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## Spring Interlude

We have just experienced for the first time in our life the pleasures to be gained from a Spring holiday. We chose a small manufacturing town high up in the Jura mountains on the French side of the Swiss frontier. It was still winter when we arrived, but a fortnight was sufficient to effect a full transition into early summer. The colours of the wild flowers—daffodils, tulips, crocii and gentians—are deeper and fresher than the English varieties, and fruit blossom seems brighter in the clear atmosphere. Our small town makes chocolates, absinthe and castings in a little foundry operated by the owner and a boy. In the area, saw mills and watch factories abound, many of the latter being workshops attached to the farms.

To visit a sizeable foundry, we had a motor-car run of 60 miles, on what surely must be one of the most picturesque roads of Europe. The foundry was attached to one of the great French automobile works and, as at the B.T.H. shops at Rugby, is situated on the first floor. We have never been able to appreciate the economy of this type of layout, but it seems to operate satisfactorily. The system followed for the making of moulds is much the same as with some English motor-car factories, that is, a well-gauged core assembly is dropped into a box-like mould rammed-up on an Osborn machine. Many of the cores are dried by passing through banks of infra-red lamps. Others are conveyed through tar-oil-fired horizontal stoves, fired at 240 deg. C. For some of the steel castings, the bond for the cores is water-glass—a war-time improvisation which, being found satisfactory, has persisted. The moulding sand was batch-milled and distributed by the normal overhead system. The manœuvring of the moulds was, in the main, by roller conveyors. Proper attention was paid to dust extraction at the knock-out, and the general atmosphere was good. The output of cars is of the order of 500 per day. The whole works employs about 13,000 operatives. The quality of the castings is of a particularly high standard, and the foundry is fortunate in possessing its own machine shop for general maintenance.

There is a general lack of apprentices for the foundry, but any shortage of labourers is met by hiring North Africans. The social services are much the same as in this country, but the canteen service is no longer as popular with the married employees as it was. They prefer to dine at home. There is just one aspect which is different from ours and that is, when a young man becomes engaged to be married, the firm arrange for the sweetheart to attend a special school to be instructed in the art of cooking and housewifery. Then there is a generous system of family allowances, so that a lazy labourer with eight children need no longer work.

The most interesting side of such a visit is the exchange of experiences with the foundry manager and the chief metallurgist. The lining of the cupola—should it be acid or basic and should water cooling be used. Could the splendid life they are obtaining from the baby Bessemer be improved on—and so forth. The kindly welcome and abundant courtesies we received have left an indelible impression on our mind of the richness of French hospitality.

## Contents

# Notes from the Branches

### *Wales and Monmouth*

Last month the Wales and Monmouth branch of the Institute of British Foundrymen held a dinner at the Royal Hotel, Cardiff, when Mr. N. P. Newman, national president, and Mr. Tom Makemson, general secretary, were present. Other guests were Mr. G. R. Hayward and Mr. A. Hares, president and secretary of the Bristol branch. Apologies for absence were received from Mr. Gordon Rees, president, West Wales section; Mr. James, president, South Wales Engineers' Institute, and Mr. I. Evans, Central Office of Information, Cardiff.

Proposing the toast of The Institute, Mr. R. J. Richardson reviewed the history of the foundry industry and the Institute. Up to the beginning of the present century progress in the foundry had been slow and without any semblance of organisation. Then, around 1904, the Institute was founded by a small band of foundrymen, with the objects set out in the Charter. It was no mere coincidence that progress in the industry had kept pace with the growth of the Institute.

He hoped that the increase in membership would be maintained and so enable the Institute to continue the excellent service he had enjoyed with others in the past, and for which he personally was grateful. He was pleased to be chosen to propose this toast and to couple with it the name of the national president.

Responding, Mr. N. P. Newman expressed his appreciation of invitation to the Wales and Monmouth branch. It was the parent of his own branch at Bristol, which, by the way, was an offspring to be proud of. The branches represented the support of the Institute, and it was a pleasant duty to visit them in turn.

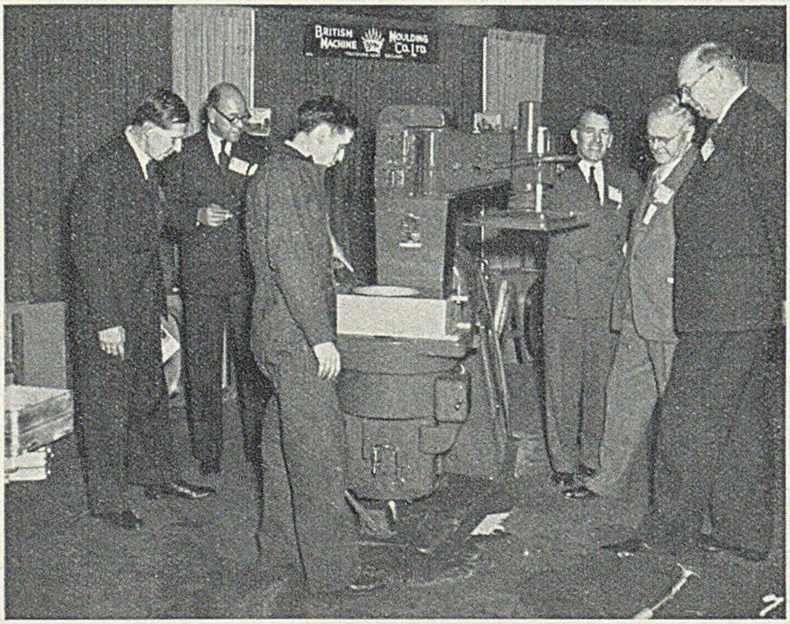
Proposing the toast of The Branch, Mr. Makemson outlined its history since 1912, its decline and subsequent revival in 1920 when Mr. McClelland undertook the duties of hon. secretary and organiser. In spite of difficulties due to the scattered area, progress was steady, and in due course a section was established in Bristol, which had since matured into the Bristol and West of England branch. Great credit was due to Mr. Hares, who had been honorary secretary of that branch since its inception in 1942. He was pleased to observe that the West Wales section was making progress, and thanks were due to Mr. D. Rogers and Mr. Gordon Rees, of Llanelly, for their efforts to keep the work of the Institute alive in that area. He coupled the toast with the name of Mr. Herbert Cole, branch president.

Mr. Cole briefly responded, and in looking back upon his year of office said it appeared too short. His duties had been made easy by the assistance of the hon. secretary and the support of the branch council. He hoped, however, to continue to promote the welfare and progress of the branch and to encourage all members, particularly the younger ones, to avail themselves of all that the Institute provided.

MR. H. J. V. WILLIAMS proposed the toast of Our Guests, and regretted that sickness and other unavoidable causes had reduced their numbers. MR. HAYWARD and MR. HARES responded on behalf of the visitors, expressing their appreciation of the hospitality.

## Printers' Bicentenary

On Wednesday of last week, Harrison & Sons, Limited, printers, of London, Hayes, High Wycombe and elsewhere, celebrated the 200th year since their inception with a dinner at the Connaught Rooms, London, W.C.2, attended by over 600 guests and staff. Features were the equipping of all the serving staff in costumes of 1750 and a demonstration of the use of early printing machinery for printing the menu cards. The reception was by Mr. B. Guy Harrison, chairman, and the directors, and the evening's programme was supplemented by music and entertainers. Harrison & Sons have been printers of the FOUNDRY TRADE JOURNAL since 1929, and members of the JOURNAL staff were guests at the dinner.




VISITORS TO THE STAND OF THE BRITISH MOULDING MACHINE COMPANY, LIMITED, AT THE AMERICAN FOUNDRYMEN'S SOCIETY'S EXHIBITION AT CLEVELAND. ON THE RIGHT OF THE PHOTOGRAPH MAY BE SEEN MR. E. W. HORLEBEIN, A.F.S. PRESIDENT, AND MR. N. P. NEWMAN, PRESIDENT OF THE INSTITUTE OF BRITISH FOUNDRYMEN.

# Modernising an Iron Foundry*

*By L. W. Bolton, F.I.M., A.M.I.Mech.E., and W. D. Ford†*

*When mechanical aids to production are installed in a foundry in which floor moulding has been satisfactorily carried out, many problems arise. The Authors examine factors influencing the choice of moulding sand and metal mixture, and the successful production of cores over a wide range of sizes with a standard time/temperature drying cycle. The use of automatic shake-outs is discussed and recommendations are made for securing fume- and dust-free working at shake-out stations. Experience with lighting, heating and the use of colour are briefly described. Dust exhausting in the fettling shop is examined and stress is laid on the importance of casting quality in reducing dust and noise in this department. Examples show how dressing may be minimised.*

### Introduction

IMPROVEMENTS in foundry methods and equipment over the past 20 years have been so progressive that modernisation of ironfoundries should have been a continuous process. That this has not been the case in some foundries is due to the fact that much of the newly-developed equipment is more suited to quantity production than to jobbing work. When mechanised equipment is installed in a foundry in which floor moulding has been satisfactorily and conveniently carried out, many problems arise, not only with regard to the provision of such essentials as moulding sand, cores, and metal, but also with other matters such as dust and fume control, lighting and heating. It is thought that a brief description of some of the problems encountered and methods adopted for their solution may be of interest.

The foundry with which the Authors are concerned, originally built for floor moulding, is now making castings in high-duty iron on a quantity-production basis. Thirty-five different components for an agricultural tractor are made, which vary in weight from a few ounces to 500 lb. It is appreciated that some of the methods employed are practicable only where large quantities of castings are required from a limited range of patterns, but it is thought that some at least could be adopted in any ironfoundry.

The installation of mechanical equipment for the continuous preparation of moulding sand, production and conveying of moulds and for the cleaning of castings, involves a high capital outlay and relatively heavy maintenance costs. On the other hand, where the production is suitable for this type of operation, the advantages derived are considerable and may be listed as follows:—

(1) The maximum use may be made of unskilled labour; (2) greater control is possible over sand and metal; (3) improvement in working conditions can be effected; (4) increased production is obtainable from a given floor area; and (5) higher earnings can be made available to workers.

### Layout and Equipment

In planning the production of the range of castings, it was divided into classes, light, medium and heavy, and the plant was designed to operate in three sections, each dealing with a separate class. For the lighter castings, *i.e.*, those up to a maximum weight of about 100 lb., straight-draw jolt-squeeze machines were installed. These machines are provided with an overhead sand feed by a continuous mill. The continuous mill also supplies sand to the second section of the plant, where a machine of the slinger type produces moulds for the heaviest castings, which weigh approximately 5 cwt. The medium castings in the range 100 to 200 lb. are made on jolt-squeeze-turnover machines. Because of further possible extensions, this third section of the plant is not completely mechanised, the sand being prepared in a batch mill and supplied to the machines by hand methods.

### Provision of Moulding Sand

Much has been said and written on the question of synthetic *versus* natural sand for moulding. There is no doubt that the use of a natural sand, with large editions of new sand to maintain suitable properties, provides a simple means of securing a satisfactory moulding sand.

An examination of the castings to be made showed that full moulding production necessitated the use of approximately 60 tons of cores per week and it was assumed that the bulk of this sand would enter the moulding sand system. It was anticipated that such a large addition of burnt core sand would, by dilution, offset any advantage likely to be secured from a natural sand. The decision was therefore taken to adopt a synthetic sand, using the burnt core sand as a basis, with suitable additions of bond and coal dust. Experience has shown that in normal working, additions of new sand to the moulding sand are unnecessary, and, in fact, the supply of sand through burnt cores is more than sufficient to make good the losses. Large pieces of unburnt core are rejected by a screen, but should the sand level in the moulding-sand bunkers become low, they are replenished by bringing into use rollers situated over the shake-out belts. These rollers crush the larger sand lumps and reduce the rejections at the

TABLE I.—*Grading of Two Silica Sands Used for Coremaking.*

| Sieve. | Congleton. | Leighton Buzzard Fine. |
|---|---|---|
| | Per cent. | Per cent. |
| + 16 | 0.1 | — |
| + 30 | 1.5 | — |
| + 44 | 11.2 | 0.2 |
| + 60 | 34.6 | .6 |
| +100 | 43.7 | 34.2 |
| +150 | 7.6 | 52.7 |
| +200 | 0.8 | 6.9 |
| −200 | 0.1 | 1.8 |
| Clay | 0.3 | 2.6 |

* Paper presented to the London branch of the Institute of British Foundrymen, Mr. F. Arnold Wilson presiding.

† The Authors are manager and foundry engineer, respectively, at the Wellingborough foundry of Morris Motors, Limited (Engines Branch).

*Modernising an Ironfoundry*

screen. Two sands are employed for core making with rather different gradings as shown in Table I.

These sands are normally used in the core-sand mixture in approximately equal proportions, but the proportion of each sand may be adjusted to suit the requirements of the moulding sand. Should the permeability fall, an increased proportion of the coarser grained sand is used and *vice versa*. The properties of the moulding sand are maintained between the limits:—

| | |
|---|---|
| Moisture .. .. .. .. | 5.0 to 6.0 per cent. |
| Green compression strength .. | 10 to 12 lb. per sq. in. |
| Permeability .. .. .. | 50 to 60 A.F.S. |
| Shatter value .. .. .. | 70 to 80 |
| Volatile content .. .. | 3.5 to 4.0 per cent. |

### Continuous-mill System

In the sand system provided with a continuous mill, additions of bond and coal dust are made by mechanical feeders. The simplest and most convenient form of feeder consists of a hopper with an 8-in. wide belt feed travelling at about 10 ft. per min., located over the belt which supplies the mill. An adjustable gate permits any pre-determined rate of addition to be maintained. An Archimedian-screw type of feed has also been found satisfactory, but does not allow any simple means of varying the rate of addition. An average bond addition of 1.5 per cent. is sufficient to maintain the strength of the sand and a similar addition of coal dust maintains the volatile content at a satisfactory level.

The continuous mill has proved to be a most efficient and satisfactory piece of equipment and by its use a sand of controlled quality may be maintained for long periods without excessive supervision. No serious difficulties arise from the use of a common sand mixture for the pin-lift moulding machines and the slinger-type equipment. It would, however, be incorrect to suggest that both types of machines give their best results with the same sand properties and these have to represent a compromise between the two requirements.

### Batch-mill System

The batch mill used in the system producing the medium-size castings has the advantage that radical alteration to the moulding-sand mixture may be effected instantaneously and experimental mixes with regard to constituents or time of milling, can be prepared when needed. Where control is exercised over moulding sand, it is possible to maintain suitable properties for considerable periods without trouble, but the provision of a batch mill is a safeguard when such troubles arise. Reference to special advantages obtainable from facing sand which can be produced when a batch mill is available, will be referred to later in the Paper.

### Core Production

In order to secure full production of castings, it is necessary to dry approximately 6,000 cores each week, varying in weight from a few ounces to more than 100 lb. The main drying equipment consists of an oil-fired continuous stove which is operated at a temperature of 450 deg. F. (230 deg. C.) with a full cycle of 100 min.

Originally, an oil-dextrine mixture was used for all cores. This type of mixture has very good ramming properties and produces cores with an excellent skin finish having adequate green strength so that carriers are not needed. When using this mixture, however, the largest cores required a double passage through the stove which curtailed drying capacity and increased the work of the stove attendants. For these cores, therefore, a change was made to a synthetic-resin-base binder, using starch to provide green bond. The change from dextrine to starch was necessary because a higher moisture is needed in obtaining optimum dry strength with the resin binder. With the oil-dextrine mixture, a moisture content to 1.0 to 1.5 per cent. is satisfactory, whereas this must be increased to 3.5 to 4.0 per cent. in the resin sand.

A phenolic-resin base was chosen as it allows more latitude of drying temperature than urea resin, that is to say, cores over a wider range of sizes may be dried with a constant time/temperature cycle, without trouble from under- or over-baking. By its use, the largest cores weighing up to 120 lb. and with sections varying from 1½ in. to 6 in. thickness are dried in 100 min. Apart from the very considerable benefit derived from drying the largest cores in one trip, the phenolic resin produces no objectionable fumes in the core-shop or foundry. The reduced amount of fume evolved during casting, and the consequent improvement in the foundry atmosphere, is particularly noticeable. Both mixtures have almost identical green strength and stripping properties. Spraying with clean water before stoving has been found to give the resin-bonded cores an improved surface hardness.

### Metal

As previously stated, the castings produced vary considerably in weight and section thickness. It was therefore necessary to develop a suitable high-duty iron to cover the range. A base composition suitable for the medium-size castings is melted and the properties of the metal are adjusted as necessary in the ladle.

In producing cupola metal of controlled composition for high-duty castings, two methods are available. In the first, low-carbon or refined pig-iron may be used as a basis for the mixture, and in the second, high-carbon pig-iron with steel scrap. Both methods are widely used and an examination of their relative merits may be of interest.

When a mixture containing pig-iron with 15 to 20 per cent. steel scrap is melted in a cupola, metal of uniform composition from tap to tap can be secured only if adequate provision is made for the mixing of the molten metal before it is taken for casting. A sufficient body of metal, usually equal to three or four charges, must be held with the object of smoothing out fluctuations in composition. This can be done by providing a well of ample capacity or by collecting the metal in a receiver. In the latter case, some means of heating the receiver is desirable before and also preferably during operation.

With mixtures containing steel, carbon pick-up is a matter of extreme importance and changes in the quantity or quality of the fuel used can have a marked influence on the composition of the metal. Very exact technical control is therefore necessary, if composition is to be maintained within close limits, during a melt and from day to day. Steel mixtures melt at a higher temperature than pig and cast-iron scrap mixtures and thus tend to give a higher tapping temperature, but some of this additional heat may be lost in receiver operation unless a high heat input is available for maintaining the temperature of the bath. The cost per ton of metal charged is lower than with a steel-free mix. Against this must be set a higher coke consumption, increased expenditure on laboratory control, higher refractory costs and, if a receiver be used, the additional cost of heating this and of necessary repairs.

Mixtures of low-carbon pig iron and return cast-iron scrap of very similar composition reduce the need for mixing any very large body of metal. Although it is necessary in producing metal within close limits of composition, to exercise strict control over all raw materials and operations, the degree of control need not be so exact as with mixtures containing appreciable proportions of steel. When introducing the production of high-duty iron into a foundry, therefore, the choice of mixture to be used may be influenced by the melting equipment available, *i.e.* whether a large well-capacity can be provided or whether sufficient height is available for the installation of a receiver.

In supplying metal for continuous casting through an 8-hour melting period, some form of foundry control test is necessary so that the chilling properties of the metal may be continuously examined. Suitable tests have been fully described in the report of Sub-committee T.S.6 of the technical committee of the Institute of British Foundrymen (Proc. I.B.F. Vol. XXXIX). The simple form of chill test illustrated in Fig. 3 of that report has been found to give satisfactory results and with a little experience can be related to the carbon and silicon contents which are checked chemically at not more than hourly intervals. The carbon and silicon contents of the base metal are kept within the limits ± 0.05 per cent. of the desired composition. Small additions of an inoculant are made when the lightest section castings are poured. Additions of ferro-chromium are made to the metal used for work of the heaviest section.

### Shake-out

In many mechanised foundries, the shake-out is recognised as a hot, dusty and strenuous occupation, and for this reason it is often a bottle-neck which governs the rate of working in other sections. This difficulty is intensified if an attempt is made to handle castings over a wide range of sizes at a single shake-out.

It was therefore decided to handle the castings from each of the three sections at separate shake-outs. Adequate working room and ventilation is provided at each station, with the result that shaking out has become no more arduous than moulding or any other foundry operation. The labour required for the three stations is not considered to be in excess of that which would have been needed at a single shake-out handling the whole range of castings. No difficulty is experienced in obtaining labour for this work and the high speed with which boxes can be returned to the machines is of considerable benefit to production.

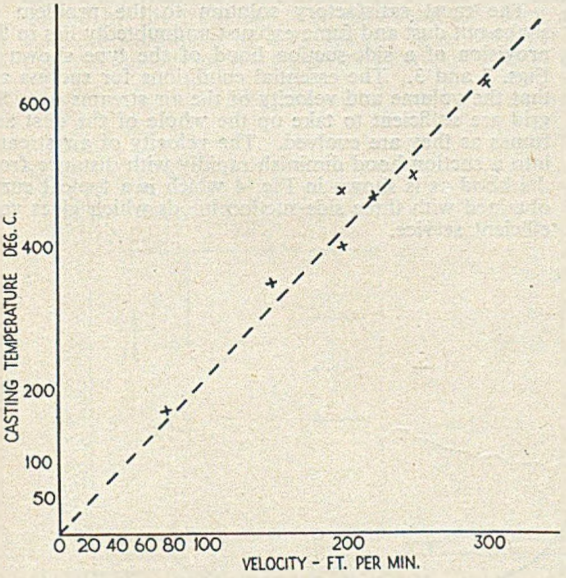



Fig. 1.—Relation between Temperature of Casting at Shake-out and Velocity at which Gases Rise from it.

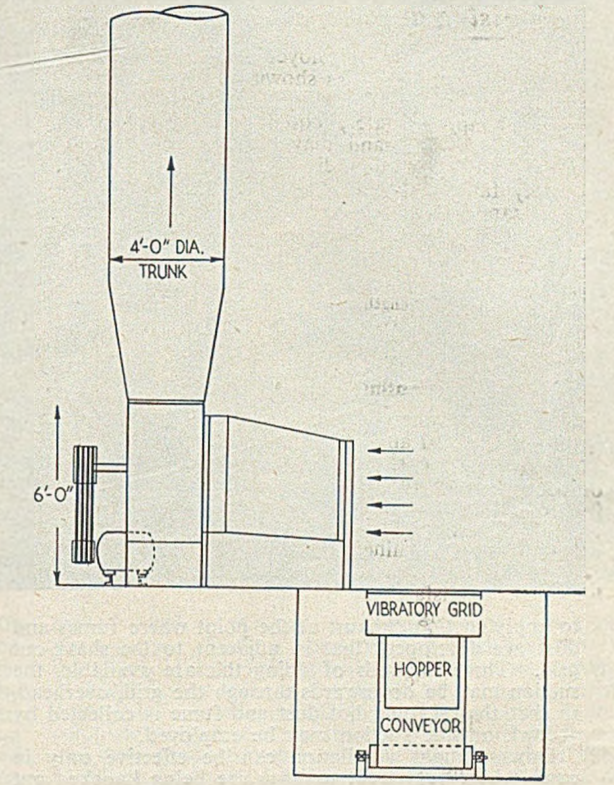



Fig. 2.—Arrangement of Side-suction Hood used in conjunction with Vibratory Grid Shake-out.

Each shake-out consists of a vibratory grid situated over a hopper which feeds the sand on to a belt conveyor. Vibratory grids of various types are available, including those operated electrically and by a positive eccentric action. A positive jolt is of value when dealing with strongly-bonded sands of the type normally used in the production of heavy high-duty castings. It should be noted that with the latter type of shake-out, light cast-iron boxes may suffer damage and the use of steel boxes of robust design is advisable. The damage to moulding boxes by a vibratory shake-out is, of course, less than when hand methods of knocking-out are used.

It is by no means generally realised that in choosing the type of shake-out to be employed, the strength of the moulding sand must be taken into consideration. With sand having a green compression strength of 10 to 12 lb. per sq. in., electrically-operated vibrators may not be capable of handling boxes at the speed required and with sand having a dry compression strength of the order of 100 lb. per sq. in., may be incapable of breaking down the sand lumps on the grid.

### Ventilation of Shake-out Stations

The ventilation provided at shake-outs stations is a matter which is receiving increasing attention. General ventilation, *i.e.* dilution of the dust and fumes, is no solution, as this can only result in contamination of the shop atmosphere. The only satisfactory method is

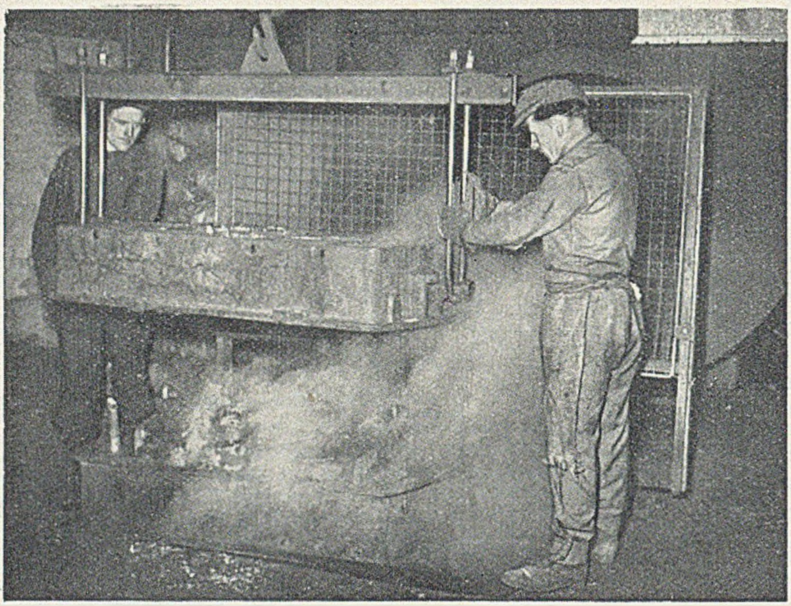


FIG. 3.—AUTOMATIC SHAKE-OUT WITH SIDE-SUCTION HOOD. STEAM AND DUST TRAVEL LATERALLY INTO THE HOOD AND DO NOT REACH THE OPERATORS.

to apply suction exhaust at the point where fumes and dust are developed, that is, adjacent to the shake-out grid. Three methods of doing this are available, the suction may be downwards through the grid, overhead, so that the escaping hot dust and fume is collected by a cowl, or side suction may be employed.

Down-draught ventilation can be effective only in cases where very light castings are being knocked out and where steam is the main nuisance. In such cases, little dry sand will be produced and the heat of the escaping gases will not be very high. Some experiments have been carried out to determine the speed at which gases rise from hot castings and Fig. 1 shows the relationship beween temperaure and gas velocity. It will be seen that when a casting is knocked out at a barely visible red heat, *i.e.* about 500 deg. C., the hot gases rise with a velocity of approximately 250 ft. per min. In order to trap these gases and draw them downwards, a down-draught of the order of 250 to 300 ft. per min. is required at the grid. Hot, dry moulding sand falling through air currents of this velocity may be picked up and exhausted with the fumes. When hot, dry sand falls through a shake-out grid, a downward suction velocity as low as 100 ft. per min. has been found to exhaust large quantities of sand grains, together with even larger proportions of clay and coal dust. At the same time it has proved almost completely ineffective in arresting the fumes rising from the castings. It should also be noted that when a down draught is employed through the shake-out grid, any large quantity of sand flooding on to the grid will cut off the draught, or very much reduce it, until the grid is cleared.

An overhead cowl provided with suction which assists the escape of the rising steam and fumes is simple to design and operate, but has the disadvantage that the operators must often bend into the dust streams. Overhead suction cannot, of course, be used when the size of the boxes necessitates handling with an overhead crane.

### Side-suction Hoods

The most satisfactory solution to the problem of shake-out dust and fume exhaust undoubtedly lies in the provision of a side-suction hood of the type shown in Figs. 2 and 3. The essential conditions for success are that the volume and velocity of the air streams over the grid are sufficient to take up the whole of the dust and fumes as they are evolved. The velocity of air streams into a suction hood diminish rapidly with distance from the hood as is shown in Fig. 4 which is a typical curve obtained with three side-suction hoods which gives very efficient service.

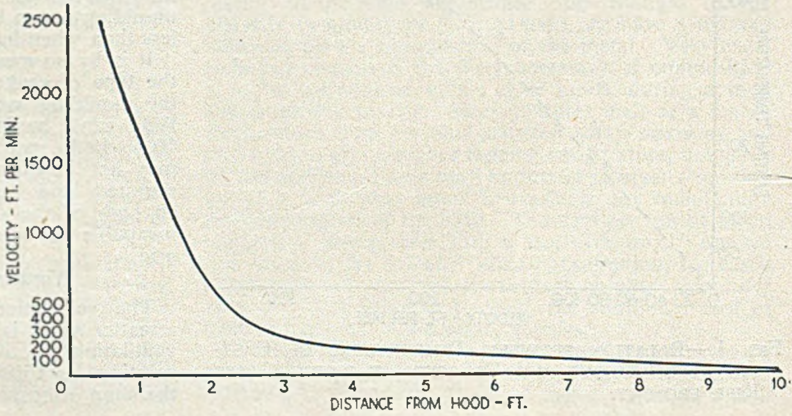



FIG. 4.—TYPICAL CURVE SHOWING RELATION BETWEEN VELOCITY OF AIR STREAMS AND DISTANCE FROM SIDE-SUCTION HOOD.

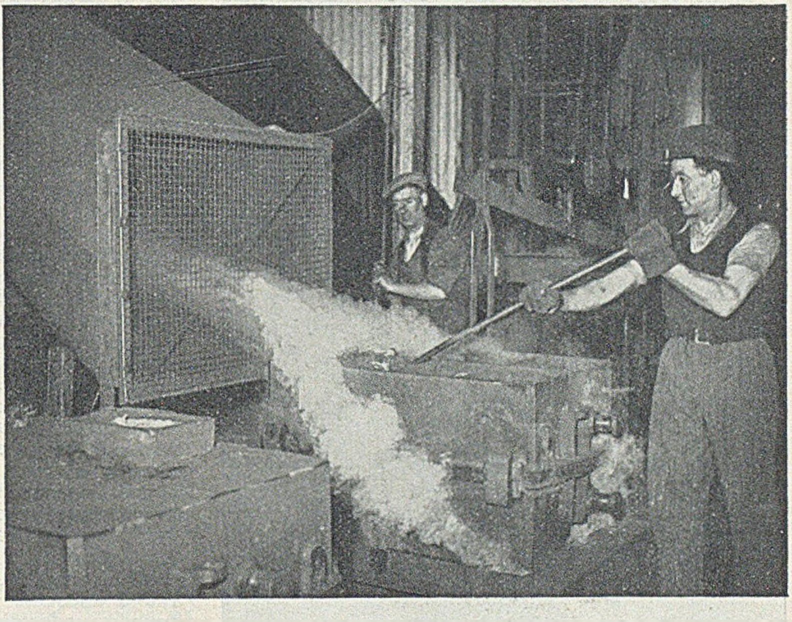


FIG. 5.—SIDE VIEW OF SUCTION HOOD USED FOR MEDIUM-SIZE BOXES. THE LATERAL TRAVEL OF THE DUST AND STEAM IS CLEARLY SHOWN.

It will be seen that the average initial velocity of 2,500 ft. per min. (*i.e.*, approximately 30 m.p.h.) near the hood mouth, falls rapidly and is reduced to only 250 ft. per min. (or about 3 m.p.h.) at a distance 4 ft. from the hood. Experience has shown that for shaking-out castings of 5 cwt. at temperatures up to 700 deg. C., an air velocity of at least 250 to 300 ft. per min. is required at the centre of the shake-out grid. Fig. 4 also shows that the air velocity at 8 to 10 ft. from the hood is so low as to be negligible. Operators working continuously at shake-outs ventilated in this way have no complaints of excessive draughts or restricted working space due to one side of the grid being occupied by the hood.

The current consumed by the exhaust fan is to some extent dependent on the resistance to the air stream offered by the trunking. For maximum efficiency, the trunking should be of a sufficiently large diameter so that the velocity of the air passing through it does not exceed 4,000 ft. per min. at a pressure of ½ to 1 in. water-gauge. With a modern high-efficiency fan, a motor of 7½ h.p. will provide an average air current of 2,500 ft. per min. at the mouth of a hood 3 ft. by 3 ft. 6 in. A velocity of this order has been found completely effective in removing the whole of the fumes and dust produced when shaking out castings at temperatures up to 700 deg. C. at an average distance of 3 ft. 6 in. from the hood mouth.

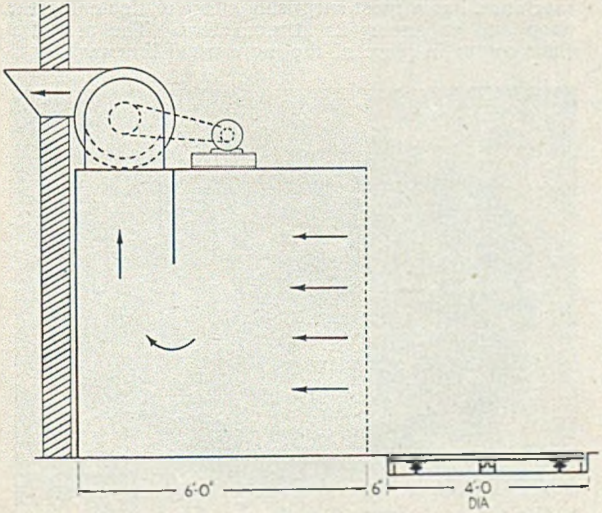



FIG. 6.—ARRANGEMENT OF CABIN TO EXHAUST DUST PRODUCED BY PORTABLE GRINDERS.

No special arrangement is needed to provide a uniformly-distributed air-current over the area of the hood and a simple wire mesh is sufficient to prevent accidental damage to the fan by the entry of foreign bodies. Should a stronger grid be needed, the area occupied by the bars must be taken into account in calculating the area of the opening. The air velocity does vary slightly across the hood mouth, and tends to be highest at the periphery of the hood, but this is no disadvantage. The best position for the hood has been found to be about one box height above the shake-out grid as shown in Fig. 5

With this type of equipment the loss of fine-grain sand, coal-dust and bond is very small and has not been found to have any adverse effect on the properties of the moulding sand. In the particular plant under discussion, the exhaust fumes are allowed to escape to atmosphere outside the foundry building. The foundry is situated in open country away from dwellings and other buildings, so that trouble from this source does not arise. There is no evidence that fumes or dust re-enter the foundry in any appreciable amounts.

### Foundry Working Conditions

The removal of dust and fumes produced at the shake-out effects a considerable improvement in shop conditions so far as the atmosphere is concerned. Pieces of burning core and the hot sand from the largest castings, produce fumes and steam on the main conveyor belt from the shake-out. A simple form of cowling built in sections, for easy removal, has therefore been erected over this belt and coupled to a smaller exhaust fan. Dust from other sources, notably the screen in the sand system, mills and sand throwers can be dealt with in a similar manner.

The main foundry building is provided with a jack roof and this is adequate to provide general ventilation

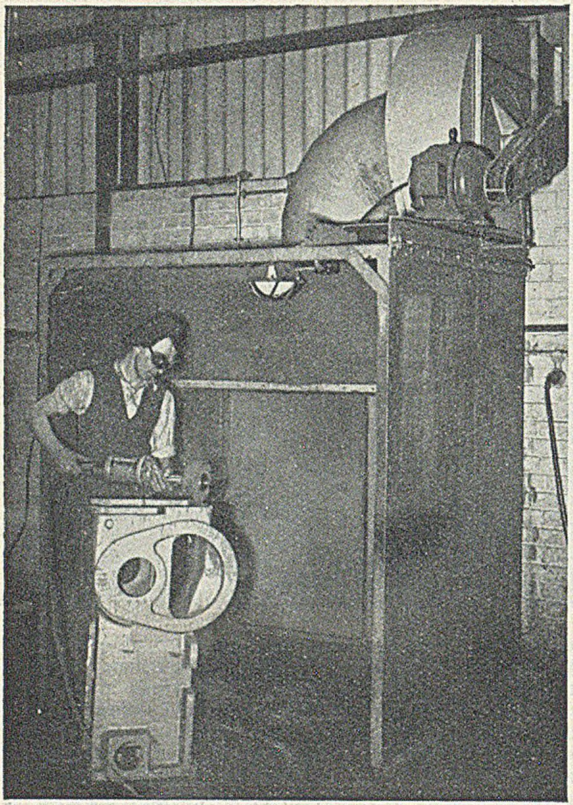


FIG. 7.—FETTLING CABIN USED FOR EXHAUSTING DUST FROM PORTABLE GRINDERS. THE CASTING STANDS ON A TURNTABLE AND GRIT FROM THE WHEEL IS THROWN TOWARD THE REAR OF THE CABIN.

now that the most serious sources of contamination have been removed. It is interesting to note that the exhaust-fan capacity installed at the points described, is sufficient to change the air in the foundry building once every 15 min. This has had no noticeable effect in producing draughts or in reducing the temperature of the shop in the winter.

### Heating

The heating of a well-ventilated building which houses large exhaust fans presents a special problem to which heating by radiation seems the only answer. Radiant heat can be supplied by electric and gas-fired heaters or by steam or hot water radiators. High-pressure hot-water heating, supplied from a central boiler through radiant heat panels, appears to have certain advantages over other systems, and equipment of this type is at present being installed.

Some experience has been gained with the use of coke-fired stoves. These heaters have the disadvantage that they occupy floor space but they require little attention and are cheap to put in and to operate. A stove of average size will heat an area of approximately 400 sq. ft. to a temperature which is 20 to 25 deg. F. above outside temperature on a normal winter day. A method of distribution can be arranged so that each gang of workers is provided with one or more stoves according to their needs, and stoves can be re-arranged to suit changed conditions without serious difficulty. It has, however, been found advisable to provide flue pipes to take fumes outside the building, as large quantities of smoke are sometimes produced when the stoves are first lighted.

### Lighting

The artificial lighting originally provided in the foundry building, consisted of 400-watt mercury-vapour fluorescent lamps set at intervals of 25 ft. by 20 ft. at a height of 37 ft. so as to avoid overhead cranes. This general shop lighting which gives an illumination of only 2.5 foot candles at floor level is inadequate for carrying out such operations as mould and core inspection, core setting, etc. Local lighting has therefore been installed at 12 ft. about floor level, with suitable dispersive reflectors, at all positions where a high degree of illumination is necessary.

A 300-watt tungsten-filament lamp, provided with a clean vitreous-enamelled reflector and situated 12 ft. above floor level, will provide an average illumination of 10 foot candles over an area of 60 to 80 sq. ft. This has been found sufficient to allow satisfactory inspection of moulds and cores, but the presence of even a small amount of dust on the lamp and reflector has been found to reduce the value of the light by 30 per cent. It is therefore most important in maintaining adequate illumination in a foundry to arrange for systematic and frequent cleaning of the lighting equipment.

An average illumination of 10 foot candles has been found adequate for all processes carried out in the foundry under discussion, including fettling and inspection. In some cases this has been provided by 400-watt fluorescent mercury lamps and in others by 500-watt tungsten-filament lamps. It is of interest to record, that with the same intensity of illumination as measured by a light meter, the sections using the latter type of lighting appear to be more brilliantly lit. The light output per unit of electricity consumed by a tungsten-filament lamp is only about half that provided by a mercury-vapour lamp. It is, however, suggested that the provision of bright and cheerful lighting in a foundry building has a psychological value which should not be ignored. A combination of mercury vapour with filament lamps would appear to offer a compromise, giving economical operation without interference with amenities.

### Use of Colour

The introduction of a light colour into a foundry for the painting of steelwork, runways, hoppers and machines, has a most surprising effect in lightening the shop and enhancing its attractiveness. The use of a light colour in place of the more usual limewash, con-

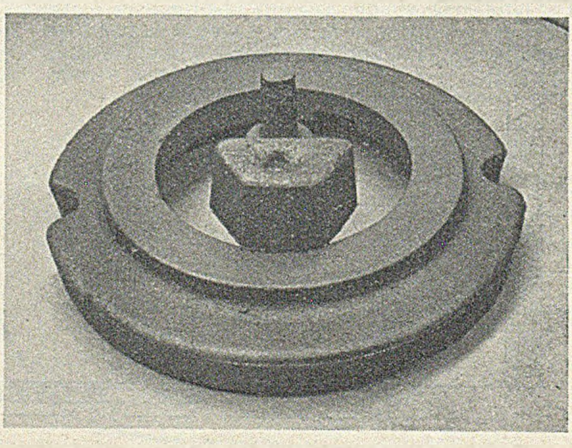


FIG. 8.—APPLICATION OF A BLOCK-RUNNER TO A SIMPLE CASTING WHICH THEN REQUIRES LITTLE FETTLING.

siderably improves the look of the shop. It is, however, quickly found that dust which collects on light-coloured equipment is more noticeable than where dark colours are used. While the amount of dust produced may be minimised by exhaust ventilation, its complete elimination is not practicable, and light paintwork in a foundry inevitably requires frequent cleaning to avoid the look of "tawdry finery" which it is so necessary to avoid. With the amount of steelwork and machines in a mechanised foundry, the cost of cleaning down at weekly intervals is fairly high. Nevertheless, the improvement in working conditions resulting from increased cleanliness and a smarter appearance is of assistance in securing and maintaining an adequate labour force. A point to which attention is drawn is that the surface finish on many machines designed for foundry use compares unfavourably with machine tools used in engineering shops. This makes cleaning down after painting a most tedious and disappointing operation. Should the use of light colours in foundries become more widespread, as the Authors think and hope it will, foundry-equipment manufacturers could greatly assist by improving the finish of their products, and also by considering design from the viewpoint of facilitating cleaning.

### Vacuum Cleaning

For the cleaning of foundry walls and equipment, such as runways, experience of vacuum cleaning as compared with the more usual blowing or brushing down, suggests that the latter are more quickly and economically carried out. There is no evidence that ordinary foundry dust constitutes a serious health hazard and although both blowing and brushing down are dusty operations, they can be quickly carried out by workers suitably equipped, at a time when the shop is otherwise unoccupied. The use of a vacuum cleaner with its filtering equipment inside the building, allows dust particles which are small enough to be dangerous to health, to escape into the shop atmosphere. The use of such equipment may reduce the amount of visible dust produced, but is no real safeguard to health. A vacuum cleaner with the filter outside the building has been found a very satisfactory method of cleaning down in fettling shops.

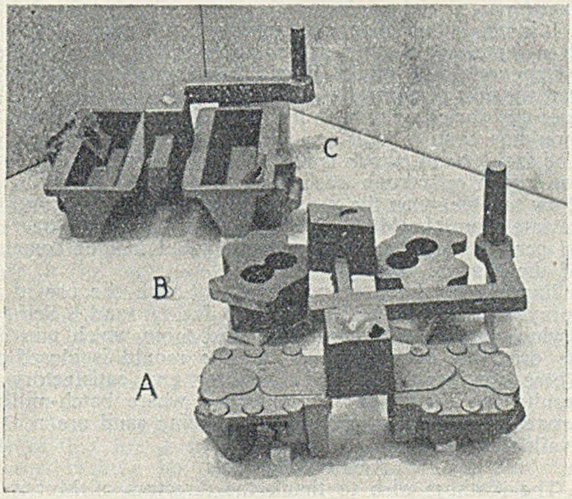



FIG. 9.—EXAMPLES SHOWING TWO CASTINGS RUN AND FED FROM A SINGLE BLOCK-RUNNER. CASTINGS A ARE SUBJECTED TO A HIGH HYDRAULIC-TEST-PRESSURE AFTER MACHINING. THREE PATTERNS ARE SHOWN, A AND B ARE GROUPED.

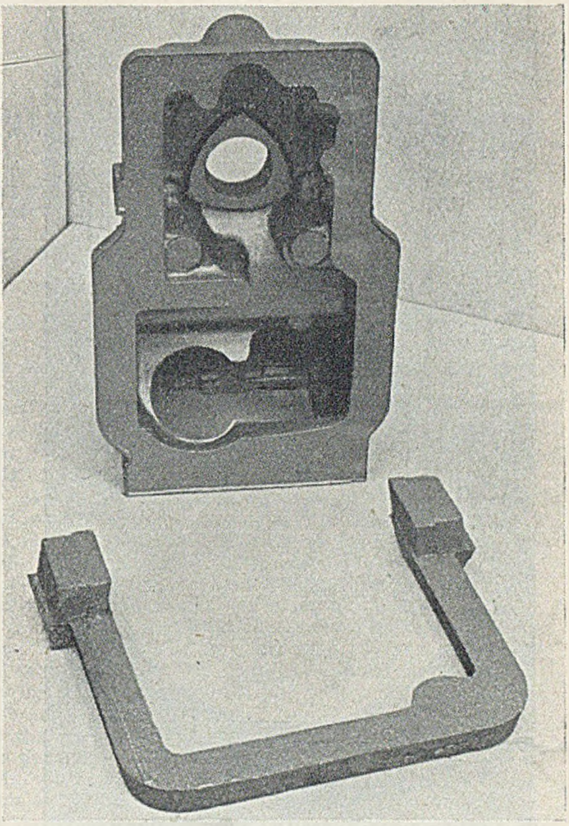


FIG. 10.—CASTING WITH INTERNAL BOSSES FED THROUGH TWO BLOCK-RUNNERS. NO INGATES OR FEEDERS NEED REMOVING.

### Fettling

The fettling of castings made on a quantity-production basis could be the subject of a separate Paper, but because of the important relation between casting quality and fettling-shop production, it must be briefly discussed. When dressing large castings which cannot be handled on the normal dust-exhausted pedestal grinder, hand chisels and chipping hammers are preferable to portable grinders because of the smaller amount of dust produced. Considerable difficulty has been experienced, however, in securing labour prepared to use such tools. On the other hand, almost any type of labour is willing to use a portable grinder. These are therefore used in large numbers and give very satisfactory results. Tapered wheels are used, held with tapered side plates, together with guards wherever practicable.

The dust problem arising from the use of numerous portable grinders has been largely overcome by the provision of dust-exhausted cabins of the type illustrated in Figs. 6 and 7. The average air velocity at the entrance to the cabin is 125 ft. per min. (1.5 m.p.h.) and is obtained by the use of a fan of 4,000 cub. ft. per min. capacity, driven by a 2 h.p. motor.

The heaviest castings are set on a turntable in front of a cabin so that grinding can always be carried out towards the exhaust system. The flying particles are directed into the cabin and although much of the heaviest material is deposited at its base, the fine particles pass away through the exhaust trunking. The fettling shop is situated away from other buildings and the dust is exhausted to the atmosphere. The number of

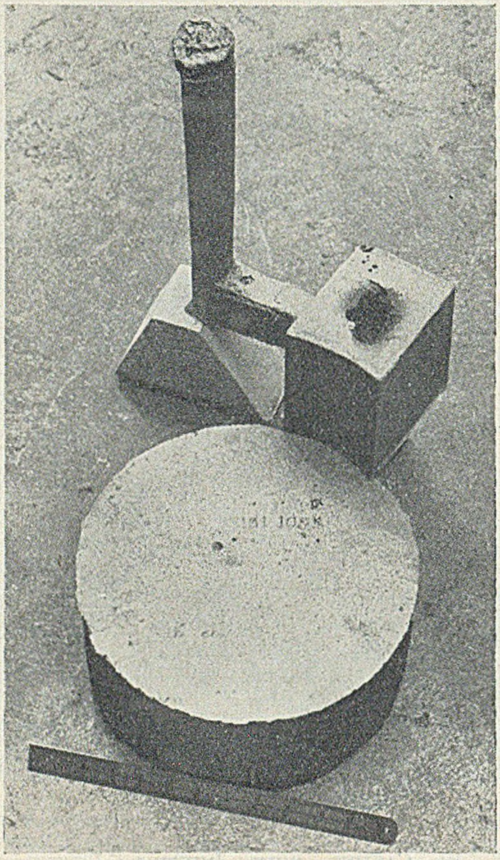


FIG. 11.—PISTON BLOCK $11\frac{1}{2}$ IN. DIAM. BY 5 IN. DEEP WEIGHING 135 LB. SUCCESSFULLY FED BY A SINGLE BLOCK-RUNNER.

cabins provided is sufficient to change the air in the fettling shop once every 5 min. and this is of assistance in keeping the general shop atmosphere free from dust.

### Minimising Fettling Requirements

It is obvious that the better the finish on a casting, freedom from flash, strains, scabs and swells, the less attention it will need in the fettling shop. In the works under consideration, difficulty has been experienced in recruiting men for fettling and for this and other reasons, attention has been devoted to producing castings requiring a minimum of finishing.

In a number of the simpler castings, the removal of runner and ingates by chipping or grinding has been completely eliminated by the use of the "Connor" or block runner. This method, described by Measures,* has been found most effective, not only in producing a casting in which the ingates and runner are automatically removed at the shake-out, but also in reducing the danger of dirt and slag inclusions. Its further benefit in increasing the soundness of castings prone to show shrinkage defects, is also an important feature.

The method consists essentially of running the casting through a block of metal which is immediately filled and kept full while the mould is cast. The ingate is no more than $\frac{1}{16}$ in. overlap of the block on to the castings. It can be applied without any difficulty to castings having a flat top or only a shallow impression in the top part of the mould.

* FOUNDRY TRADE JOURNAL, Vol. 87, No. 1719, August 11, 1949.

A selection of successful applications is shown in Figs. 8 to 11. In some cases, as will be seen from Fig. 9, two castings are run and fed from a single block, while in others (Fig. 10) two or more blocks are used for a single casting. A considerable amount of experimental work has been carried out with this method and the most successful arrangements have generally been developed by trial and error. Table II gives the weights of the castings illustrated, with details of the sizes of blocks used.

TABLE II.—*Details of Castings and Block Runners Illustrated in Figs. 8 to 11.*

| Illustration. | Casting weight in lb. | Weight of runner, lb. | Size of ingate, in. | Size of block runner, in. |
|---|---|---|---|---|
| Fig. 8 .. | 108 | 10.0 | $\frac{1}{16}$ by 3 | 3 to $5\frac{1}{2}$ by 3 by 3 |
| Fig. 9 (*a*) | 15 | 7.5* | $\frac{1}{16}$ by $2\frac{1}{2}$ | $2\frac{7}{8}$ by $3\frac{1}{4}$ by $3\frac{1}{8}$* |
| Fig. 9 (*b*) | 11 | 7.0* | $\frac{1}{16}$ by $2\frac{1}{4}$ | $2\frac{1}{2}$ by $3\frac{3}{4}$ by $3\frac{1}{8}$* |
| Fig. 9 (*c*) | 20 | 7.0* | $\frac{1}{16}$ by 3 | 3 by 3 by $3\frac{1}{4}$* |
| Fig. 10 .. | 110 | 6.5† | $\frac{1}{16}$ by $3\frac{1}{2}$ | $3\frac{1}{8}$ by $2\frac{1}{8}$ by $3\frac{1}{4}$† |
| Fig. 11 .. | 135 | 30.0 | $\frac{1}{16}$ by 4 | 4 by $5\frac{1}{4}$ by $5\frac{5}{8}$ |

* This runner serves two castings.
† These figures apply to each of two feeders.

Another important direction in which fettling time may be minimised is in the control of moulding sand. This matter has been given careful attention over a prolonged period and the conclusion has been reached that in the quantity production of high-duty castings, where large amounts of burnt core-sand enter the moulding sand, the use of a facing sand is a definite aid to production.

It is appreciated that the preparation and transport of facing sand represents an additional cost and its application entails a further operation, resulting either in loss of moulding production or increased labour. Nevertheless, it has been proved over considerable periods of time, that the production of finished castings per man-hour worked is increased when facing sand is employed. The main saving is in the fettling shop and is reflected not only in a reduced amount of finishing but also in reduced volumes of dust and noise produced per ton of castings.

It is hoped that this recommendation will not be taken to indicate that insufficient control is exercised over the system moulding sand. It will, however, be apparent that the cost of controlling the properties of a specially-prepared facing mixture is less than if the whole of the moulding sand is kept at a similar level of efficiency. The facing sand, which is prepared in the batch mill, is used only on certain castings known to be prone to show trouble when the properties of the moulding sand deviate from the ideal. These amount to a little over 25 per cent. of the total production, but include some of the heaviest castings.

Experiments have been carried out with the use of sprayed mould coats in place of facing sand. Self-drying coatings have been used and those which must be dried off by ignition before the mould is closed. These coatings have been found to give satisfactory results and their use is commended where batch-mill capacity or facilities for applying facing sand are not available.

### Acknowledgments

The Authors wish to thank the directors of Morris Motors, Limited, for permission to publish this Paper. Thanks are also due to Mr. E. C. Dickinson and Mr. J. H. Shaw of Engines Branch, Coventry, for assistance in its preparation and to Mr. R. W. Barnes of the photographic section, Nuffield Organisation, who supplied the illustrations.

*Institute of British Foundrymen* *London Branch*

# Patternmaking for General Engineering Castings

## *Discussion of Mr. H. S. W. Brittain's Paper*

Opening the meeting, the chairman, Mr. F. Arnold Wilson, extended a very warm welcome to two visitors, Mr. John Cameron, junior, a member of the General Council and attached to the Scottish branch, and Mr. J. E. Harle, of the Indian Iron and Steel Company, Kulti. He then introduced the speaker of the evening, Mr. H. S. W. Brittain, immediate past-president of the Sheffield branch of the Institute, and branch representative for the past four years on the Technical Council. Mr. Brittain was trained as a patternmaker in Sheffield, and for the past 17 years had been in charge of a pattern-shop or engaged in foundry management at Newton Chambers & Company, Limited, Markham & Company, Limited, and was at present with Brightside Foundry & Engineering Company, Limited. He had also been lecturer to students taking City and Guilds courses in Foundry Practice and Patternmaking.

[Mr. Brittain then read his Paper, which was printed in the April 13 and April 20 issues of the JOURNAL.]

### Plastic Patterns and Moisture Testing

MR. B. LEVY, congratulating the Author on his Paper, observed that new developments in patternmaking occupied his closest attention, and he thought it might interest Mr. Brittain to know that in his own works they were already making patterns with phenolic thermo-setting type plastics. They had got on quite well, but he would not like to say they were *au fait* with all the problems that had to be overcome, although the fact remained that they were turning out plastic patterns of a moderate size which had a very good finish and were all the Americans claimed for them. It might also interest members to know that the resin they were using was a British resin, which had actually rather better properties on the whole than the American resins, including a better tensile strength and greater surface hardness.

He was very interested in Mr. Brittain's remarks on moisture testing of wood. It was interesting to learn that the method used for sand could be used also with sawdust, but he had some doubt as to the accuracy of the readings. No doubt Mr. Brittain was aware of the very highly specialised instrument which was available for testing wood, but the average pattern-shop could ill afford to spend the time or money on such elaborate apparatus. However, the journeyman patternmaker was so used to estimating the amount of moisture present, that that was usually the method used.

MR. BRITTAIN, in reply, said he was very pleased to learn that Mr. Levy's firm were developing plastic patterns, because he thought it was something that should not be missed, and was a development on which we should keep well to the fore. On the subject of moisture tests, he agreed it was difficult to keep them accurate, but the "Speedy" was a method which could be used satisfactorily and replaced the older "rule-of-thumb" method.

MR. PENDREY raised the question of the use of native beech in patternmaking. This wood was much used for heels of ladies shoes. Several small patterns he had made from it had finished perfectly and had lasted as well as metal patterns. He would like to know whether the Author had had any experience of using native beech for patterns instead of mahogany.

MR. BRITTAIN had used beech for patternmaking and, as Mr. Pendrey had remarked, it did give a fairly good pattern, but he did not think there was sufficient of it in this country to enable it to be used on a large scale. Very often, the materials used were a matter of personal preference, and he certainly did not think there was any harm at all in using beech wood so long as it gave the required hardness and smoothness. When using beech, it was important to ensure that it was of the type which had been dried under steam pressure. He did not doubt then that it would be possible to obtain a decent job, but it would be very expensive and there would not be sufficient available if it was used generally.

MR. B. LEVY said he had had experience in using beech for small patterns, and a very important factor was the weight of the pattern if made in beech. It was a very heavy material to work with, and was, of course, a hard wood. Consequently, the time taken in manufacture, cutting and shaping would be considerable, and if a sizeable pattern were involved the weight would be absolutely prohibitive.

MR. G. PIERCE said, as a foundryman and not a patternmaker, he had listened with great interest to Mr. Brittain's remarks.

There was, however, one thing missing from the lecture. He had not yet heard the Author grumble about the foundry knocking patterns about. Surely he had something to say of this subject, which was dear to the patternmaker's heart.

Taking up the challenge, MR. BRITTAIN observed that it was said in the pattern-shop that the foundry workers were "extremely clumsy," particularly so far as patterns were concerned. If they had to rap a pattern to get it out of a mould they used a punch about 6 in. diam. and knocked a whacking great hole in it. They then proceeded to knock the pattern out with a 14-lb. hammer and later complained that the casting was ¼ in. or more larger than it should be. Then patternmakers were put to the trouble of checking their patterns all over again and found a big rapping hole had been knocked into their calculations.

### Taper and Tolerances

A MEMBER said patternmakers expected the foundrymen to get a core, say, 4 in. diam., into a 4-in. print. Also, if sufficient taper was put on a pattern the moulder would not have to use so much rapping. Moulders were happier when they could get a pattern out of a mould easily.

One of the points the foundrymen did try to impress upon patternmakers was the desirability of putting a

*Discussion—Patternmaking*

small amount of clearance on a core print. A tightly fitting print was one of the main bugbears of a foundryman's life.

MR. BRITTAIN observed that a lot of the previous speaker's remarks bore out his statement in the Paper when he expressed the opinion that it was necessary to have information from the foundry, but if patternmakers were not given this information and were not told where the allowances were required it was hardly likely that the patternmaker would take it upon himself to say where such allowances could be made. He agreed that patternmakers could draw on their experience, but it was not always wise to do that without some consultation with the foundry as to where and why a particular allowance was beneficial.

With small machining allowances, the pattern-shop was greatly restricted in the margins they could give on a core print, either smaller or larger, and so they made it a tight fit. If there could be a greater degree of co-operation and full instructions were given he was sure anomalies would not occur. On the question of prints he agreed that some of them were extremely inadequate, but he did not think it was true to say that the patternmakers did not put the taper on. There was a tendency to knock a mould about unnecessarily, and he thought it was something on which the members present had to instruct their operators. It was a matter of education and something which would only be eliminated by educating the younger generation of moulders and by a more virile management which would take steps to follow the various stages of the work through the foundry and not leave it for the foundrymen to decide for themselves.

### Apprenticeship

MR. A. A. MATTHEWS was under the impression that a patternmaker served part of his apprenticeship in the foundry. If that were the case surely a lot of the difficulties mentioned by earlier speakers would be avoided.

MR. BRITTAIN, in reply, said it would be found that a number of apprentice patternmakers had not actually had the advantage of working in a foundry. If an apprentice patternmaker was lucky enough to be working for a firm which had a foundry, the advantage would be there, but there was no general organised system of sending a patternmaker into a foundry. In foundries which were more enlightened, boys were sent from the pattern-shop into the foundry, but it was not his experience generally to find that done. Master patternmakers had not always the opportunity of sending their boys to the foundry, but they were, nevertheless, good patternmakers.

A great service could be done by organising some form of education for pattern-shop apprentices to go into the foundry to get some idea of what is needed in patternmaking from the foundryman's point of view, and it is foundry sense that is needed rather than knowledge. They did need to create a little more foundry sense in the pattern-shop.

MR. A. WHITE referred again to the question of taper and said the references to oversize cores were all to the point, but at the initial stage would not a top print of higher taper eliminate any chance of subsequent damage to the mould by a tightly fitting core?

In his reply MR. BRITTAIN said he doubted whether there was any difference in efficacy between a core with higher taper and one which was slightly tapered. One might just as well make the core print a little larger and allow for the convenience of the moulder in having to insert his core. He thought the only way to eliminate such difficulties would be to have an inspection department for the cores, in the manner of the mass-production shops.

In ordinary circumstances there was bound to be difficulty unless information was available to the patternmaker as to how much a core was likely to grow, as grow they did. It was very difficult to give a very adequate account of how much swelling there was going to be on any particular core.

MR. A. AUGSTEIN said that the main reason for swelling of cores was the fact that some foundries were using too high a percentage of core binders, and the drying was effected at an incorrect rate. This danger could easily be eliminated by a proper control of binder additions and the core ovens.

MR. D. BARNARD also spoke on the subject of core swelling, and observed that after drying, cores would not go into their boxes. He found that if the print portion of the core was made to standard rule and the print on the pattern to contraction rule, core rubbing could be avoided. He found that it was a very satisfactory compromise.

MR. BRITTAIN thought it was a possible solution, but a number of cylindrical cores were not made in core boxes, but on extrusion machines. Most patternmakers knew of this allowance for cores swelling and they did attempt to compensate for it. One additional difficulty for the patternmaker was knowing just how much "blacking" was going to be used on a core. Blacking was put on in considerable quantity and had the effect of making the core larger than its core box.

MR. CLARKE said that the onus of producing a pattern often remained with the foundry, who were left to produce it in the cheapest possible way. This was particularly the case where a single mould was required. It was no question of producing patterns in the mass production manner but of obtaining it as the least possible cost. This fact should be borne in mind when making comparisons.

Replying, MR BRITTAIN said he had observed that on certain occasions they were obliged to produce a fairly cheap pattern. Sometimes the onus was placed on the foundry and every patternmaker was aware of that fact. He thought it was one of those things that would go on until such time as some one would say every pattern must be perfect whether one casting is to be made or one hundred. He hoped he would be alive to see that happy day.

### Vote of Thanks

Proposing the vote of thanks MR. B. LEVY said Mr. Brittain had handled his subject admirably and had given them full replies to all the questions. The subject of patternmaking was a difficult one because, obviously, Mr. Brittain could not touch on all the numerous aspects of the subject. The materials used in the modern pattern-shop were varied indeed and a patternmaker would have to be a "jack-of-all-trades" to be proficient with all the materials we used to-day; the day of making the wooden pattern alone was long past. All patternmakers knew the difficulties to-day and they tried their utmost to co-operate with the foundry, but it would probably be found that in 100 foundries there were 100 different ways of producing the same job. The question of suitable treatment was therefore profound indeed and he thought the Paper Mr. Brittain had given covered a wide aspect and he was sure they all were very grateful.

Seconding the vote of thanks, MR. D. BARNARD said they had had a most interesting lecture but there was just one other thing he would like to ask Mr. Brittain and all other patternmakers and that was the question of marking patterns, particularly where machining is allowed. His firm and, he had no doubt, so had many others, received patterns from customers about which there was no indication of where machining was required, and then it was difficult to decide which way to mould a job. If patternmakers could get together and lay down some instructions, to mark patterns and machined portions in the standard colours it would be a very great help to the foundryman.

Responding to the vote of thanks, MR. BRITTAIN said he would first like to answer Mr. Barnard's question about marking patterns. If all pattern-shops would adopt a very old British standard, for the marking of patterns, when they get into the foundry this problem would not arise. In his own works the standard marking was used. As Mr. Barnard had said, the method of marking for machining is extremely important to the foundry. He happened to have been in the fortunate position of being a foundryman for a considerable time and he had found that the pattern-shop did not mark machining in a great many cases. He did not think, generally, that it was appreciated that the machining has to be considered in the foundry. He thought all patternmakers should take careful note of Mr. Barnard's remarks.

The object of his Paper had been to show what had to be contended with in a general foundry pattern-shop, handling all sorts of patterns, where no one was tied down to a particular method; and accepting outside patterns as well. Nevertheless, they did the best they could, having in mind always the drive towards increased productivity.

## More Scrap from Germany

A report from Western Germany refers to the conclusion by the British Iron and Steel Corporation and the *Deutscher Schrottverband* (German Scrap Merchants' Association) of an agreement for the supply and delivery of 300,000 metric tons of scrap.

Various qualities are to be supplied, and there has been no change in the supplying firms under the new agreement.

## Technological Honours Awarded

Awards ranking among the highest in British technology were made on May 17 in Birmingham. One woman and ninety-eight men who have successfully completed advanced courses were admitted as Associates of the Birmingham Central Technical College, A.C.T.C. (Birm.). Honorary Associateships of the College were conferred on four distinguished Midland scientists and engineers. Four men widely known in the Midlands for their teaching work at the College were admitted to Elective Associateships.

Amongst those who received honorary associateships were Dr. Maurice Cook, director, Imperial Chemical Industries, Limited, Metals Division, and Mr. F. G. Woollard, M.B.E., a director of Midland Motor Cylinder Company, Limited, and Birmingham Aluminium Castings (1903) Company, Limited. From the metallurgy department, of which Mr. D. Jepson is head, the following students were admitted to associateship:—Mr. A. W. Armstrong; Mr. R. Brookes; Mr. D. Jukes; Mr. J. E. Srawley, B.Sc., and Mr. E. A. Taylor, B.Sc.

## Engineering Research Station

Up to the end of March, £30,000 had been spent on the site works and foundations of the mechanical engineering research station at East Kilbride, Scotland. A start has now been made on the buildings, and the estimated expenditure during this year is £260,000. These facts are revealed in a letter from Mr. Herbert Morrison replying to questions put to him regarding the project by Mr. John Rankin, M.P. for Glasgow. The Government, Mr. Morrison states, plans to spend £300,000 next year, and the same amount in 1952. By the end of the latter year, therefore, £890,000 will have been expended out of the total estimated cost of £1,500,000. Thereafter the aim will be to spend £250,000 a year until the work is completed.

MEMBERS OF THE BRASS & BRONZE FOUNDERS PRODUCTIVITY TEAM VISITED A NUMBER OF BRITISH FOUNDRIES BEFORE SAILING FOR AMERICA. THIS PHOTOGRAPH WAS TAKEN AT THE FOUNDRY OF METROPOLITAN-VICKERS ELECTRICAL COMPANY, LIMITED, MANCHESTER.

Front Row (from left to right): Mr. W. F. Underhill,* works manager and general manager, Samuel Booth & Sons, Limited, Birmingham; Mr. A. C. Main, assistant works manager, Metropolitan-Vickers; Mr. F. Hudson,* foundry research development dept., Mond Nickel Company, Limited, London (team leader); Mr. A. Phillips, superintendent, foundries and patternshop, Metropolitan-Vickers; Mr. A. N. Wormleighton,* director and cost accountant, Phosphor Bronze Company, Limited, Birmingham. Back Row: Mr. E. M. Anderson,* moulder, Phosphor Bronze Company, Limited; Mr. W. Frith, assistant superintendent, foundries and patternshop, Metropolitan-Vickers; Mr. E. C. Mantle,* research investigator, British Non-Ferrous Metals' Research Association, London; Mr. G. B. Booth,* machine-shop chargehand, Harrison (Birmingham), Limited; Mr. D. H. Potts,* foundry engineer, Westinghouse Brake & Signal Company, Limited, Chippenham; Mr. H. V. Grundy, assistant superintendent, foundries and patternshop, Metropolitan-Vickers. (*Team member.)

# Moulding Machine of Novel Design

*Suitable for Stove Plate and other Relatively Large Flat Castings*

A moulding machine incorporating entirely novel principles of design and operation has been developed by the British Moulding Machine Company, Limited, of Faversham, Kent. Described as the "BD" down-sand-frame moulding machine, it breaks new ground for the British foundry industry and is also fundamentally different from any machines of broadly similar type manufactured in the United States. The machine has been designed expressly for the rapid production of relatively flat castings such as are required by the stove, cooker and similar industries. It is rather more than a moulding machine, in that not only does it make the mould but it also removes it and turns it over, and it is possible to close the moulds directly on the same machine. So far only two "BD" moulding machines have been built, both of which have been installed and are in successful operation at the foundry of the Beeston Boiler Company, Limited, at Beeston near Nottingham.

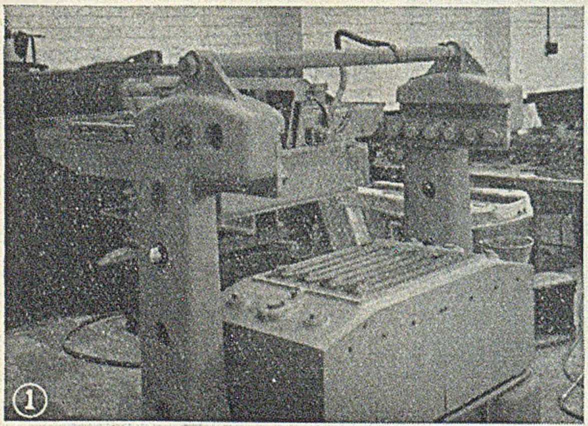
### Typical Arrangement

The designers have aimed at producing a machine which can be most effectively operated when used in pairs, connected by a short length of gravity roller conveyor. The set-up visualised is that one machine is engaged on drags, cores are inserted between the machines, and the copes are closed directly on to the drags on the second machine. The sequence of operations, shown stage by stage in the accompanying illustrations, is as follows: The moulding box is placed in position by operator No. 1 and filled with sand from an overhead hopper. The operation of a lever then brings the squeeze head or platten forward. The squeeze is operated and clamps engage automatically with the trunnions on the moulding box. After the pattern and frame have been withdrawn the stripped mould remains clamped against the squeeze plate, and the platten and mould move to the rear of the machine, leaving operator No. 1 free to place the next box in position. At the rear of the machine, operator No. 2 lowers the mould on to a previously-moulded drag. If the mould from the machine is a drag, it is lowered, turned over, and then positioned on to a waiting bottom board. These operations are facilitated by a roller table at the rear of the machine which is pneumatically raised and lowered. As the mould descends, the roller table comes up to meet and support it, the two clamps swing free, and the mould is then lowered by the roller table into line with the gravity roller conveyor.

### Additional Features

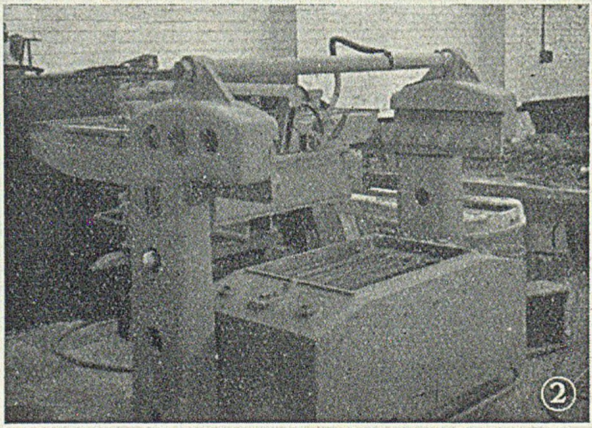
Incorporated with the squeeze piston is a very powerful vibrator which comes automatically into action during the squeeze stroke. This has proved a very successful innovation, since it overcomes some of the drawbacks normally experienced with plain "squeeze" moulding. Electrical heating of the metal pattern plates is incorporated in the machine, the heat being controlled at any one of three temperatures by the switch which can be seen on the side of the column.

The moulds produced on this machine are of uniform and consistent hardness, readings taken with a standard mould-hardness tester being between 80 and 85. If, however, softer moulds are required, the frame is easily and quickly adjusted to produce moulds of any hardness up to the figures as quoted above. The complete production cycle, from blowing down the pattern to putting the finished half mould on to the conveyor, is 31 sec., but since each operator is responsible for only half of the cycle, it will be seen that it is easily possible to maintain a production rate of between two and three half moulds per minute with each machine. The machine is constructed mainly of iron and steel castings and weighs 3 tons 2 cwt. The moulding boxes seen in the illustrations are 30 by 20 in. The maximum box dimensions which can be used with this particular size of machine are 30 by 24 in., but machines of larger size are under construction.



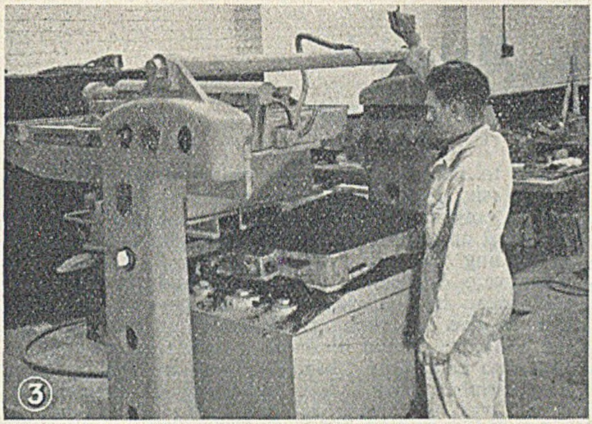
①

VIEW OF THE DOWN-SAND FRAME MOULDING MACHINE FROM THE SIDE OCCUPIED BY OPERATOR NO. 1. THE FRAME IS IN THE "LOWERED" POSITION.

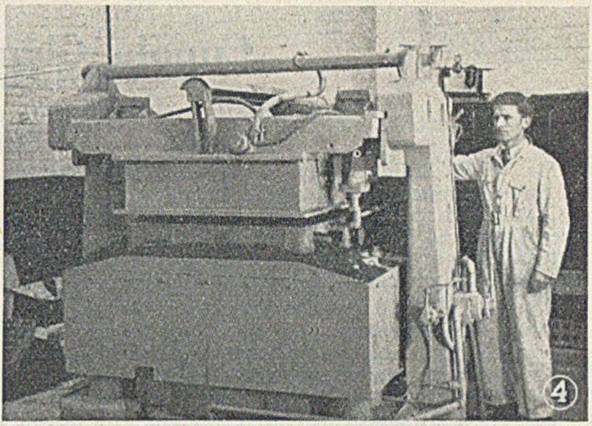


②

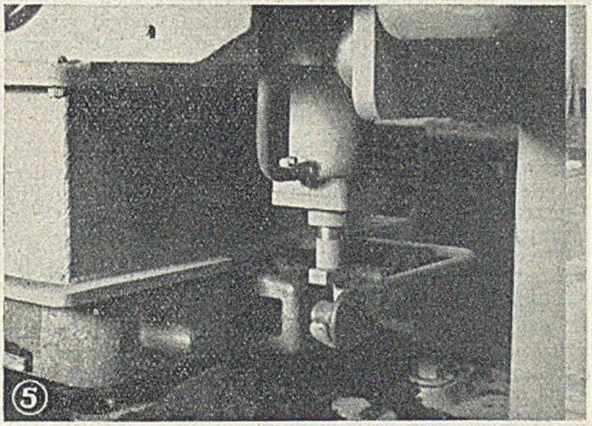
MACHINE WITH THE FRAME IN THE "RAISED" POSITION. MOULDING COMMENCES BY PLACING A BOX PART ON THE MACHINE WHEN THE FRAME IS IN THIS POSITION.



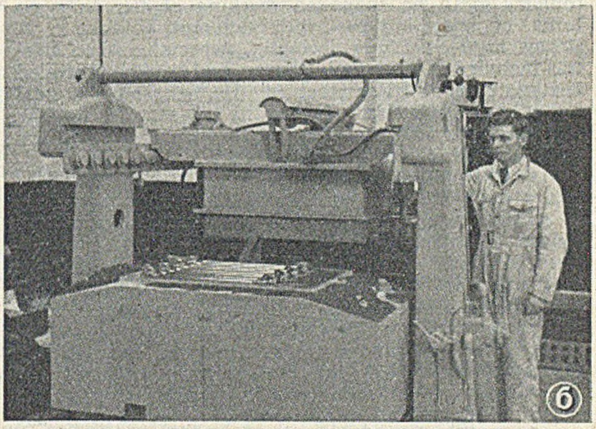

Second Stage in Mould Making. Operator No. 1 delivers Sand from an Overhead Hopper. Excess Sand is Strickled Off.



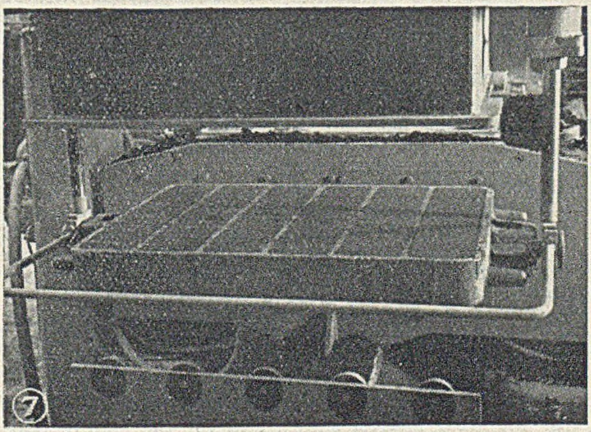

Operator No. 2, from the Rear of the Machine works a lever to bring forward the Platen over the Box.



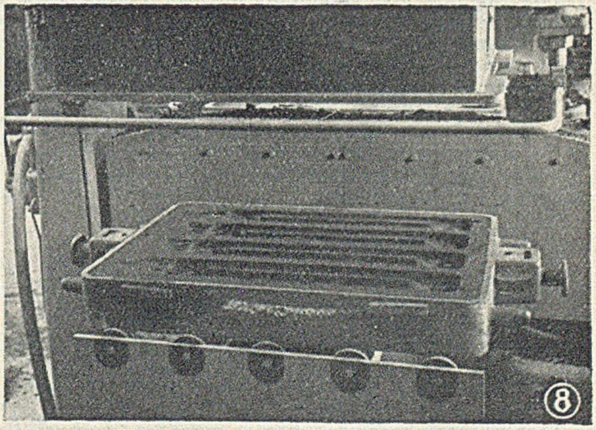

Close up of one Side of the Machine after Squeezing showing the Pattern Drawn and the Special Clamp engaging the Box Lug.




Mould Withdrawn along with the Platen: Operator No. 1 puts the next Box on the Machine.




Operator No. 2 lowers the Mould (if it is a Cope half) from the Platen on to a Previously-moulded Drag.




A Drag Half-mould after turning over is placed on the Draw Table and the Clamps are raised.

# Cupola Charge Materials

## *Further Discussion of the T.S.27 Report*

Mr. W. W. Braidwood recently presented the Report of Sub-committee T.S.27* of the Technical Council on "Cupola Charge Materials" to a Cardiff meeting of the Wales and Monmouth branch of the Institute of British Foundrymen. Mr. Braidwood outlined only the main recommendations of the committee, so as to leave the maximum possible time for discussion.

MR. GORDON-JONES expressed agreement with almost all of the report, and was particularly pleased to note the committee's insistence on the need for accurate weighing of all the metallic constituents of the charge. He added that the variations which could occur in weight of air necessitated weighing of this element also, and said that, in his opinion, an air-weight meter was a necessary part of the equipment of a modern cupola.

To aid in the segregation of various grades of foundry scrap he suggested marking of the daily returns of special types with different colours. A strong, hard coke was necessary, especially when steel was included in the cupola charge, and he recommended analysis of each truck received. He believed that steel scrap was carburised during its passage down the cupola shaft, with the result that when it reached the melting zone it was no longer steel.

MR. BRAIDWOOD agreed that an air-weight controller was a desirable item of cupola equipment, and that, in special cases, paint-daubing was a necessary procedure in ensuring complete segregation of scrap returns. With Mr. Gordon-Jones' ideas on the mechanism by which steel melted in the cupola, however, he did not agree. Practical investigation by many research workers had shown that partially-melted steel specimens were carburised only to the extent of about 0.5 per cent. carbon and only in the very thin surface layers in which melting had begun. He had no doubt that steel did melt in the cupola as steel, at temperatures approaching 1,500 deg. C., and that carburisation took place only in the surface layers and only as these began to melt. He stressed the committee's recommendation that really massive pieces of steel were not suitable for cupola melting and should be directed to the open-hearth or electric furnace.

In answer to MR. WILLIAMS, who asked whether measurement or weighing of coke charges was the better method, MR. BRAIDWOOD said that he preferred to weigh. Allowance could always readily be made for the presence of moisture. Measurement was satisfactory only when use was made of a container of the desired capacity. The shovel was not an accurate unit of volume.

### Tapping Special Charges

MR. GREGORY asked for advice on the best method of ensuring correct tapping of a special charge, inserted during the melt.

MR. BRAIDWOOD stressed that cupola charges were not melted layer by layer. With the aid of blackboard sketches he illustrated what actually happened during the melt, and showed that the constituents of probably three separate charges were in course of melting at any instant. If the quantity required was equal to the weight of two unit charges, he would charge six units of the type and arrange the special tap to coincide with the calculated melting period of the third and fourth of these special charges. Methods of dealing with the "transition" or "intermediate" irons were discussed. Mr. Braidwood recommended that these be included, wherever possible, in large taps to give the maximum dilution and that inoculating additions should be made to taps seen, or thought likely, to be unduly "hard." He advised his audience to remember always the limitations of the cupola, which was a continuous—and not a batch-melting—furnace, and to plan melting programmes accordingly. With suitable appreciation of what could, and what could not, be done by the cupola, very satisfactory results would be obtained.

Where complete isolation was necessary, as for example, in the case of expensive charges such as those for austenitic irons, the only certain method was to drain the cupola, rebuild the bed, add the special charges and re-commence melting.

### De-sulphurisation

Following a remark by MR. GORDON-JONES, MR. BRAIDWOOD illustrated the construction of the water-cooled, basic-lined cupola invented, and operating successfully, in the foundry of the Ford Motor Company, Limited, Dagenham. All interested were referred to the Paper on the subject by Renshaw and Sargood which appeared in the FOUNDRY TRADE JOURNAL of October 13, 1949.

MR. NIEL enquired as to the comparative efficiency of keeping the slag hole open, or closed except at regular intervals. Mr. Braidwood described the use an ever-open slag hole as bad practice. Periodic tapping of slag was much to be preferred, but the lecturer's own choice was for use of the constant-flow self-slagging spout, wherever practicable.

MR. GREGORY asked if de-sulphurisation in the ladle was advisable before pouring. Mr. Braidwood said that de-sulphurisation by the conventional method using sodium carbonate involved some loss of temperature and also produced an alkaline slag of particularly insidious type, which was difficult—almost impossible—to remove completely. When de-sulphurisation had to be effected, in metal for direct use, *e.g.*, to comply with a specification, it was best to do this in a tilting receiver fitted with a tea-pot spout, through which only clean metal would be delivered to the pouring ladle.

Proposing a vote of thanks to the lecturer, MR. H. J. V. WILLIAMS said that the cupola was that item of foundry equipment about which the average foundryman knew least. In seconding, MR. GORDON-JONES voiced his approval of the report which had been so well presented, and said that it rightly stressed the importance of careful attention to matters which, though apparently of minor character, could yet make all the difference between success and failure.

In responding, MR. BRAIDWOOD thanked all present for the great interest shown and for the helpful contributions made to the discussion. He said that successful cupola operation and economical and efficient usage of available materials were primarily the results of "good housekeeping."

* Printed in the JOURNAL July 7, 14 and 21, 1949.

# Foremanship*

*By S. Lewis*

The organisation of management functioning through groups of individuals, working together by reason of their special knowledge, has senior board groups, junior executive groups and supervisory groups, and although foremen come into the last group, their responsibility represents the first stage of management authority, for their duties bring them into constant and direct control of labour.

This daily contact at floor level brings endless problems and many are the qualifications desired in good foremanship. Much depends upon natural aptitude which, like leadership, is something not easily acquired, rather is it inherent. A foreman's first loyalty must be to those in authority, yet at the same time he has to retain the respect of the worker. Equally, it is management's duty to support the foreman, recognise his responsibilities and keep him informed as to management policy. A foreman said to be unpopular with his men might indicate efficiency to management, but maximum efficiency must surely lie in a happy medium of equal respect.

The title of foreman covers many grades and qualifications from hourly rated to staff grade and from control of a handful of personnel to a hundred or more, although here it may be stated that one foreman should not be responsible for more personnel than he can reasonably make contact with in his working day. Craftmanship is not always the first qualification for good foremanship; some skilled workers dislike promotion, while others, without having qualified as craftsmen are instinctively good administrators. Much depends upon the type of job; with to-day's increased trend towards mechanisation, engineering knowledge is an asset, while the application of a scientific mind can help to successful foremanship.

Personality must count considerably in any sphere but fundamental knowledge is the first essential to successful control.

### Authority

The foreman's authority to-day is not so autocratic, there is more "get together" nowadays, but, whilst his authority has lessened, his responsibilities have not, for with increased production coupled with shortages and substitution both of materials and man power, foremen's troubles are increased. Like management, a foreman must study his men's qualities, their different temperaments and abilities in order to have the right man in the right job and to eliminate the black sheep.

Margins of difference between worker and supervisory staffs have lessened in many directions but the worker is not to be grudged his benefits—rather is it up to the foreman to do his utmost in order that his own standards are raised.

### Functions

The foreman's most important managerial function is to maintain as efficient flow of work with the minimum amount of friction. This requires a close relationship between the foreman who knows the job and worker who has job to perform. The foreman's duty is to shoulder intermediate responsibilities, clearing away the smaller problems and decisions, leaving only the biggest for managerial decision. Although he cannot alter agreed policy, he is in the position to translate such policy and its applications where required, for as technicians are interpreters of science, so foremen are the interpreters between management and worker. The foreman to-day has to be knowledgeable with regard to union agreements and procedure, working together, within certain specified limits, with his shop steward in order to maintain maximum efficiency.

Some points which workers expect foremen to watch are—recognition that the worker is a human being, part of the organisation, and treated as such, otherwise a sense of frustration is bred. Workers expect a safe, clean and well-equipped place in which to work, one they are content to return to, where they can enjoy the companionship and respect of their fellow men.

### Qualities

Other qualities embodied in foremanship include initiative, reliability, ability to influence people, a sound background, to be able to maintain a certain social status yet be a good mixer, show tact and skill in handling men, fairness and justness. Good foremanship means discipline but not humiliation. Unbusinesslike methods lose "face" for the foreman in the eyes of the workmen, especially if the foreman practises "do as I say not as I do." Inefficiency in one department cannot be condoned by diverting attention to that in another, and whilst rivalry between departments can be an incentive, it should not lead to inter-departmental banditry.

Overbearing, domineering foremen are not popular—neither are their opposites, the waverers. The emotionally-immature type of foreman, and one easily peeved, should remember that if he is right he can afford to keep his temper, if he is wrong he cannot afford to lose it. The art of good foremanship lies in realising that workers come to work for themselves with the foreman, not for him. A foreman should give workmen a clear picture of the part they play in the productive scheme; every employee knows something of the running of the job, maybe it is only small, but the psychological effect on the worker of having been taken into consultation is often more important than the actual contribution of ideas gained.

As to foundry foremen, the writer considers them to be a race apart, and far be it for him to attempt to define their multifarious qualities in these general thoughts on foremanship.

### DISCUSSION

MR. RUDDEN asked how many men the Author would say a foreman could efficiently supervise, and what percentage of his ability should be practical and what percentage administrative.

MR. LEWIS replied that the number of men a foreman could control would be entirely dependent upon the job. Perhaps 100 would be more than enough for any foreman to supervise alone, especially, say, in a foundry having 100 different jobs being worked at the same time. It was not so much a question of numbers of men as the amount and type of production which governed a foreman's responsibilities, and the pro-

* A winning entry from a short paper competition organised by the East Midlands branch of the Institute of British Foundrymen.

## *Discussion—Foremanship*

portions of practical and administrative ability desired. Although the number of men required to produce a given quantity was fewer when the method was mechanised, the administrative ability called for in maintaining constant production was probably greater than where the method was more dependent upon practical skill.

In either case, foremen must have an intimate working knowledge of the job to be performed so that correct operational procedure was maintained. It would be difficult to state any hard and fast percentages of practical and administrative qualities desired.

MR. AMOS remarked that Mr. Lewis had not made any reference in his Paper to "flattery," which seems to play a very large part in dealing with men.

MR. LEWIS replied that there must be a certain amount of "flattery." A foreman should tell a man the part he played in the job. If a foreman ever consulted an operator about the job, the very fact that he had done so made the man even more interested. Foremen received similar treatment from above sometimes.

A MEMBER asked whether a foreman could do his job efficiently if he had also to deal with wage packets, ratefixing and estimating.

MR. LEWIS said that in such cases the foreman was a general factotum. It was for the management to help such a foreman as much as possible. A foreman should not have to handle time-cards all day—a girl clerk could do that sort of work. The foreman should be able to give more attention to the job he was there to do.

Continuing, Mr. Lewis said one point he had not mentioned was the training of the foreman, and apprentice training. In some cases, apprentices spent too much time in one particular department. He thought apprentices should have wider training, and suggested an exchange scheme whereby similar types of foundries should allow apprentices and trainees to spend time at other foundries as only by exchange of information could progress be made. The Institute was a pioneer in this respect, and also in bringing into being other means of the study of foremanship.

### Selection of Foremen

MR. LILLEYMAN asked whether in the case of a vacancy a man should be brought in from outside, or should a foreman be chosen by promotion. What were the advantages and disadvantages?

MR. LEWIS replied that in the case of a specialised job it might be necessary to bring a man in from outside. In his case, internal promotion was practised and several of the higher executives came from the ranks.

MR. C. A. PAYNE said the promotion practice carried out in the establishments controlled by the Admiralty was very interesting. By combination of examination and selection board the men eligible for promotion were sifted out. Generally speaking, when a person was promoted he was moved from the scene of his previous employment either to another department or another dockyard. Presumably, the idea was that to promote a person and leave him amongst his previous workmates was not the most effective procedure from the point of view of discipline and control, as the promoted man would know his new subordinates too well, and they in turn would have too familiar a knowledge of the man before his new position to become entirely respectful of his authority.

On the other hand, some industrial organisations made a great point of all promotions being from within their own organisation. In the main he thought that the best approach was that if there were people already on the job who were suitable, they should be promoted, and if not, the best possible from outside should be sought.

In view of the fact that recently at Ashorne Hill the foremen's training course of the Institute was held, he considered perhaps there was present that evening someone who had attended this course, who might have some opinion on this matter which was well worth hearing.

MR. J. BOLTON, who attended the course, outlined the activities and said the chief topic for discussion was, it seemed, the relation of the foreman to those who had come into industry, personnel officers, and so on. Foremen seemed to think that the ground was being cut from under their feet, and that they were losing authority.

MR. LEWIS, when he stated that the foreman's authority to-day was not autocratic as years ago, had that in mind. On the other hand, responsibility had increased and shortages of materials and labour had not made things any easier. The welfare officer did not help directly, nor did the personnel officer. The latter found men for the foreman, who had to sort them out afterwards. The biggest trouble was to keep production going, and the foreman was always short of something.

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## British Standards Institution

The Monthly Information Sheet of the British Standards Institution for April, 1950 (just received), lists among *Amendment Slips*: PD 1028 Amendment No. 3 to B.S. 1125: 1945 W.C. flushing cisterns (the amendment refers only to copies purchased before April 1, 1949). In *Future Publications* there are Handbook No. 12: 1950, British Standards for water fittings. (25s.). No. 18: 1950 Tensile testing of metals. (2s. 6d.). 1639: 1950 Simple bend test. (2s.), and 1651: 1950 Industrial safety gloves. (4s.). Amongst *New Work Started* there are listed:—Domestic pressure cookers and miners' safety boots, while *Draft Standards Circulated for Comment* includes CM 725 Protective spectacles for steel melters: CM 828 Copper-alloy ingots and castings (amendment slip to B.S. 1400); CM 836 Carbon steel castings for surface hardening, and CM 1298 Cast-iron economisers.

### Addendum to 1949 Yearbook

The 1949 edition of the Institution's Yearbook was carried to December 31, 1948, and an Addendum is now available which contains information on all new and revised British Standards and of amendments thereto issued during 1949, together with a subject index. The Institution will not be publishing a 1950 edition of the Yearbook, but a special 1951 edition (to the end of December, 1950) will be published early in 1951 to celebrate the jubilee of the Institution.

The free copy of the Addendum is being despatched to each subscribing member. Further copies can be obtained by subscribing members at a price of 1s. 4d., and copies are available to non-members at 2s. each (post free in both cases).

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A FIRE which caused £33,000 damage in the premises of Henry Balfour & Company, Limited, gas and chemical engineers, Durie Foundry, Leven, destroying valuable patterns—some of which could not be replaced—is the main part of a £40,000 action for damages against British Railways. Lord Strachan on May 10 heard a procedure rôle debate in the Court of Session in which the company claim that in August, 1948, a train passing 85 ft. from their premises emitted a glowing cinder which was blown into the pattern store, and the complete store and its contents were destroyed.

# Steel Castings Replace Fabrications

## *Components of a 28-ton Rotor Reduced to Two*

A noteworthy example of the practicality of replacing fabricated structures by steel castings lies in the production by David Brown-Jackson, Limited, of Salford, of a 28-ton rotor for service in a water-driven turbo-alternator for New Zealand. It is the normal practice to fabricate these large rotors, using many hundreds of components in the process. In full knowledge of the complexity of the undertaking, David Brown-Jackson's formed the opinion that a casting in steel could offer commercial as well as technical advantages.

At the first attempt, the rotor disc was cast in four sections. Two of them were then welded together to form each half of the rotor, and the halves were bolted together, giving the completed job. Obviously, making the job as a casting readily permitted the incorporation of swells to accommodate the machining of the slots for the rotor windings, whilst maintaining the lightness of the structure as a whole. As was expected, the projecting vanes from the flat disc-like

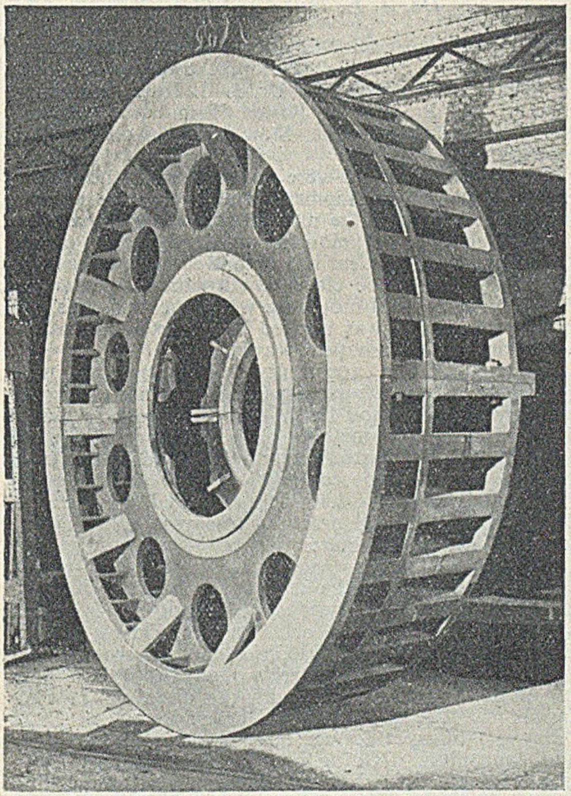

FIG. 1.—STEEL ROTOR WEIGHING 28 TONS ASSEMBLED FROM FOUR CASTINGS.

surface resulted in small tears at the junction of the vanes and the disc surfaces, and in the interests of soundness, rigid inspection was ordered, necessitating the grinding of all fillets, rooting to the base of even the slightest tears and the application of crack detection and gamma-ray inspection. The completed rotor is shown in Fig. 1.

The experience gained as a result of close technical control of this trial casting supported the view that

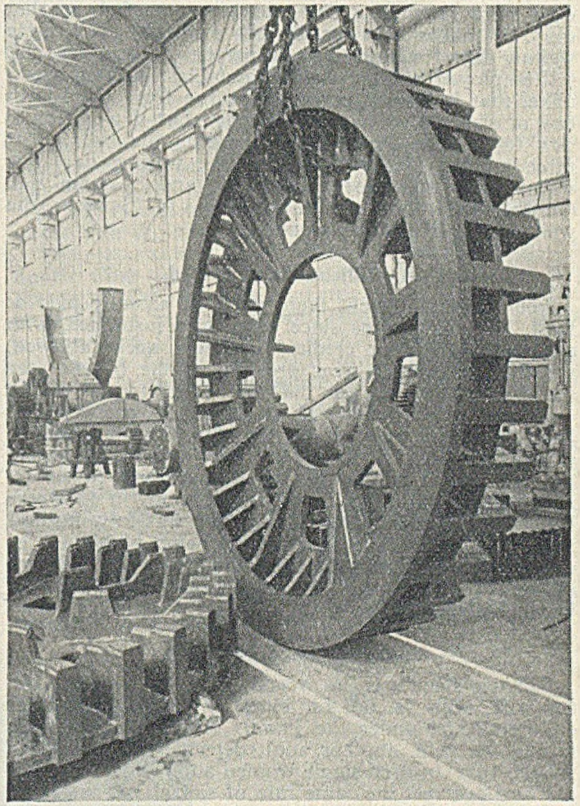

FIG. 2.—TWO HALVES OF A CAST-STEEL ROTOR PROOF MACHINED READY FOR ASSEMBLY.

an even more satisfactory job could be obtained by casting in only two parts and welding them together. This has since been done, as shown in Fig. 2, and a highly gratifying result has been achieved. Radiographs have demonstrated the physical superiority of the casting (*a*) as compared with the normal fabricated structure, and (*b*) as to the inherent strength of the casting arising from its homogeneity. The rotor illustrated in Fig. 2 is 14 ft. 8 in. in diameter and 3 ft. 6¼ in. wide. The alternator into which it is being built will deliver 20,000 kva.

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MORE THAN 1,500 employees of Thomas Glover & Company, Limited, and R. & A. Main, Limited, ironfounders, Falkirk, including directors, celebrated the jubilee of the combined firms last week when they were entertained to trips on the Clyde. It was the centenary of Glovers and the 75th anniversary of Main's.

# Sickness Benefit

*By F. J. Tebbutt*

With practically everyone insured under the National Insurance Scheme, it was thought that a short article explaining in some detail the sickness-benefit provisions would be welcomed. When the scheme was going through Parliament, must interest was shown by various organisations of employers as regards sickness benefit, these urging benefit for short as well as long illnesses to be treated as in Class B (employers, etc.), for the Bill provided for benefit for Class B only after 24 days of sickness, whereas for Class A only three waiting days were required. The pressure succeeded, so that the Act makes Sickness Benefit available after three waiting days for both Class B (persons on own account, self employed, employers, etc.) and Class A (employees) alike, that is benefit begins to accrue from the fourth day of sickness. That is ordinarily, but if a person is sick for twelve days or more during the subsequent three months (dating from the first waiting day) this waiting-days rule does not apply, and if again sick (another spell, that is) within a period of 13 weeks, the waiting rule is again inoperative.

### Qualifications Required

For Sickness Benefit there must be actually paid at least 26 contributions since entry into insurance, with at least 50 paid or credited (sickness weeks allowed) for the contribution year previous to the benefit year (see later); totals of less than 50 payments may secure only reduced benefits. If at least 156 contributions have been paid, sickness benefit is payable indefinitely, otherwise after 312 days (*i.e.*, twelve months) benefit ceases. But it should be noted that right to this is revived again after 13 more contributions in 13 weeks have been actually paid. If a person was fully insured under the old Health Insurance scheme (voluntary or employed contributor) and had actually paid 104 contributions, this fulfils the 156 contributions conditions for benefit indefinitely.

### Rates of Sickness Benefit

Sickness Benefit is 26s. weekly, with, if married, 16s. for wife, with 7s. 6d. for eldest or only child (other children come under the Family Allowances scheme); failing the wife, another adult dependent may qualify for the 16s. Insured single women and widows 18 years old and over get the same rate of sickness benefit as a man, that is 26s., but an insured married woman only receives 16s. ordinarily. She gets the 26s., however, if she is living apart from her husband, or cannot get financial help from him, as, also, she does if the husband is dependent upon her and she gets a dependent's allowance for him (*e.g.*, a husband incapacitated and so dependent upon his wife). Young persons under 18 years of age get 15s. The foregoing rates may be reduced if the person is in arrears with contributions. As regards the increase for the wife (that is, 16s.), this is not payable if she herself earns more than 20s. per week.

### Important Points

Under the old schemes the contribution year for all ran July to July; now, for easy administration with the increased millions of insured persons, the year ending dates are different for different batches of people, so that this may run from March, June, September, or December as the case may be, with the benefit year commencing the following August, November, February or May respectively. Previously the benefit year for all ran from the January following the end of the preceding contribution year (*i.e.*, July).

A very important matter is that the National Insurance number should always be quoted when communicating with the authorities. It is to be found on the front of contribution card, as this is really the main point of the identity of the insured person, and enables his particulars (all kept under this number) to be easily found.

For benefit, a medical certificate is required from a doctor; usually the doctor uses a form which fulfils the doctor's requirement of stating the illness, and can be used by the sick insured person as an application for benefit. Notice must be sent to the local National Insurance office, within three days of incapacity; if a medical certificate is not available, a notice in any case should be sent, but the medical certificate must follow within ten days. Afterwards, weekly medical certificates are required while the sickness lasts, but doctors can in some circumstances issue certificates available for longer periods. Payment is usually made by Orders sent through the post payable at a Post Office. But benefit can be paid in cash at the National Insurance office, or in special circumstances at the claimant's home.

# Early Developments in Ironfounding

*Dr. J. E. Hurst's Address*

The great contributions of a Black Country man, Abraham Darby, to the development of ironfounding in Britain, was stressed by Dr. J. E. Hurst, managing director of Bradley & Foster, Limited, Darlaston, when he addressed the Stourbridge Rotary Club recently.

Dr. Hurst said there were two epochs in the history of ironfounding development, and both were sharply divided according to the method adopted and materials used in making the moulds. With very few exceptions indeed all the earlier method of moulding used either clay or plastic clay-like substances. From the days of Henry VIII moulding was done with this wet pasty mass which was applied to a particular pattern and strickled with shaped boards.

In view of the apparently rough methods used by the workmen, it was surprising what a high degree of accuracy and good finish was obtained. A partial description of the method of moulding common in 1693 was that the pattern was first coated with grease, then a layer composed of fine loam, horse dung, butter and clay was laid on and dried without fire. This method was still practised to-day to a limited extent, but the use of butter had been done away with, Dr. Hurst added.

The actual date of the second epoch could be fixed as 1707, when there was a record of an invention standing in the name of Abraham Darby in the British Patent Journals. Unfortunately the text of the patent was lost, but Darby's daughter-in-law, writing in 1775, credited him with the discovery of casting in sand instead of loam or clay, and she said this was "of great service both in respect of expense and expedition." Going further, she added: "If we may compare little things with great, as the invention of printing was to writing, so was the moulding and casting in sand to that of loam."

Darby was born at Sedgley, Dudley, in 1676, and he was interested in the substitution of iron for brass in the manufacture of various small commodities such as cooking pots and household utensils.

However, the present-day modern methods of moulding in sand arose entirely from his invention.

# News in Brief

THOS. S. SMEETH, iron, steel, and pig-iron merchants, of Bradford, has been formed into a limited liability company.

A FLUORESCENT LIGHTING SYSTEM is to be installed by the British Thomson-Houston Company, Limited, at Rio de Janeiro.

THE TECHNOLOGY EXHIBITION to be held next year in Kelvin Hall, Glasgow, as part of the Festival of Britain, has been fixed as from March 26 to September 4.

THE ANNUAL SUMMER MEETING of the Newcomen Society, which is held at a place of interest and importance to the industrial historian, will this year take place at Sheffield. It will commence on May 31.

THE TYNE'S FIRST EMPTY SHIPYARD appeared when John Readhead & Sons, South Shields, launched their last ship on May 16. The yard's three building berths are now empty for the first time in almost 20 years.

COMMERCIAL VEHICLES manufactured during March averaged 5,300 units a week, the highest level ever reached in the history of the motor industry. Exports of lorries and buses totalled nearly 13,000, which was also a record.

F. A. STANDEN & SONS, LIMITED, agricultural and general engineers, of St. Ives (Hunts), and Ely, Whittlesey and Wisbech (Cambs), have now completed the rebuilding and reorganisation of The Foundry, North End, Wisbech.

TO MARK THE 50TH ANNIVERSARY of Guest, Keen & Nettlefolds, Limited, employees of all subsidiary companies are to receive a jubilee bonus. Those with one year's service will receive £2 and those with 10 years £5, both amounts subject to tax.

DAMAGE estimated at £2,500 was caused by fire which broke out on May 10 in the iron foundry of G. Paul & Company, Limited, Duncarron, Denny. The firm's offices were practically destroyed, but firemen prevented the flames from spreading to the main part of the works and production is unaffected.

AN order for a tanker of 16,500 tons dw. has been received by William Hamilton & Company, Limited, Port Glasgow (Renfrewshire), from the Blue Star Line, Limited, London. The propelling machinery will consist of Rowan-Doxford oil engines, to be supplied by David Rowan & Company, Limited, Cranstonhill, Glasgow, C.3.

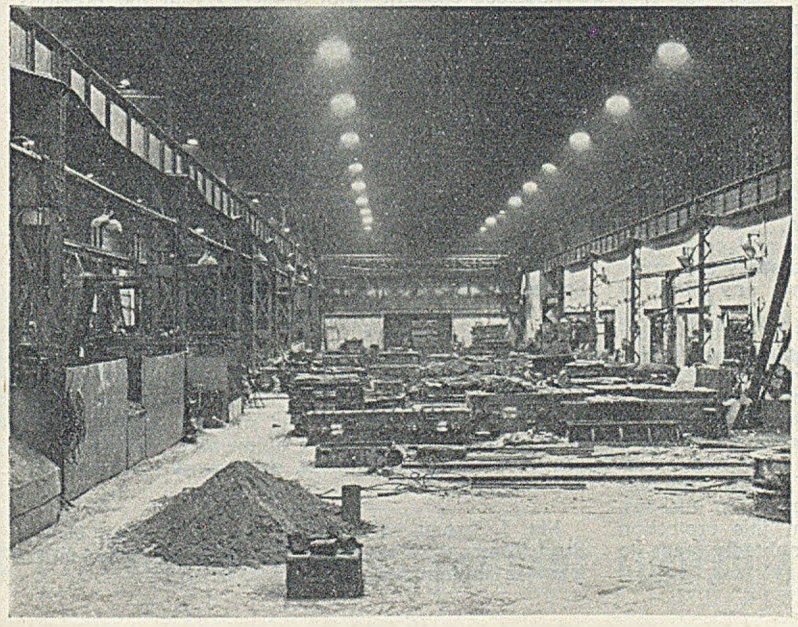
FOR THE FIRST TIME in their history of 71 years' the Brush Electrical Engineering Company, Limited, Loughborough, on Saturday last, threw open their works to the public. More than 7,500 visitors toured the premises, comprising not only the employees of the company with their relatives and friends, but visitors from many Midland towns and cities.

HUDDERSFIELD MODEL ENGINEERING SOCIETY, one of the oldest in the North of England, has been inundated with applications for membership but already has as many youngsters as can be dealt with comfortably. Mr. C. Spencer Wollard, vice-president, stated that the members are so keen that they attend the society's workshop several nights a week, although Friday is the usual night.

AGENTS OF TUBE INVESTMENTS, LIMITED, from 11 European countries and Egypt are attending a three-day conference at Birmingham this week, to discuss sales problems in the light of changing market conditions and to consider new development projects. During their stay in England, the party, numbering about 30, will visit T.I. factories to discuss their countries' specialised needs with the men who make the products.

THE ANGLING SECTION of Allied Ironfounders' Social & Sports Club last week had their first outing for this season to fish the Tweed, Ettrick and Yarrow. The anglers were favoured by brilliant sunshine. All firms in the Allied Ironfounders', Falkirk group, were represented. A trophy has been given by Mr. T. Hill, Polmont, to the section which will be awarded to the member with the highest aggregate on the season's outings.

A THOROUGH INSPECTION of the Admiralty Dockyard at Corpach, near Fort William, was made recently by Commodore T. McKenzie, a director of Metal Industries, Limited, with a view to an extension of the shipbreaking work now carried on at Faslane, on the Gareloch. Inquiries are to be made as to the possibilities of getting a flat rate for transport of goods and materials, the high cost of which was a definite deterrent to the establishment of the works.



OUR ILLUSTRATION SHOWS THE LIGHTING OF THE STEEL FOUNDRY OF A. JOPLING & SONS, LIMITED, PALLION STEEL WORKS, SUNDERLAND. USING METROVICK 400-WATT MERCURY VAPOUR DISCHARGE LAMPS FITTED WITH CLEAR GLASS DUST COVERS, THE SYSTEM GIVES 15 LUMENS PER SQ. FT.

## Another Productivity Report

Although, as a general rule, the activities of the steel-forging industry are not of direct interest to founders, the report of the drop-forger's productivity team after its visit to the States contains a number of precepts which are applicable in foundries. Relevant extracts are paraphrased below:—

### Maximum Machine Utilisation

The team considered that the greatest factor in achieving high productivity in America has been the acceptance by both labour and management of the principle that every blow which the forging unit can deliver should be utilised for the performance of useful work. The hammer man (or forge operator), who alone can obtain maximum utilisation of every blow, should be so serviced that he performs no unproductive work. He must not be limited by having to perform the ancillary operations of fetching bars or pieces from the furnace, passing forgings for clipping, and so on. These operations are better performed by a helper or by mechanical handling devices. Where the physical effort expended by the hammer man and his crew is so great that it is impossible to maintain it continuously for an extended period, the introduction of an auxiliary crew is necessary to enable the machine to maintain maximum production. In America, high productivity is furthered by means of the incentive to the worker, who is encouraged by the knowledge that if he increases production he will benefit accordingly in gaining for himself increased purchasing power. The fear of replacement if he fails to achieve the accepted standard is an indirect incentive.

### Labour Relations and Safety

It seemed to the team that the relations between employers and employees are on a sound basis in the United States, although they admit that six weeks is a short time in which to assess such relationships. Suspicion seemed largely absent and frank discussions could take place. Settlements, once obtained, are regarded as a fair bargain between two equals, while the profit motive is viewed without suspicion. From these conditions the team drew the conclusion that increased mutual confidence between employer and employee must assuredly lead to higher productivity. It is recommended that greater confidence between management and all grades of workers be encouraged.

Mechanical handling is an important factor in high productivity. The American dictum is not to put anything on the floor, as somebody must be paid to pick it up. In the large plants elaborate conveyors are used, but even in the smallest shops, where little mechanical handling was in evidence, the intelligent use of wheelbarrows saved much time and cost. The team recommends that all firms should study this problem of reducing the number of times any piece of material has to be handled.

An enormous effort has been made to ensure safety to eyes and limbs in the United States, through propaganda and co-operation. All individuals entering a forge, be they workers or management, wear safety goggles, and eye accidents have been reduced to a negligible number. The wearing of gloves, safety boots and helmets is regarded in much the same way. This undoubtedly reduces the number of major accidents and the amount of the time lost through minor mishaps. The feeling of security derived from this protection improves a man's efficiency and undoubtedly leads to higher production.

## Lower Export Rate

The provisional value of United Kingdom exports in April was £150 million. Owing to Easter holidays, April contained only 23 Customs working days. Adjusted to a standard month of 26 days, the total would be £169½ million, which is slightly below the average of £174 million in the first quarter of this year, but 12 per cent. above the average (£151½ million) for 1949. Exports in April, 1949, which also included Easter holidays, were £137.4 million.

Imports in April were valued provisionally at £211 million and re-exports at £6 million, so that the excess of imports (valued c.i.f.) over exports and re-exports (valued f.o.b.) was £55 million, bringing the adverse visible balance for the first four months of the year to £125 million, against £107 million in the corresponding period of last year and £140 million in September-December, 1949.

United Kingdom exports to Canada in April were, provisionally, £8.9 million, and to the United States £5.6 million; in terms of U.S. dollars these totals were $2.50 million and $15.6 million, respectively. Adjusted to a standard month of 26 working days, exports to Canada in April were 13 per cent. higher than in March and continued the improvement in the daily rate of exports which has taken place since October last. Exports to the U.S.A., similarly adjusted, were the lowest since last October.

## International Nickel Earnings

The report of the International Nickel Company of Canada, Limited, and subsidiaries for the three months ended March 31, 1950, shows net earnings of (U.S.) $8,329,015 after all charges, depreciation, depletion, taxes, etc. This is equivalent, after preferred dividends, to 54 cents per share on the common stock and compares with net earnings per common share of 40 cents for the fourth quarter of 1949, 31 cents for the third quarter, 53 cents for the second, and 84 cents for the first quarter of 1949. The total earnings for the year 1949 were $32,252,314, equivalent to $2.08 per share of common stock.

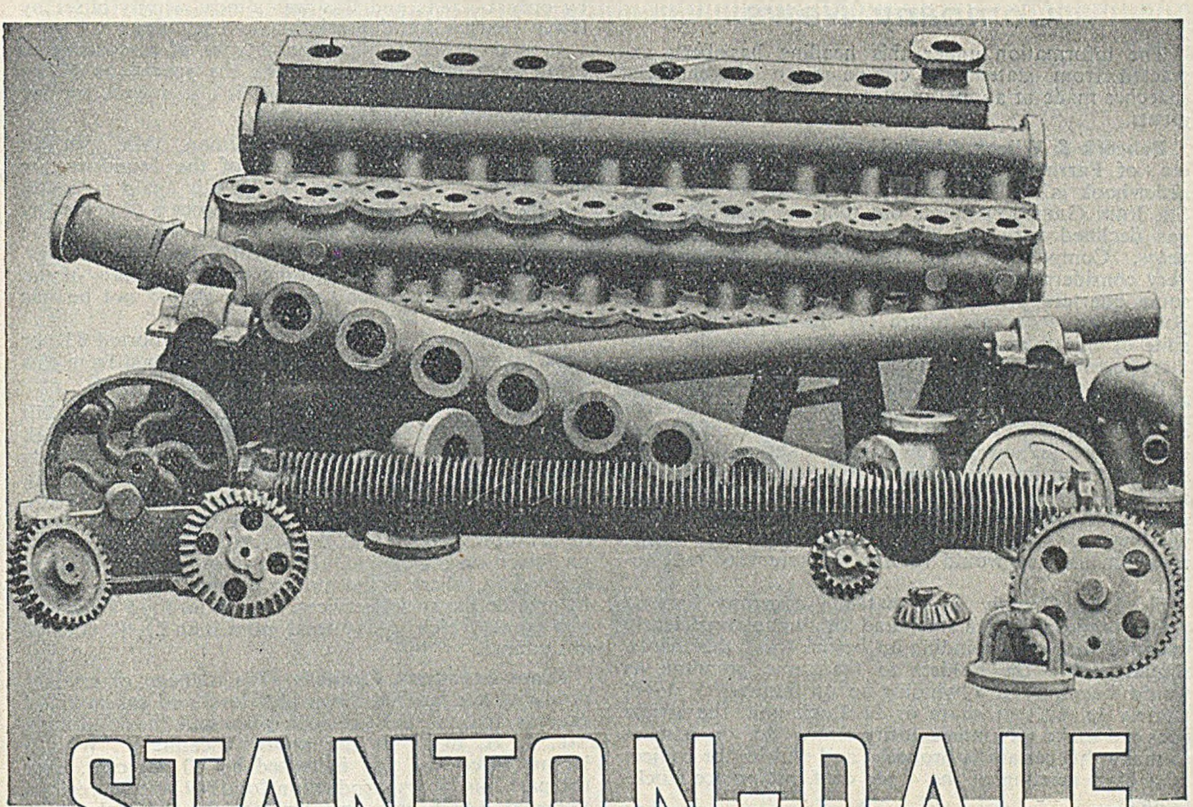
Net sales in the first quarter of this year of $47,392,082 compare with $44,895,721 in the previous quarter and with $55,624,831 in the corresponding period of 1949. After costs and with the inclusion of other income, there was a balance of $16,157,024, against $13,490,647 for the last three months of 1949 and with $22,436,682 for the January-March quarter last year.

## E.C.A. Aid to Britain

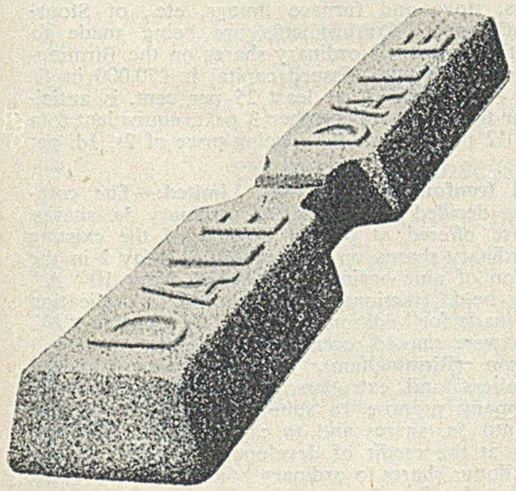
In the first two years of Marshall aid, the United Kingdom is stated by the Economic Co-operation Administration to have had access to $2,391.4 million (£854 million at the exchange rate of $2.8 fixed last September) for the purchase of essential food, fuel, raw materials, and machinery from the United States and other dollar countries.

Out of a total of $1,098 million for industrial commodities, the U.K. imported, under Marshall aid, $67,000,000 worth of industrial machinery and $51,700,000 worth of iron and steel products, in addition to substantial amounts of metallic ores and concentrates, mining equipment, metal-working machinery, and machine tools.

MR. J. PAGAN, pattern-shop manager, Indian Iron & Steel Company, Kulti, Bengal, is spending three months leave in this country.



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# Company News

The information under this heading has been extracted from statements circulated to shareholders, speeches made at annual meetings, and other announcements.

**Babcock & Wilcox, Limited,** engineers, boilermakers, etc., of Farringdon Street, London, E.C.4:—While the order-book is still satisfactory, the chairman (Lt.-Col. Sir John Greenly) points out that the rate of orders has declined very considerably during the last three years. Competition in the world markets has increased very considerably in the last 12 months, he says. In some quarters prices are being quoted which do not portend an economic future for the industry, but in spite of this the export business obtained by the company remains at a satisfactory level.

It is proposed to adopt new articles of association. They include a reduction in directors' qualification from a holding of £2,000 nominal of stock to £500; increasing the borrowing powers from an amount equal to the authorised capital to twice the issued capital and the article on which the 4 per cent. preference shares were issued last year. The article provides that on a winding-up, holders shall be entitled to the same premium as they would receive on voluntary redemption.

Sir John Greenly says that the company has no right to redeem before 1960, and although it was clearly intended that on a winding-up before then, the shares, should entitle the holders to the same premium as would be paid on a winding-up on January 1, 1960, namely 1s. 6d. per share or £1 stock unit, the article does not make this satisfactorily clear. An amendment to make this certain is proposed and will be the subject of a class meeting of the 4 per cent. preference stockholders.

The meeting will be held at the Waldorf Hotel, Aldwych, London, W.C.2, on May 30 at noon.

**Colvilles, Limited:**—The directors state that the demand for the products of the group during 1949, except alloy steels, required full productive capacity, and the ingot output of 1,855,080 tons was an all-time record

The report includes the following 1949 output figures (in tons), with the 1939 figures in parentheses:—Pig-iron, 511,142 (118,772); steel ingots, 1,855,080 (1,558,620); steel plates and sheets, 646,409 (539,190); steel sections and bars, 612,417 (561,570); steel slabs and billets, 435,807 (305,398); steel castings, 7,314 (6,215); iron castings, 40,552 (37,292); bright steel bars, 16,629 (7,895); galvanised sheets, etc., 35,024 (44,643); coke, 309,155 (76,179).

The quantity of coal consumed in 1949 was 900,736 tons, compared with 1,070,404 tons in 1939, the average cost per ton being 54s. 9d. and 18s. 7d., respectively. The average number of employees in 1949 was 17,400, the average sum of money received per employer being £393.

The analysis of £1 of sales in 1949 is as follows:—Purchased materials and services, 12s. 7d.; wages, salaries, and superannuation, 4s. 1d.; rents, rates, insurances, etc., 1s.; taxation, 1s. 3d.; depreciation, 4d.; transfers to reserve, 6d.; dividends, 2d.; carry forward, 1d.

**Federated Foundries, Limited:**—Sales in the home market were barely maintained, but there was a welcome increase in export trade. In April, 1949, the prices of the group's principal raw materials were raised and wages were also advanced, but there was no corresponding increase in sales prices. Notwithstanding these adverse circumstances the trading profits fell by only £40,000, and this was almost wholly offset by lower charges for depreciation and taxation.

It is proposed to alter the articles of association to bring them into conformity with the provisions of the Companies Act, 1948, but power is also sought for the appointment of special directors.

**Qualcast, Limited:**—The chairman, Mr. Victor Jobson, announces that output of the foundries for the half-year to December 31, 1949, is again a record. All sections of the foundries are in process of achieving the targets and budgets agreed by the directors for the current year, and subject to unforeseen circumstances, he feels justified in anticipating that the results of the year's operations, when completed, should not be less satisfactory than last year.

During the six months the company exported 83 per cent. by volume of the lawn mowers shipped from this country.

**Hadfields, Limited:**—The company will meet a bill for at least £300,000 if the claim for an extra £1 a week wages is successful, said Mr. J. B. Thomas, deputy chairman and managing director. On last year's trading it would, he said, more than absorb gross profit before taxation, the country would suffer a loss of £115,000 in taxation income, and the stockholder would receive no return on his capital. In the event of such a claim succeeding, where is the money coming from, he asked, to provide the social services, education, food subsidies, and grants which to-day total more than £1,400,000,000 per annum.

**Beans Industries, Limited:**—The tonnage of castings produced has reached a new high level and substantially exceeds that of the previous year said the chairman, Mr. J. H. Bean, at the annual meeting. "With a labour force that has increased by 40 per cent. over the past four years, production for 1949 was more than two and a-half times greater than in 1946," he said. "Further improvements to the layout and efficiency of the general foundry plant and in the working conditions are in progress, and when completed, should result in making this foundry one of the most efficient units in the country."

**J. T. Price & Company, Limited,** manufacturers of firebricks, stove and furnace linings, etc., of Stourbridge (Worcs):—Arrangements are being made to market the company's ordinary shares on the Birmingham Stock Exchange. Issued capital is £70,000 in 1s. shares. A dividend of at least 25 per cent. is anticipated for the year to December 3 next, equivalent to a yield of 12 per cent. at the placing price of 2s. 1d. per share.

**Allied Ironfounders (Ireland), Limited:**—The company has decided to issue 60,000 ordinary 5s. shares. These are offered at par to holders of the existing "A" ordinary shares on the register on May 2 in the proportion of nine ordinary shares for every 10 "A" ordinary held, fractions being ignored. Application may be made for additional shares. The existing "A" ordinary were quoted recently at 6s. 10½d.

**Harrison (Birmingham), Limited,** brass founders, metal rollers, and extruders, etc.:—The directors of the company propose to subdivide the £1 ordinary shares into 5s. shares and to capitalise £33,000 from amounts at the credit of development reserve by the issue of bonus shares to ordinary holders in the proportion of one for five.

**Ford Motor Company, Limited:**—Production in 1949 amounted to 151,793 vehicles, 92,950 of which were exported. The cost of the company's purchases of materials exceeded £36,000,000. Sales of parts were a record, and export sales of parts were approximately one-third as much again as in 1948.

# Company Results

*(Figures for previous year in brackets.)*

VENT-AXIA—Final dividend of 37½%, making 62½% (same).

BARTON & SONS—Final dividend of 7% (4%), making 10% (7%).

CANNON IRON FOUNDRIES—Interim dividend of 5% (same).

MARSHALL SONS & COMPANY—Interim dividend of 3¾% (same).

MORRIS MOTORS—Final dividend of 14½%, making 24½%, tax free (same).

NEWMAN INDUSTRIES—Final dividend of 10% (same), making 10% (17½%).

BRISTOL AEROPLANE COMPANY—Final dividend of 6%, making 10% (same).

MELLOR, BROMLEY & COMPANY—Final dividend of 36½%, making 54% (same).

ALLEN WEST & COMPANY—Dividend of 10% on capital enlarged by 60% bonus (10%).

BRITISH INSULATED CALLENDER'S CABLES—Final dividend of 4¾%, making 6¾% (same).

F. H. LLOYD & COMPANY—Final dividend of 9½% (second interim dividend of 7%), making 12½% (10%).

G. BEATON & SON—Dividend of 6¾% and bonus of 5% on increased capital (dividend of 10% and bonus of 5%).

SIDNEY FLAVEL & COMPANY—First and final dividend of 6% (interim dividend of 3¾%, but no final dividend).

N. GREENING & SONS—Final dividend of 12½%, making 17½% for 11 months on larger capital (same for previous year).

ATLAS STEEL FOUNDRY & ENGINEERING COMPANY—Interim dividend of 11¼% on capital as increased by 33⅓% (15%).

TUBE INVESTMENTS—Interim ordinary dividend of 12½% (same) and at the same relative rate on the liaison ordinary shares.

JOHN THOMPSON—Final dividend of 10%, making 17½% on capital increased by 33⅓% bonus (final dividend of 10% and bonus of 5%, making 22½% on former capital).

GUEST, KEEN & NETTLEFOLDS—Final dividend of 7% and jubilee bonus of 1½%, making 12½% for the year on larger capital. (Final dividend of 6%, making 10% for nine months.)

RANSOMES & RAPIER—Final dividend of 5%, making 7%, tax free (same). The £25,000 of stock issued in June, 1948, ranks for the whole year this time, against only six months in 1948.

IMPERIAL SMELTING CORPORATION—Dividend of 6% for 1949. For the previous period of six months no distribution was made, but for the year ended June 30, 1948, the dividend was 6%.

FRICKER'S METAL & CHEMICAL COMPANY—Net profit for 1949, after depreciation, £146,361; to tax, £76,350; reserve, £43,000; dividend of 10% and bonus of 5% (same); forward, £21,045 (£6,696).

F. W. BERK & COMPANY—Group profit for 1949, £283,179 (£194,176); net profit, £99,114 (£51,697); final dividend of 25%, making 42½%; balance carried forward in consolidated balance-sheet, £82,286 (£17,848).

BRISTOL AEROPLANE COMPANY—Consolidated trading profits for 1949, £1,225,663 (£1,398,558); net profit, £439,566 (£609,132); to general reserve, £200,000 (£450,000); final dividend of 6%, making 10% (same); forward, £309,544 (£267,978).

BRITISH TIMKEN—Consolidated trading profit for 1949, £933,029 (£862,755); net profit, after depreciation, taxation, etc., £313,300 (£293,129); to general reserve, £192,000 (£149,000); preference dividend, £22,000 (£13,040); ordinary dividend of 15% (same); forward, £353,907 (£287,607).

WILLIAM DENNY & BROS.—Trading profit for 1949, £254,626 (£267,636); balance, after depreciation, tax, etc., £86,580 (£90,043); taxation adjustment in respect of previous years, nil (£45,000); to general reserve, £35,000 (£45,000); pensions, £10,000 (£60,000); written off Government securities, £18,000 (nil); dividend of 10% (same); forward, £51,600 (£50,020).

LANCASHIRE STEEL CORPORATION — Consolidated profit and loss account for 1949 shows: earnings from operations, £2,265,680 (£1,878,839); net profit, after taxation, etc., £950,558 (£696,177); to profit and loss appropriation account, £768,702 (£518,715); retained by subsidiaries, £16,856 (£27,462); to general reserve, £450,000 (£200,000); dividend of 8% (same); forward, £408,680 (£304,970).

HOPKINSONS—Trading profit for the year to January 31, £627,688 (£568,289); net profit, after depreciation, taxation, etc., £277,855 (£243,674); withdrawn from tax reserve, nil (£3,723); to general reserve, £100,000 (£50,000); contracts maintenance reserve, £5,000 (£3,000); investments reserve, £2,282 (£1,096); variations in prices of materials reserve, nil (£40,000); dividend of 22½% (same); forward, £367,129 (£253,344).

FEDERATED FOUNDRIES—Consolidated trading statement for 1949 shows total income, £446,212 (£486,428); net profit, after depreciation, tax, etc., £140,564 (£141,712); written off goodwill in subsidiaries, nil (£36,765); taken into accounts of Federated Foundries, £72,071 (£12,557); retained general reserve in subsidiaries, £50,000 (£39,000); profit and loss account, £18,493 (£53,390); dividend of 10% (same); forward, holding company £76,393, subsidiaries £18,493.

RIO TINTO COMPANY—Consolidated net return on sales of produce, etc., for 1949 after adjusting rates of exchange on current assets and liabilities and charging all working expenses and proportion of past years' expenditure on removal of overburden, £722,048 (£793,997); balance, after depreciation, etc., £123,959 (£73,782); net income from trade investments, £280,894 (£272,803); other investments, £6,556 (£6,653); sundry interest, £1,886 (£2,200); unappropriated profits for 1948, £840,070 (£741,820); dividend of 10%, free of tax (same); forward, £996,177.

COLTNESS IRON COMPANY—Consolidated trading profit for 1949, £74,825 (£86,092); interim income from vested assets, gross, less administration, etc., expenses, £129,946 (£214,498); interest and dividends, £39,615 (£35,024); dividends on trade investments, £4,950 (£453); net profit, after depreciation, tax, etc., £81,720 (£91,087); adjustments of provisions for previous years, £21,973 (£167,288); minority holders' proportion of loss, £58 (profit £3,575); withdrawn from accumulated past profits of certain subsidiaries, less profits retained by others, £45,810 (deduct £65,548); second interim dividend of 16¾%, making 21¾% (same); forward, £772,753 (£707,737).

ASSOCIATED ELECTRICAL INDUSTRIES—Consolidated comparative statement at December 31, 1949, shows aggregate profit on trading, £7,601,904 (£6,219,892); net profit, after depreciation, taxation, etc., £2,688,295 (£2,525,893); proportion attributable to minority shareholdings in subsidiaries, £3,459 (£4,245); balance attributable to A.E.I. carried forward or added to reserves in books of subsidiaries, £412,234 (£564,727); available for appropriation by A.E.I., £2,272,502 (£1,956,921); transfer from taxation provisions no longer required, £250,000 (nil); to general reserve, £1,250,000 (£1,024,438); other reserves, £520,671 (£314,048); discount and issue expenses of Notes, £75,000 (nil); final dividend of 10%, making 15% (same); forward, £482,166 (£417,781).

ENGINEERING COMPONENTS—Group profit for 1949, £302,172 (£251,348); net profit, after depreciation, taxation, etc., £117,132 (£100,459); overprovision for tax in prior years, nil (£968); minority shareholders' proportion of profit, £3,176 (nil); holding company's proportion of profit retained in subsidiaries' accounts, £6,173 (£64,584); net profit of Engineering Components, £107,783 (£36,843); to general reserve, £75,000 (nil); final dividend of 15% and bonus of 5%, making 30% (same); forward to Engineering Components, £38,903 (£29,220); subsidiaries' (Engineering Components' proportion) profit retained in accounts, £6,173 (£64,584); brought in, £45,424 (£30,840); transfers to general reserves, nil (£50,000); forward to consolidated balance-sheet, £90,500 (£74,644).

# New Catalogues

**Foundry Requisites and Sundries.**—A new catalogue issued by J. W. Jackman & Company, Limited, of Vulcan Works, Blackfriars, Manchester, 3, is divided into six sections:—Metal melting, moulding, core-making, patternmaking, dressing and fettling, and miscellaneous. To cover these, sixty-eight well-illustrated pages have been incorporated. A commendable feature is the incorporation of a code word for not only each class but for every size included within the range. The range of goods detailed is indeed comprehensive, and it is difficult—though not impossible—to find omissions. To list the main headings needs something of the order of 220 entries. It should be clearly understood that, though the Vulcan Works manufactures many types of foundry plant, these are not included in this catalogue. The reviewer feels sure that the catalogue is available to our readers on request and recipients will find it extremely useful as a valuable source of information for their buying department.

**Gear and Gear Units.** David Brown Gears (London), Limited, Stonebridge Park Works, North Circular Road, London, N.10, have recently issued a 70-page catalogue covering a wide range of small- and medium-size gears. It is the type of catalogue which is really helpful to users, for it abounds with information on which selection can be made. The book starts off with a short history of the firm and illustrates its shops. This is quite a sound notion and is worthy of emulation by other concerns. The catalogue then systematically deals with worm-gear units, gear pumps, marine gearboxes and so forth until page 31, whereafter it prints data germane to the subject. The catalogue is solidly bound in stiff orange-brown cardboard.

# Raw Material Markets

## Iron and Steel

The Government's decision to end steel rationing, with the exception of sheets and tinplates, was announced by the Minister of Supply in the House of Commons on Monday. Such regulations of exports of steel as might still be necessary will be effected by administrative arrangements between the Government and the steel industry. A similar arrangement which exists for certain types of tubes and pipes will continue for the time being. The Government is to keep under review the distribution of other types of steel so that, should any shortage again develop, special arrangements can be made for dealing with the situation.

While current outputs of pig-iron enable many foundries to obtain adequate supplies, others, among them the engineering foundries, cannot secure all they need. The engineering establishments, whose trade has been on a much improved scale recently, would like to have much larger tonnages of the low- and medium-phosphorus irons and of Derbyshire high-phosphorus iron, but production of these grades cannot satisfy all demands and the foundries have to augment supplies with higher priced irons, including hematite and refined irons and in some cases Scotch foundry iron, although the long carriage makes the price of this grade prohibitive.

Fortunately, the makers of hematite and the refined irons have so far dealt successfully with the demands made upon them, and this has, to a great extent, assisted the foundries in achieving their present higher outputs.

The demand for the Northamptonshire grade of high-phosphorus pig-iron is not so heavy, as the light foundries have not the work on hand to warrant their taking up all available supplies, but there is prospect of an improvement in the demand for their type of castings from the building trades, which should show more activity now that some of the restrictions have been lifted. Outputs of castings at these foundries continue at a steady level, but they could accommodate much more work, as could also the jobbing foundries, whose forward bookings are few.

The demand for steel sheets shows no diminution, and the mills are heavily committed. Much more work could be secured, as neither home nor export consumers can obtain all the tonnage they need. Other re-rollers are not so favourably placed. Business is slow for sections and bars rolled by the heavy mills, and apart from the smallest sections and bars from the light mills, there is very little call. Export business helps the mills to maintain production, but orders from this source are not heavy, as foreign competition is restricting sales. Steel semis supplies are at hand in most sizes to meet all requirements, apart from small square and flat billets, which continue to be in demand.

## Non-ferrous Metals

After weeks of waiting, the stability of the United States copper price was broken last week when the domestic quotation for electrolytic was lifted by 1 cent to 20½ cents. The first warning of a change came on Thursday when the export price was quoted over here as 19.75 cents f.a.s. and the Ministry of Supply raised its selling limit by £2 to £164. But on the following day there was a general advance, both for home and export, to 20½ cents and this became effective as the world price. The UK price advanced to £170. On the New York Commodity Exchange May futures were quoted 18.35 cents which suggests that a further advance in electro may take place in the near future.

Now that the plunge has, as it were, been taken and the determination on the part of some producers not to make a price advance has been defeated, we may well see the upswing carried further. If arguments are required to justify more appreciation in the copper price they can be found in the statistical position as disclosed at the end of last month. Moreover, buying is persistent, and the authorities continue to take some 20,000 short tons monthly for the stockpile. So long as the American consumers continue to buy, all will be well; what we must fear is the arrival of the day when their enthusiasm flags.

Tin last week was fairly steady, closing about £1 lower on balance. No change was made in the lead and zinc quotations, but the latter metal is very strong in the United States and on Friday last May futures were listed at 13 cents, so that it looks as if another advance is on the way. In view of this and the advance in copper to £170, all scrap quotations have been very firm, but at the time of writing the market has not really found its feet and values are uncertain. Before business closed on Friday brass swarf could not be bought below £98, while rod scrap was not easy to negotiate at £105. The Government advanced its buying price for rough copper by £6 to £132, which imparted a firmer tone to copper-bearing residues. HC copper was quoted at about £150.

Metal Exchange tin quotations were as follow:—

*Cash*—Thursday, £595 10s. to £596 10s.; Friday, £594 10s. to £594 15s.; Monday, £599 10s. to £600; Tuesday, £601 to £601 15s.; Wednesday, £604 5s. to £604 10s.

*Three Months*—Thursday, £596 to £597; Friday, £595 15s. to £596; Monday, £600 5s. to £600 10s.; Tuesday, £602 10s. to £603; Wednesday, £605 10s. to £606.

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## Chrome-ore Prices Increased

Because of increased rail freight rates, chrome-ore prices have been raised for despatches effected on and after May 15. The Ministry of Supply's revised price-list is as follows, the prices being per ton, delivered f.o.r. nearest point consumers' works, ex-ship, and, in parentheses, ex-store:—

Refractory—Rhodesian Imperial grade, £10 19s. 2d. (£11 16s. 6d.); Transvaal, basis 44 per cent., scale 1s. 6d. (£8 18s. 6d.); Indian, basis 40 per cent., scale 1s. 6d. (£10 2s. 6d.); Turkish, basis 43 per cent., scale 5s., £13 19s. 5d. (£14 17s. 6d).

Metallurgical—Rhodesian lumpy, £11 5s. 2d. (£12 2s. 9d.); Rhodesian washed concentrates, £10 11s. (£12 11s. 3d.); Baluchistan (£12 0s. 6d.).

Chemical—Transvaal XL, basis 50 per cent., scale 2s. 6d. above 50 per cent., £10 15s. 5d. (£11 15s); Transvaal "A," basis 48 per cent., scale 2s. 6d. above 48 per cent., £9 6s. 8d. (£10 6s.); Transvaal chemical, basis 48 per cent., scale 2s. 6d., £9 4s. 5d. (£10 3s. 6d.); Rhodesian Dyke chemical, £11 6s. 8d. (£12 2s. 3d.); Rhodesian Lalapanzi, basis 48 per cent., scale 2s. 6d. above 48 per cent. (£11 8s. 6d.); Rhodesian concentrates, basis 49 per cent., scale 2s. 6d., £9 4s. 2d. (£10 3s. 6d.); Indian chemical, basic 47 per cent., scale 2s., £8 15s. 8d. (£9 11s. 3d.); Baluchistan chemical (£12 0s. 6d.).

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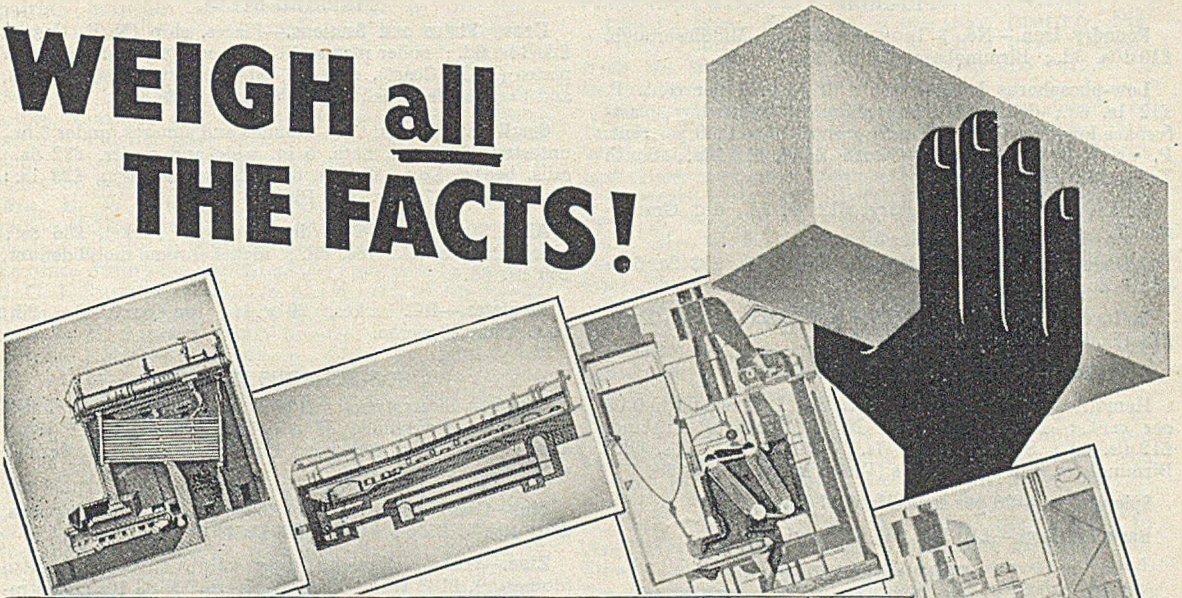
## Steel Research in Sheffield

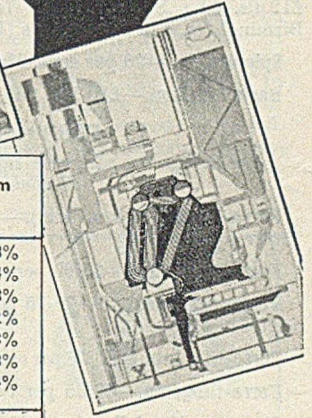
Work has been started in Sheffield by the British Iron and Steel Federation on the conversion and equipment of workshops for research work in steel-melting and forging problems. In part they will be available within the next few months, and it is expected that the whole will be in use this year.

An adjacent site is being cleared for the first stage of the new-style research station to be built and equipped by the Federation at an estimated cost of £250,000. The station will house in miniature much of the equipment of a steelworks.

## For a Correct Balance of Thermal & Physical Properties

# WEIGH all THE FACTS!





| CHEMICAL ANALYSIS | Glenboig "A1" | Glenboig "A1" Crown | Glenboig | Glenboig Crown | Castlecary | Gem |
|---|---|---|---|---|---|---|
| Silica ($SiO_2$) | 52·36% | 52·36% | 57·32% | 57·32% | 57·93% | 60·28% |
| Titanic Oxide ($TiO_2$) | 1·24% | 1·24% | 1·15% | 1·15% | 0·88% | 1·04% |
| Alumina ($Al_2O_3$) | 42·52% | 42·52% | 37·08% | 37·08% | 37·24% | 34·38% |
| Ferric Oxide ($Fe_2O_3$) | 2·27% | 2·27% | 2·56% | 2·56% | 2·04% | 2·42% |
| Magnesia (MgO) | 0·20% | 0·20% | 0·22% | 0·22% | 0·10% | 0·18% |
| Lime (CaO) | 0·56% | 0·56% | 0·58% | 0·58% | 0·56% | 0·58% |
| Alkalies ($Na_2O$, $K_2O$) | 0·60% | 0·60% | 0·98% | 0·98% | 0·90% | 0·94% |
| **PHYSICAL PROPERTIES** | | | | | | |
| Refractoriness | Seger Cone 34 (1750°C) | Seger Cone 34 (1750°C) | Seger Cone 32/33 (1720°C) | Seger Cone 32/33 (1720°C) | Seger Cone 32/33 (1720°C) | Seger Cone 31/32 (1700°C) |
| Refractoriness U/L of 2 kilos/sq. cm. | 1630°C | 1610°C | 1610°C | 1580°C | 1600°C | 1580°C |
| Refractoriness U/L of 50 lb./sq. in. | 1580°C | 1530°C | 1530°C | 1510°C | 1520°C | 1510°C |
| Thermal (Reversible) Expansion—mean co-efficient X $10^{-5}$ | 0.568 | 0.522 | 0.584 | 0.540 | 0.562 | 0.623 |
| Porosity—Total Percentage by Volume | 18/20 | 24/26 | 18/20 | 24/25 | 16/20 | 16/20 |

GLENBOIG

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99

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

*(Delivered, unless otherwise stated)*

May 24, 1950

## PIG-IRON

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

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

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

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

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

**Cold Blast.**—South Staffs, £16 3s. 3d.

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

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

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

## FERRO-ALLOYS

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

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

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

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

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

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

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

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

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

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

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

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

## SEMI-FINISHED STEEL

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

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

**Sheet and Tinplate Bars.**—£16 16s. 6d.

## FINISHED STEEL

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

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

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

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

## NON-FERROUS METALS

**Copper.**—Electrolytic, £170; high-grade fire-refined, £169 10s.; fire-refined of not less than 99.7 per cent., £168; ditto, 99.2 per cent., £168 10s.; black hot-rolled wire rods, £179 12s. 6d.

**Tin.**—Cash, £604 5s. to £604 10s.; three months, £605 10s. to £606; settlement, £604 5s.

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

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

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

**Other Metals.**—Aluminium, ingots, £112; antimony, English, 99 per cent., £160; quicksilver, ex warehouse, £17 5s.; nickel, £321 10s.

**Brass.**—Solid-drawn tubes, 17⅝d. per lb.; rods, drawn, 23¾d.; sheets to 10 w.g., 21⅝d.; wire, 22¼d.; rolled metal, 20⅜d.

**Copper Tubes, etc.**—Solid-drawn tubes, 17¾d. per lb.; wire, 191s. 3d. per cwt. basis; 20 s.w.g., 217s. 9d. per cwt.

**Gunmetal.**—Ingots to BS. 1400—LG2—1 (85/5/5/5), £110 to £127; BS. 1400—L.G.3—1 (86/7/5/2), £120 to £138; BS. 1400—G1—1 (88/10/2), £158 to £200; Admiralty GM. (88/10/2), virgin quality, £185 to £223, per ton, delivered.

**Phosphor-bronze Ingots.**—P.Bl, £180-£220; L.P.Bl, £130-£133 per ton.

**Phosphor Bronze.**—Strip, 29½d. per lb.; sheets to 10 w.g., 31⅜d.; wire, 31⅛d.; rods, 29d.; tubes, 32¼d.; chill cast bars: solids, 29¼d., cored, 30¼d. (C. Clifford & Son, Limited.)

**Nickel Silver, etc.**—Ingots for raising, 1s. 11¼d. per lb. (7%) to 2s. 9¼d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 2s. 5¼d. (7%) to 3s. 3¼d. (30%); to 12 in. wide, × .056, 2s. 5½d. to 3s. 3½d.; to 25 in. wide × .056, 2s. 7½d. to 3s. 5½d. Spoon and fork metal, unsheared, 2s. 3¾d. to 3s. 1¾d. Wire, 10g., in coils, 2s. 10½d. (10%) to 3s. 8¾d.; (30%). Special quality turning rod, 10% 2s. 9½d.; 15%, 3s. 2d.; 18%, 3s. 6¼d.

## Personal

MR. D. E. ROBERTS, a director of Roberts Castings, Limited, Huddersfield, has been re-elected to Huddersfield Town Council.

MR. ROBERT M. NIVEN, commercial manager of the repairing branches of Barclay, Curle & Company, Limited, shipbuilders and repairers, etc., of Whiteinch, Glasgow, has retired after 46 years' service with the firm.

MR. H. SPURRIER, managing director of Leyland Motors, Limited, and MR. G. E. BEHARRELL, deputy chairman and manging director of the Dunlop Rubber Company, Limited, are the new vice-presidents of the Society of Motor Manufacturers and Traders.

MR. E. W. COLBECK, metallurgical and research director of Hadfields, Limited, has been elected the next president of the Institution of Metallurgists and will take office during the annual general meeting on June 14. DR. C. J. SMITHELLS, director of research of the British Aluminium Company, Limited, will be hon. treasurer.

MR. E. R. RAINE, foundry manager, F. Issels & Son, Limited, Bulawayo, Southern Rhodesia (associated with the John Brown group of companies), is on a business visit to this country. He will be participating in the Buxton Conference of the Institute of British Foundrymen and returns to Rhodesia at the end of next month.

ON MAY 10—his 80th birthday—Mr. Joseph Lilly, of 31, Waverley Road, Small Heath, Birmingham, celebrated 65 years in the brassfoundry trade—a record his father had also achieved. Mr. Lilly began work at 5s. a week with James Cartland & Son, formerly of Constitution Hill, Birmingham—for which firm his father worked 65 years—and is now a director of R. Harris, Limited, Newhall Street, Birmingham.

## Board Changes

MILLOM & ASKAM HEMATITE IRON COMPANY, LIMITED —Mr. W. H. Powell has been appointed a director.

HARRISON, MCGREGOR & GUEST, LIMITED, agricultural engineers, of Leigh (Lancs)—Mr. W. Drew and Mr. FitzHerbert Wright have been appointed directors.

INDIAN IRON & STEEL COMPANY, LIMITED—Mr. P. J. P. Thomas and Mr. W. R. Elliot have resigned from the board. Mr. J. H. Methold and Mr. J. L. Esplen have been appointed directors.

MASSEY-HARRIS, LIMITED, agricultural engineers, of Trafford Park, Manchester, 17—Mr. E. P. Taylor, Mr. W. E. Phillips, Mr. C. W. Webster, and Mr. A. L. Weeks have been appointed additional directors.

RICHARD SUTCLIFFE, LIMITED—Consequent upon the death of the joint managing director, Mr. T. D. Sutcliffe, Mr. W. F. G. Sutcliffe has been appointed to that position. Mr. J. D. Sutcliffe has been appointed sales director.

ALLEN WEST & COMPANY, LIMITED—Mr. V. J. Breeze has been co-opted to the board in place of Mr. F. E. Colchester who has retired. Mr. A. E. Owen has been appointed to fill the vacancy caused by the resignation of Mr. H. Tonkinson.

THERMOTANK, LIMITED—Mr. Iain Maxwell Stewart has been appointed chairman of Thermotank, Limited, and associated companies, in which position he succeeds the late Sir Frederick Charles Stewart. Mr. I. M. Stewart served in the company's works and drawing offices and in 1941, after war service, he joined the board. In April, 1945, he was appointed managing director. Mr. Stewart is a director of Glenfield & Kennedy, Limited, the Engineering Centre, Limited, the Glasgow Industrial Finance (Development), Limited, and other companies.

# CLASSIFIED ADVERTISEMENTS