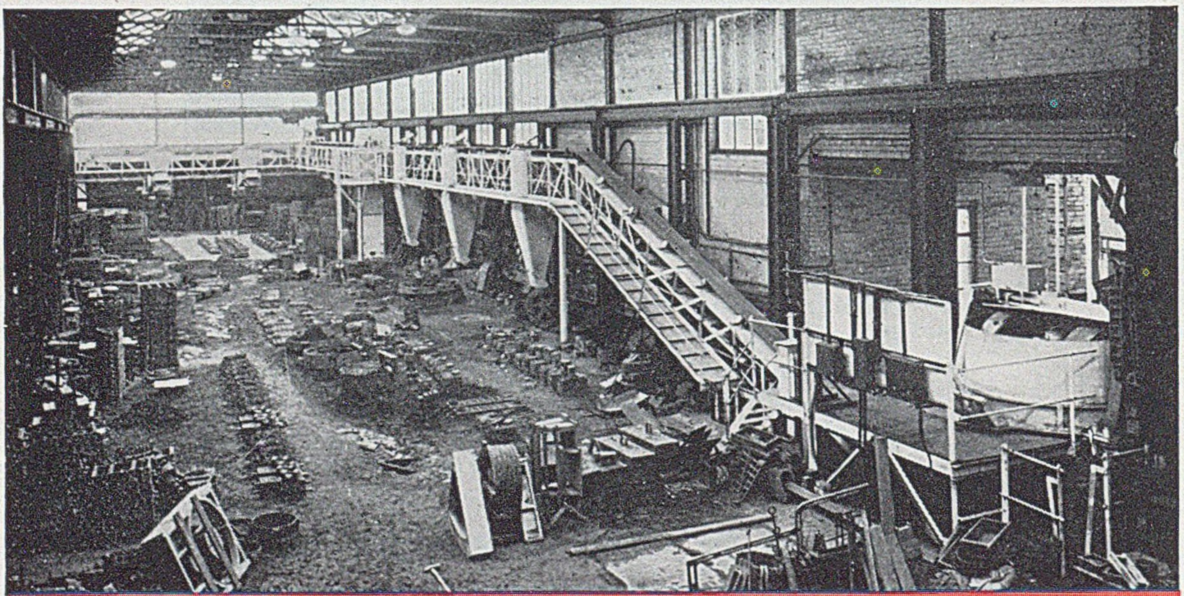

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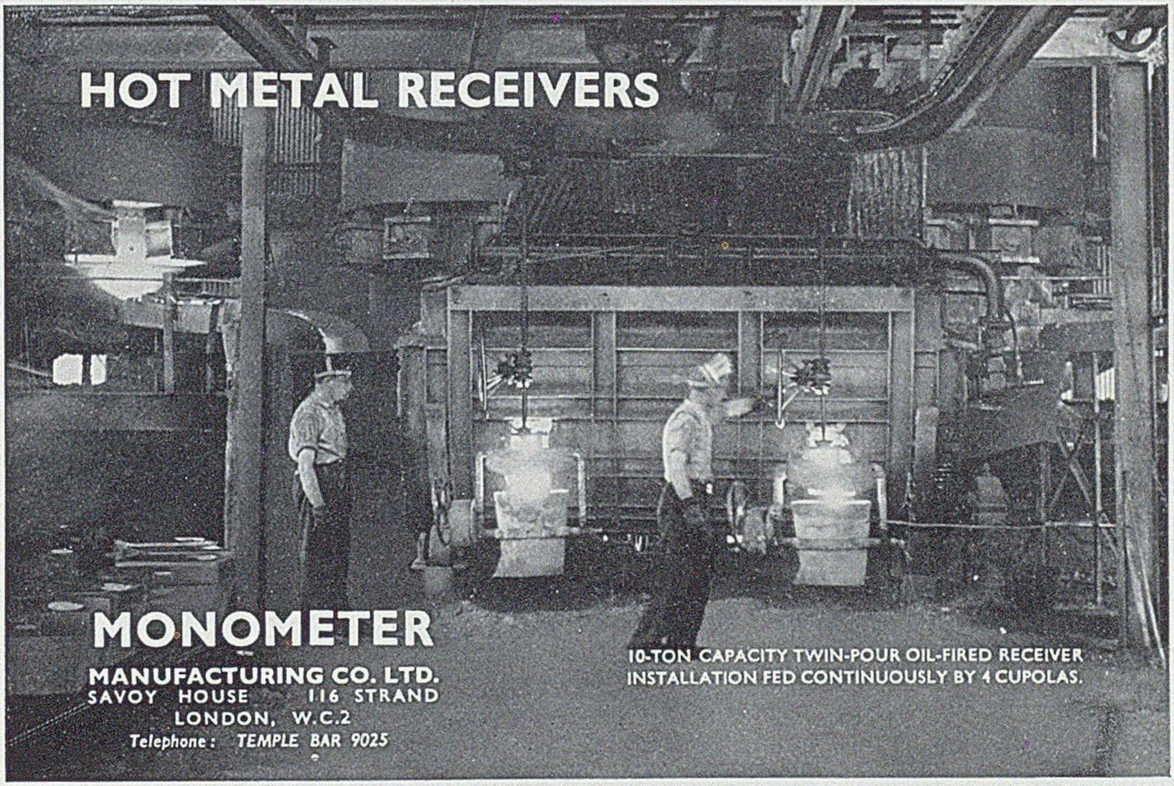
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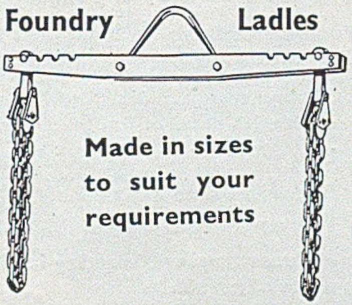
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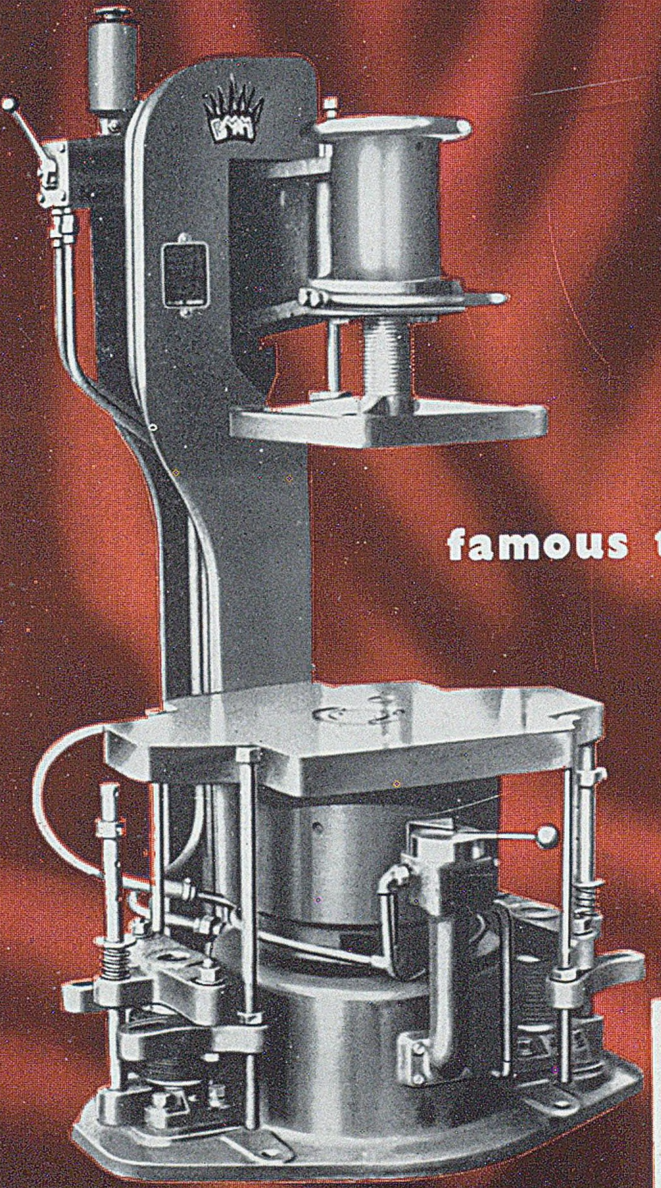

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