FOUNDRY TRADE JOURNAL

EST. 1902

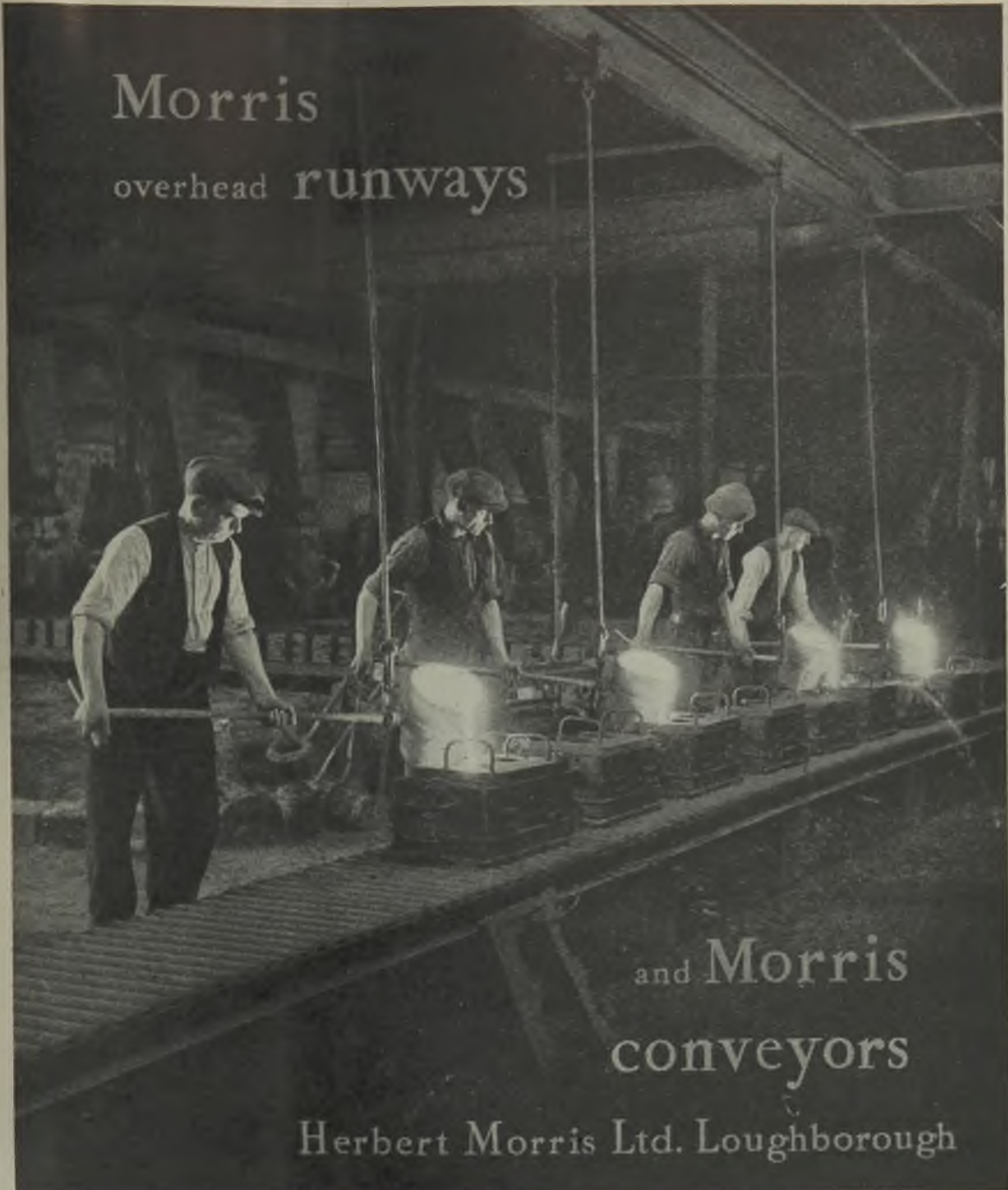
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

VOL. 73. No. 1456. JULY 13, 1944

Registered at the G.P.O. as a Newspaper

Offices: 49, Wellington Street, Strand, London, W.C.2.

Single Copy 6d. By Post 8
Annual Subscription, Hom
and Overseas, 21/- (Prepaid


Morris
overhead runways
and Morris
conveyors
Herbert Morris Ltd. Loughborough

FOUNDRY TRADE JOURNAL

Established 1902

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

49, Wellington Street, London, W.C.2.

WARTIME ADDRESS to which all communications should be sent :—
3, Amersham Road, HIGH WYCOMBE, Bucks.
'Grams: "Zacatecas, High Wycombe."
'Phone: HIGH WYCOMBE 1792 (3 lines).

PUBLISHED WEEKLY: 21s. per annum (Home and Overseas)

OFFICIAL ORGAN OF:

COUNCIL OF IRONFOUNDRY ASSOCIATIONS

Chairman: FitzHerbert Wright, The Butterley Company, Ripley, near Derby. Secretary: V. Delport, 2, Caxton Street, Westminster, S.W.1.

Participating Associations: British Bath Manufacturers' Association; British Ironfounders' Association; British Malleable Tube Fittings Association; Cast Iron Axlebox Association; Cast Iron Chair Association; Cast Iron Heating, Boiler and Radiator Manufacturers' Association; Cast Iron Segment Association; Greensand Pipe Founders' Association of Scotland; Ironfounders' National Confederation; National Association of Malleable Ironfounders; National Ingot Mould Association; National Ironfounding Employers' Federation Association of Automobile and Allied High Duty Ironfounders; British Cast Iron Research Association (affiliated); British Grit Association (affiliated); Flushing Cistern Makers' Association (affiliated); Institute of British Foundrymen (affiliated).

INSTITUTE OF BRITISH FOUNDRYMEN

PRESIDENT, 1943-44: D. Sharpe, Foundry Plant & Machinery, Ltd. 113 West Regent Street, Glasgow.

General Secretary: T. Makemson. Acting Secretary, J. Bolton Saint John Street Chambers, Deansgate, Manchester 3.

BRANCHES

Birmingham, Coventry and West Midlands: A. A. Timmins, F.I.C 33, Carters Lane, Quinton. Bristol and West of England: A. Hares, 20, Greenbank Road, Hanham, Bristol. E. Midlands: S. A. Horton "Three," Mostyn Avenue, Littleover, Derby. Lancs: H. Buckley Ellesmere, Norfolk Avenue, Burnley. London: V. C. Faulkner, 3, Amersham Road, High Wycombe. Middlesbrough (pro tem.): J. K. Smithson, North-Eastern Iron Refining Company, Limited, Stillington, Stockton-on-Tees. Newcastle-upon-Tyne: C. Lashly, Sir W. G. Armstrong, Whitworth & Co. (Ironfounders), Ltd., Close Works, Gateshead. Scottish: J. Bell, 60, St. Enoch Square, Glasgow. Sheffield: T. R. Walker, M.A., English Steel Corporation, Ltd., Sheffield. Wales and Monmouth: A. S. Wall, 14, Palace Avenue, Llandaff, Cardiff. West Riding of Yorkshire: Douglas Jepson, M.Sc., 9, Ambleside Avenue, Bradford. South Africa: B. P. Skok, Mutual Building, Johannesburg.

SECTIONS

Burnley: H. Buckley, Ellesmere, Norfolk Avenue, Burnley, Lancs. Cape Town: K. Zwanziger, P.O. Box 346, Cape Town, S. Africa. East Anglian: A. N. Sumner, 516, Norwich Road, Ipswich Falkirk: T. R. Goodwin, "Viewfield," Falkirk Road, Bonnybridge. Lincoln: E. R. Walter, Ph.D., The Technical College, Lincoln.

ASSOCIATION OF BRONZE AND BRASS FOUNDERS

President: H. Bissell, J. Stone & Co., Ltd., London. Secretaries: Heathcote & Coleman, 25, Bennetts Hill, Birmingham, 2

THE INSTITUTE OF VITREOUS ENAMELLERS

President: W. H. Whittle, W. H. Whittle, Limited, Eccles, near Manchester. Chairman: W. Todd, Parkinson Stove Co., Ltd., Stechford, Birmingham. Hon. Sec.: W. Thomas, A.I.C., Bank House, High Street, Rickmansworth, Herts.

FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION

President: G. E. France, August's, Limited, Thorn Tree Works, Halifax. Honorary Secretary: K. W. Bridges. Assistant Secretary: Miss L. Cox, 52, Surbiton Hill Park, Surbiton, Surrey.

WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION

President: W. E. Clement, C.B.E., Morfa Foundry, New Dock, Llanelly. Secretary: J. D. D. Davis, 1, St. James Gardens, Swansea.

BRITISH CAST IRON RESEARCH ASSOCIATION

Alvechurch, Birmingham. 'Phone and 'Grams: Redditch 716.
Scottish Laboratories:—Foundry Technical Institute, Meek's Road, Falkirk. (Phone: 332.)

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export

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

Vol. 73 | Thursday, July 13, 1944 | No. 1456

The A.F.A. Convention

We wish to register a mild protest against the time-lag in the receipt of transatlantic technical publications. It is important for British industry to know of the technical developments as revealed by the Annual Convention of the American Foundrymen's Association, in order that they may be harnessed to the war machine. This Convention ended on April 28, yet only a day or two ago did the first short account of its findings reach this country in a magazine (" Steel "), dated May 1. This urgency was obviously realised by the retiring president, Mr. Lee C. Wilson, who in welcoming the delegates at the opening session of the Congress, " emphasised that the keynote of the four-day Convention was the production of superior weapons which would aid the United Nations in speeding victory." A notion which has every appearance of being of extreme value to the Allies was disclosed by Dr. H. W. Gillett, of the Battelle Memorial Institute. He gave an address on " Raw Materials for the Cupola," and described some experiments he had made with the object of using up machine-shop borings and turnings without having recourse to the use of heavy presses for briquetting. He has been successful in converting this finely-divided scrap into briquettes by mixing it with certain types of coal and coking the mixture. The coke-bonded briquettes can, according to Dr. Gillett, be handled with a magnet and withstand storage and transport like pig-iron.

This country possesses an extremely wide range of coals, embracing all grades from anthracite to the stickiest of bituminous, and within it, it should be possible to find one which will answer the purpose. Whether the system is economically attractive matters but little in wartime, as all efforts must be designed to utilise all waste material so as to yield technical advantages to the nation. No figures are so far given as to recommended percentages of coal; its fineness, and the desirable temperature for baking; nor are any data yet available as to the physical condition of the swarf—by this we mean whether the borings have to be crushed in a pug mill. It is only natural that we wait with interest the receipt of more data, as we are aware that even to-day large quantities of swarf are finding their way to the rubbish tips. The importance of the foundry industry to the United Nations' war effort was stressed by Rear-Admiral A. H. Van Keuren, the director of the Naval Research Laboratory, Washington. It was revealed that an American destroyer requires some 9,000 valves and fittings, whilst a battleship needs about 15,000 castings, exclusive of structural members. He forecast the increased use of components manufactured by a combination of foundry and welding processes. As we expected from recent disclosures in American business newspapers, the attention of the Congress was drawn to the present dearth of foundry labour. It has been revealed by the Gray Iron Founders' Society that the shortage is of the order of 22,000 operatives. At the Convention the situation was analysed by Mr. H. S. Colby, an official of the War Production Board. Amongst the figures he quoted were a 15 per cent. increase in foundry output since last September, associated with an augmentation of only 2 per cent. in the number of workers engaged. This increase, he thought, could not be maintained now that the industry is potentially faced with the loss of 15 per cent. of its employees.

The new president of the Association is Mr. Ralph J. Teetor, the president of the Cadellac Malleable Iron Company, and to him go the best wishes of all foundrymen in this country. The problems he has to face are similar to those engaging the attention of British foundrymen. The long established and cordial co-operation existing between the Institute of British Foundrymen and the American Foundrymen's Association has done much to improve the technology of the castings industry.

Contents

BOOK REVIEW

"**Machining of Wrought Aluminium Alloys,**" being Information Bulletin No. 7. Published by Wrought Light Alloys Development Association, Union Chambers, 63, Temple Row, Birmingham, 2. Price 1s.

This Bulletin has been compiled to put before the users of these alloys the most recent information on a subject which has hitherto been inadequately discussed in print. The advice and experience both of machining experts in the aircraft industry and of the manufacturers of special machine tools were sought and obtained throughout the writing of the Bulletin, so that the practical aspects of machining have not been sacrificed to purely theoretical discussion. It is emphasised that while a number of operations can be carried out with tools used on other metals, the best results can only be obtained by using the tool angles and shapes appropriate to the light alloys, and the various modifications required for tools used on these alloys are described in detail.

The general principles of tool design for use on the light alloys are shown to be the grinding of large top and side rake angles, and the keeping of the cutting edges sharp and free from burrs and the surfaces of the tool free from grinding marks and scratches before beginning machining. It is pointed out that exceptionally high speeds can be used on aluminium alloys, and that in certain instances, as in turning and milling, the speed of operation is limited only by the speed of the machine itself. The necessity of the machines being free from vibration and the tools from chatter is emphasised, and it is pointed out that best results are obtained by holding the tools as near to the cutting edge as possible.

Following a discussion on the machining properties of the aluminium alloys, an account is given of the cutting materials used—plain carbon and high-speed tool steels, carbide-tipped tools, and diamond cutting tools. Cutting compounds and lubricants are then discussed, and tool shapes and operations dealt with in detail under the following heads:—Turning; parting; forming; piston turning with diamond tools; milling (vertical milling, spar milling and routing); planing, grinding, drilling, reaming; counterboring; tapping (screw cutting and thread rolling); sawing; filing; blanking; and de-burring. The account of each operation is accompanied by a table summarising cutting angles, speeds and feeds and lubricants recommended. The Bulletin is illustrated by photographs and drawings of tools and cutting angles for each operation. The Bulletin concludes with a discussion of the distortion of machined components and a bibliography on machining with special reference to the aluminium alloys.

According to "Steel," a new high-speed X-ray inspection machine is claimed to be capable of photographing as many as 17,000 castings per hr. on a continuous film.

IRONFOUNDRY FUEL NEWS—XI

"Sir—We feel that you will be interested to learn that, following your visit to these works with Mr. —— some time ago, we have been able to reduce the coke bed on our cupola by 18 in., with a subsequent saving in coke of approximately two tons per week. We very much appreciate the assistance given."

The above letter was received by a member of the West Midlands Regional Panel of the Ironfounding Industry Fuel Committee after he had visited a malleable-iron foundry in the district. Panel members frequently find cases where an unnecessarily high bed is being used and foundrymen might therefore be reminded of one or two points in this connection. A bed height of 2 ft. above the tuyeres (above the top row of tuyeres if two rows are used) may be regarded as the minimum height which should be employed. In exceptional cases a bed height of 4 ft. or more may be necessary, but the majority of ironfounders should not need to operate at a height of more than about 3 ft. It is, of course, false economy so to reduce the bed height that the temperature and quality of the metal are jeopardised, but a gradual reduction over a period of days will indicate how far it is possible to go.

The height then being fixed, a measuring rod or ball and chain inserted through the charging door should be used to check the bed height for each succeeding melt. The minimum weight of coke will be required for the bed if large pieces of fairly uniform size are used.

(A few copies of the booklet, "Fuel Economy in the Cupola Furnace," which was circulated to all ironfoundries in January, 1943, are still obtainable from the Fuel Officer, Ironfounding Industry Fuel Committee, Alvechurch, Birmingham.)

ATMOSPHERIC FEEDING OF STEEL CASTINGS

The success resulting from the publication of Taylor and Rominskis' Paper in 1942 covering the use of blind risers and the controlled application of atmospheric pressure, has now reached a further stage in so far as the system applies to steel castings. Instead of using an oil sand core for preventing the formation of an impermeable metallic skin within the riser and for maintaining atmospheric pressure throughout the feeding period, graphite rods are now in vogue. Because they dissolve giving a localised higher carbon material with a lower freezing point, they are said to be more effective. Round rods are just as efficient as square sectioned ones. A Paper on this subject by Mr. John W. Juppenlatz in "Metals and Alloys" recommends the following relationship between the diameters of the riser and the rod:—

Riser Diameter.	Graphite Rod Diameter.
3 to 5 ins.	$\frac{1}{4}$ in.
5 to 8 ins.	$\frac{5}{16}$ in.
8 to 12 ins.	$\frac{3}{8}$ in.

By adhering to these ratios, there will be no excessive carbon pick up by the steel.

MECHANICAL HANDLING IN FOUNDRIES*

REPORT BY THE MECHANICAL DEVELOPMENT SUB-COMMITTEE OF THE TECHNICAL COMMITTEE

The major stages in the handling of materials for the production of castings

CONSTITUTION

The Constitution of the Mechanical Development Sub-Committee is as follows: J. W. Gardom, Convenor, N. C. Blythe, L. W. Bolton, F. J. Cook, T. Makemson, J. J. Sheehan, B.Sc., J. Wilkins, D. H. Wood, J. Bolton, Secretary.

INTRODUCTION

This Report reviews the more important mechanical handling methods and devices employed in foundries for the handling of materials from the time of their receipt to the despatch of the finished castings.

It should be clearly understood that the Sub-Committee is concerned only with general principles of each method or device described, and in no case has it recommended any particular proprietary article or piece of plant. Furthermore, the Report is confined to the handling of foundry materials and products as distinct from processing operations. Where handling equipment is an integral part of a processing machine, or piece of equipment, it is not necessarily included.

It is appreciated that many of the remarks will not be applicable to some foundries where the installation of the more advanced mechanical handling methods would not be an economical proposition, but it should be remembered that a relatively small number of foundries produce the bulk of the castings output of this country.† It is hoped, therefore, that the Report will be of value to those responsible for the major proportion of the industry's production.

An endeavour has been made to deal with all the principal alternative methods for each stage of material handling, the economic and technical advantages and limitations to the employment of each method or device being indicated. It is realised that almost infinite variations may be made to suit the individual requirements of any particular foundry, but it is impossible to discuss all these at any length. Some of the more frequently recurring variations are, however, mentioned. The Report is divided into the following sub-headings, which represent the major stages in the handling of materials for the production of castings:—

I.—Stock yard.
II.—Stock yard to melting furnaces.
III.—Molten metal.
IV.—Moulding sand.
V.—Moulds.
VI.—Core sand and cores.
VII.—Heat-treatment.
VIII.—Fettling shop.
IX.—Inspection.
X.—Storage and despatch.

* Presented at the Forty-first Annual Meeting of the Institute of British Foundrymen.

† To substantiate this statement it should be mentioned that about 12 per cent. of the ironfoundries produce approximately 75 per cent. by weight of the country's castings.

I.—STOCK YARD

Raw materials are received by one, or a combination, of the following methods:—(*a*) rail; (*b*) road, and (*c*) water.

Rail

Since the tare weight of all railway rolling stock is painted on at the time of manufacture, the most common method of checking the weight of raw materials is to bulk weigh the wagon and load on a railway weigh bridge.

Discharging Metal.—The following methods are recommended for the heavier metals:—(i) Overhead crane; (ii) travelling jib crane, and (iii) dumper. When either of the foregoing hoisting methods of discharge is employed in ferrous foundries, it should be used in conjunction with a lifting magnet. Skips can be used in conjunction with cranes, but involve hand handling of materials. Grabs may be employed, but they cannot extract from the corners of wagons, and there is also a danger of damage to wagons. Lifting magnets are obviously impracticable for non-ferrous foundries.

When the stock yard runs at right angles to the rail track, the overhead crane is eminently suitable owing to the large area which may be covered due to the fact that the length of the stock yard is only governed by site conditions.

When the stock yard runs parallel to the rail track, the travelling jib crane is particularly useful by virtue of its outreach and considerable manœuvrability, thus permitting the stock to be spread over a wide area on each side of the track.

The overhead crane in itself constitutes a higher capital charge than the travelling jib crane, and the latter may be used for hauling wagons not only in the stock yard but in other parts of the foundry. An important point to remember in this connection is that railway companies do not, as a rule, allow their locomotives beyond a certain point in works, and therefore wagons have to be taken from the railway siding to their respective sites. To meet special circumstances travelling jib and overhead cranes may be combined.

In medium sized foundries the dumper has proved to be a rapid and convenient method of discharging metal. The capital charge is low, and if ramps are

Mechanical Handling in Foundries

constructed the tipping mechanism with which it is provided permits direct discharge to storage bins.

Discharging Lump Coal, Coke, Sand and Limestone.—The three methods recommended for discharging metal hold good for discharging the above materials, except that where cranes are used a skip or other attachment is employed. Where the rail track is adjacent to the storage bins either drop-side or tipping wagons may be employed. These types of wagons may be combined with conveyors to elevate and transport material to the storage bins. The drop-side wagon is recommended for coke to minimise breakage. Silica sand should be loaded at the source in a sufficiently wet state to reduce wastage during transport and unloading.

Discharging Refractory Bricks and Ganister.—Owing to their brittleness refractory bricks should be discharged by hand methods either into skips on overhead cranes or travelling jib cranes, or into handbarrows for delivery to the storage bins where hand discharging is again carried out. The same remarks apply to ganister which, owing to its nature, should be stored in covered bins as a protection against weather.

Road

The same methods of discharging all materials may be adopted for road vehicles as for railway wagons, but the load from a road vehicle is usually deposited on the ground before delivery to the storage bins. Owing to the flexibility of the road vehicle with tipping mechanism and the comparative ease with which road ramps may be constructed to the head of storage bins as compared with railway equipment, discharging problems are very often simplified. In addition to the above methods the "dumper-shovel-loader" (Fig. 1) may be usefully employed, and is preferable to the dumper.

Water

The hoisting methods only are recommended for discharging from barges or other similar vessels, since it would be impracticable to discharge into a dumper which would of necessity be higher than the load. As already stated, the travelling jib crane is a lower capital charge than an overhead crane, the more so in this particular application owing to the necessity of cantilevered gantry or gantry columns being erected on foundations under water.

Discharging from water-borne vessels necessitates the employment of a weighing hook on the crane for checking weights of materials. An important point to be borne in mind when a sea-going vessel is discharging is that the ship's compass should be first removed if it is intended to discharge metal by the aid of a lifting magnet.

Storage Bins

It is recommended that two sets of storage bins be provided, one set of bins to be used for main storage, the other set for working stock. The main storage bins which need not necessarily be immediately adjacent to distribution points, should contain up to, say, two months' supply; the working stock bins on the other hand should be situated close to the foundry for immediate day to day requirements. It is unnecessary to deliver incoming raw materials to the storage bins and they should as far as possible be delivered to the working stock bins The control of materials is facilitated by the adoption of this method.

II.—STOCK YARD TO MELTING FURNACES

The types of melting furnaces for which handling methods are considered are:—(*a*) cupola; (*b*) converter; (*c*) open-hearth; (*d*) electric; (*e*) rotary; and (*f*) air.

Cupolas

General.—All cupola charges of metal, coke and limestone should be accurately gauged. The only practicable way of gauging metal charges is by weighing, and although it is often convenient to gauge coke and limestone for large cupolas by weight, it is frequently found on smaller units that measurement by volume is equally accurate, and a great saving in time is achieved. Measurement by volume is effected by using a skip or basket to give the required charge of coke, and a suitably smaller size for the limestone.

The method of raising and introducing metal, coke and limestone into the cupola influences the method of weighing, and also the most suitable position for the weighing machine. For this reason the method of weighing charges will be discussed with each type of equipment described. Further notes on weighing will be found at the end of this section. Where cupolas are worked only on short runs, and have a capacity less than 5 tons per hour, the recommended method of charging is hand controlled from the cupola stage.

For cupolas having a capacity in excess of 5 tons per hour it is an advantage to employ mechanical skip charging for charges up to 10 to 12 cwt. and the drop bottom bucket method for charges greater than this. For cupolas which have to supply continuous casting plants mechanical skip charging is recommended, but care must be taken in the preparation of small charges. Where skip charging is employed the charging door of the cupola should be at least 1 ft. 6 in. above the normal level, and should be fitted with a hinged baffle plate to prevent the charges wearing the lining opposite the door and also to give a better distribution. An auxiliary door for inspection should be provided at right angles to the charging door.

Charging Methods

Hand Pulley Block.—For small capacity cupolas the hand pulley block is an economical proposition, and is usually mounted on a monorail or swinging jib. The charge can be raised in a barrow or skip and stacked on the stage for hand charging (when the weighing machine may be on ground level or on the stage), or discharged direct into the cupola, in which case the weighing machine should be of the clock type.

Electric Pulley Block.—The method of employment of the electric pulley block is the same as for the hand pulley block, but is used for cupolas having rather larger capacity.

Hoist or Lift.—This may be of the "goods" type controlled externally or of the passenger type, in which case the operator travels with the load. If the charges are contained in barrows the weighing machine may be on ground level between the stock yard and the hoist or sunk into the cupola stage so that a flush surface is maintained. If bogies on rails are employed, connection must be made at ground level and on the cupola stage with rails on the floor of the cage. The method of weighing the charges is as for barrows. A third method in which a hoist may be adopted is by bringing the charges to the hoist on a monorail, making contact with a monorail suspended from the roof of the cage and connecting again with a monorail over the stage, the method of weighing the charges being as for the pulley block methods.

Skip Hoists.—Skip hoists are employed for direct charging to the cupolas, and are of two types:—(*a*) Where the charging skip is fixed to the hoist; and (*b*) where the charging skips are a separate piece of plant and may be fixed to the hoist for raising to the cupola charging floor. With the fixed type skip the charges are fed to the skip, but with the loose type the skip travels to the stock yard usually on rails. Both types of hoist can be adapted to serve a single cupola, either of a pair, or any number of cupolas. In the latter arrangement the hoist is mounted on rails and moved into position in front of the cupola to be charged.

With the fixed type skip it is necessary to weigh the charges between the stock yard and the hoist, but with the loose type skip, or bogie on rails, the charges can be weighed on a weigh bridge.

Drop Bottom Buckets.—Drop bottom buckets are employed for automatic charging by running the loaded bucket into the charging hole of the cupola by an electrically operated charging machine on the cupola stage. The buckets may be charged from stock on the stage or the charging machine may run on a gantry over the stock yard. In either of these methods the weight of the charges is checked over a weigh bridge or a weighing machine which may be built into the charging machine. The other methods of transferring charges from the stock yard to the cupola stage previously described may also be employed, and it is possible for the hoisting operation to be carried out by the charging machine.

Electric Overhead Travelling Crane.—This type of equipment is successfully employed for raising materials to the cupola stage, being handled similarly to the discharging methods recommended previously. The charges are then taken from the stock on the stage in barrows or bogies and passed over a weighing machine sunk into the stage. Charges may be deposited on to a tilting weigh bridge situated immediately in front of the cupola charging hole so that after adjustment they may be shot direct into the cupola.

Conveyors.—Inclined conveyors of the slat or belt type are occasionally employed for raising metal, coke and limestone to the cupola stage for charging the cupolas in a similar manner to that described when an electric overhead travelling crane is installed.

Stock Yard at Cupola Stage Level

In some foundries site conditions permit the stock yard to be on the same level as the cupola stage served by railway siding or by road vehicles. The arrangement obviates the necessity of hoisting materials to the stage, and the charges may be introduced into the cupola by any of the methods previously described where the stock is delivered to the stage. A disadvantage of arranging the stock yard at stage level is that it is necessary to lower cupola patching material and firebricks to the cupola base. A hoist or lift is therefore required for this duty unless another route for barrows can be conveniently arranged. Similarly dirt and debris from the cupola drop must generally be disposed of by raising to the stage level.

Weighing Cupola Charges

It will be observed that two types of weighers are normally employed for checking the weight of cupola charges. The weigh bridge or platform type sunk into the ground or stage to give a flush surface so that the barrows or bogies may pass over on their way to the charging station are convenient, but have the disadvantage that usually only the total weight of a prepared charge can be checked. If it is required to check the weight of each component of a charge, the barrow or bogie must return to the control weighing station for checking each time a component part of a charge is added, or a weigh bridge must be provided at the side of each bin or stock pile.

The clock-type weigher suspended from a monorail allows the weight of each component part of a charge to be checked as it is added, but a disadvantage with this type is the necessity to provide one weigher for each loading skip.

Converters

Converters are in most cases charged with molten metal and this is usually transported from the melting furnace by an overhead travelling crane or jib crane. The use of cranes provided with remote control is advantageous in narrow shops, as the operator can then be well clear of metal and slag splashes. When converter plant is being installed, consideration may be given to the possibilities of placing the melting furnace adjacent to the converter and at a sufficient height above it, so that the molten metal may be run direct from the receiving ladle without the need for lifting equipment. Deoxidising and alloy additions are best made by hand. Where it is necessary to use cold charges, these can conveniently be introduced by hand methods.

Air Furnaces

Many furnaces of this type are hand charged, an advantage being that this allows more careful placing of the various components than is possible with mechanical methods. On large units, the furnace roof may be removable in sections, thus enabling the charges to be introduced by means of a crane. It is essential in this case that provision shall be made for a suitable distribution of the charge in the furnace.

Rotary Furnaces

Furnaces of the tilting type can be rapidly charged by hand from a suitable platform, to which the charges

Mechanical Handling in Foundries

can be raised by many of the mechanical methods already described. With non-tilting type furnaces of 5 tons or more capacity, an electrically-operated peel-type loader, as used in open-hearth practice, can be employed. A disadvantage of this type of equipment is the large amount of floor space it occupies, and its use is usually restricted to large shops employing two or more furnaces, which can, of course, be served by a single loader. For smaller units, a hand-operated peel may be more convenient than hand charging or the metal may be introduced by means of a shute.

Electric Furnaces

Large direct-arc furnaces, designed for top charging, with a removable roof, are usually loaded by a skip capable of holding a complete furnace charge. The loaded skip is lowered into the cupola by an overhead electric travelling crane or a jib crane. In the case of fixed roof furnaces, charging is carried out by the same methods as employed for small rotary furnaces. When liquid metal is charged, it is usually introduced through a special lander at the back of the furnace.

Small Melting Furnaces

In small melting furnaces, charging is best carried out by hand, as this allows more careful placing of the metal charges than is possible by mechanical methods. Hand charging reduces damage to refractories and enables relatively heavy and light material to be positioned so that the most rapid and satisfactory melting conditions are secured.

Ganister and Refractory Bricks

Similar methods to those used for discharging ganister and refractory bricks must be adopted when transferring them from storage to the furnace. Where the site permits, gravity conveyor may be employed for moving refractory bricks, but at the feed and discharge end of the conveyor careful handling is necessary.

III. MOLTEN METAL

Molten metal may be tapped continuously or in batches. The method of conveying metal to the moulds depends upon the quantity to be handled and the distance to be travelled. For small quantities and short distances the metal may be carried away in hand shanks, but for medium quantities the metal may be run into geared tilting ladles on bogies. Another method of handling medium quantities of metal is by hand tilting or geared tilting ladles on trolleys or travelling pulley blocks running on rolled steel joists or built-up steel sections. Medium to large quantities of molten metal are usually handled by overhead travelling cranes direct to the pouring points when the tapping spouts and pouring stations are in the same bay. When metal has to be transferred to other bays, the method usually adopted is by bogies, or ladles may be transported on power-driven trucks. Monotracks or rails should be continued past the furnaces to permit adequate storage space. Special types of ladles may be necessary to conserve the heat of the metal where it has to be carried some distance.

IV.—MOULDING SAND

Hand and Machine Moulding

With hand moulding it is necessary only to consider the handling of facing sand from the mills to the moulder, the backing sand usually remains at the moulder's side. The mills may be supported above floor level, so that the receptacle to receive the sand may be on floor level. If the mill is on foundations at floor level a pit is necessary into which the receiving receptacle may be lowered.

When the discharge door is sufficiently high above the floor the sand may be deposited into a container, and where a barrow is used, the Sub-Committee recommends that particular attention be given to the two-wheeled type, which is considerably easier to

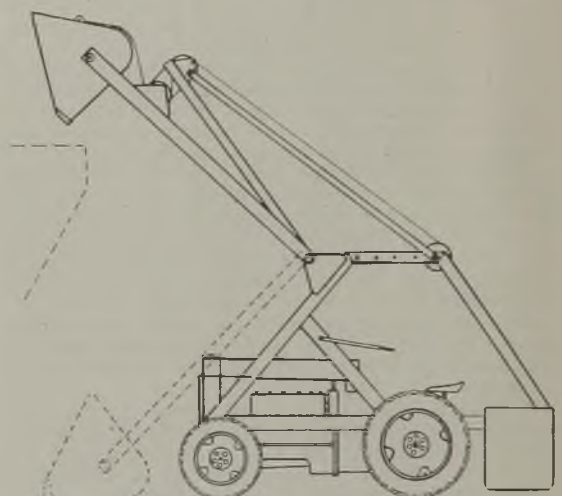


FIG. 1.—DUMPER SHOVEL LOADER.

handle owing to the fact that balancing is unnecessary.

In a larger foundry where more sand is to be handled, loose stillages may be employed, which can be lifted a few inches clear of the floor by elevating platform, power-operated trucks. Gangways must be kept clear and must be maintained in a reasonably good condition to enable the trucks to navigate the foundry. The turning circle of these trucks is, however, very small, and little moulding space is lost on gangway connections. The employment of these trucks enables other materials, such as castings, to be moved from one department of the foundry to another.

Alternatively the sand may be removed in a drop-bottom skip. In this case the mill may be either at floor level or on foundations above floor level. In the former arrangement a pit is provided into which the skip is lowered, being hoisted by pulley block or overhead travelling crane. The advantages of using the crane are that the sand may be taken direct to the moulder, and the skip used as a measuring device.

When portable moulding machines are operated the same conditions regarding the handling of sand apply as with hand moulding, since the machines may be moved along the prepared sand pile.

The most convenient method for operation of fixed power-operated machines is to have the sand delivered into an overhead hopper with a hand-operated valve or gate at its base to allow the sand to fall in a stream into the moulding box on the machine table. Alternatively the sand may be returned to a pile adjacent to the machine. The former operation involves the employment of elevating media, which are more fully discussed under the next section of this Report, but for the latter sand throwers may be used with advantage in conjunction with the methods previously discussed.

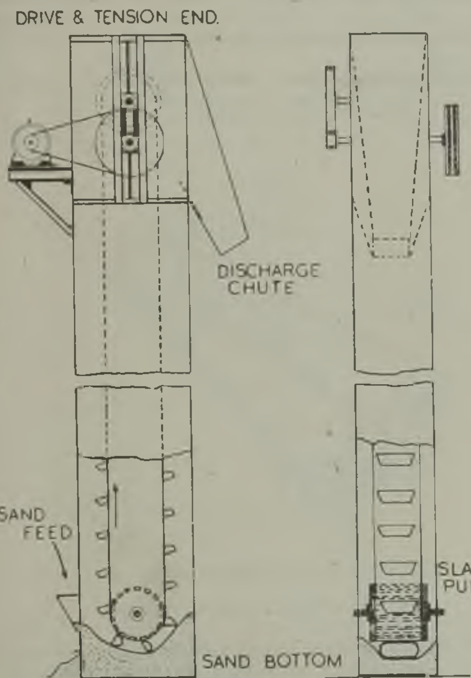


Fig 2.—Bucket Type Elevator.

Mechanised Sand System

In fully mechanised sand systems sand is automatically returned from the knock-out station to an overhead hopper above the moulding machines. This pre-supposes a closed circuit and, apart from the conveying of sand, it also involves elevation. Considerable convenience may be gained from using a unit sand, which has proved to give excellent results. The mechanical conveying of sand sometimes presents special problems in the design of equipment in order that it will give efficient service under foundry conditions. Generally the conveyors and elevators which are in use fall into five distinct types, as follows: (1) Bucket elevators; (2) tilting bucket conveyors; (3) flat and troughed belt conveyors; (4) scraper or push plate conveyors, and (5) apron plate conveyors.

With the exception of the bucket elevator, which is used as an elevating medium only, the four types of conveyors may be employed for conveying or elevating, or a combination of both. The manner in which sand is fed to, or discharged from elevators or conveyors is important. In most cases the feed of sand must be at a uniform rate within the capacity of the conveying or elevating unit, and not at an irregular loading, varying between wide limits of capacity. Inclined shutes are a potential source of trouble, since sand will build up on all but the steepest angles. It is better to avoid inclined shutes wherever possible, and when transferring from one conveying or elevating medium to another it is better to do so directly.

Fig. 3.—Tilting Bucket Conveyor.

Bucket Elevators

The greatest advantage of the bucket elevator (Fig. 2) over other means of raising material is the very small floor space which is occupied by the equipment. Elevators give good service under foundry conditions if properly designed for the purpose, but experience has shown that they are rather less satisfactory when used under steamy conditions, such as is encountered with untreated sand direct from the knock-out.

The important features can be summarised as follow:—

(*a*) From the point of view of maintenance buckets should be carried on a canvas rubber belt in preference to a chain, and the elevator should operate in a vertical position.

(*b*) The method of feeding sand should ensure a regular stream being directed into the buckets. It is good practice to feed at a point some distance above the bottom pulley instead of directly into the boot, so that at least two empty buckets will be ascending. This reduces "dredging," but it must be understood that it is impossible to keep the boot completely clear of sand and, in fact, correct working conditions for

Mechanical Handling in Foundries

an elevator require an artificial sand bottom created by the buckets dredging the sand.

(*c*) The theoretical capacity of an elevator is based upon the assumption that the contents of each bucket are completely discharged each time the bucket passes over the head pulley and upon the speed of the belt and the pitch of the buckets. The complete discharging of buckets can be relied upon when dry materials are handled, but moulding sand adheres to the corners. Buckets are therefore designed tapered in all directions, shallow and with well rounded corners. Vitreous enamel has sometimes been applied to the buckets in a further effort to minimise the loss in

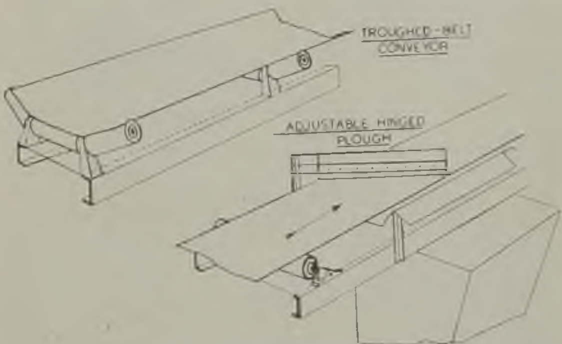


Fig. 4.—Flat-Belt Conveyor Showing Method of Discharge.

capacity, but sufficient allowance should always be made for the possible reduction which may occur. The normal speed of elevator belts is 150 to 200 ft. per min., and the pitch of the buckets is so arranged that sufficient sand to load each bucket can be deposited into the bucket by the feeding medium, a pitch of 12 to 18 in. being usual.

(*d*) The tail pulley of an elevator should be of the slatted type to prevent sand running under the belt, and should be wider than the belt so that the sand which falls into the pulley can readily escape.

(*e*) The driving gear and tensioning device arranged at the head of the elevator is advantageous.

Tilting Bucket Conveyors

This type of conveyor (Fig. 3) has a wider application than the bucket elevator, in that it can be used for horizontal conveying as well as for elevation, and can also provide for collection and discharge at any number of stations; it cannot, however, change direction in the horizontal plane. The buckets are carried on chains, which of necessity have to be supported on the horizontal runs, which increases the maintenance costs. They are of much higher capacity, which allows a corresponding reduction in speed and are also designed so that a continuous supply of sand may be fed to the horizontal runs without spillage.

Tilting bucket conveyors involve a much higher capital expenditure than bucket elevators, and in consequence are not installed to accomplish elevation of sand only, but when the special advantages of multiple point feeding and discharging can be fully utilised consideration should be given to them.

Flat and Troughed Belt Conveyors

Belt conveyors (Fig. 4) are employed to convey sand horizontally and for elevating. When used for elevating, a troughed belt is usually employed, and may be inclined at any angle up to 20 deg. to the horizontal. These conveyors cannot, of course, change direction in the horizontal plane, and as regards changes of direction in the vertical plane, the strand in tension cannot assume a concave form. Satis-

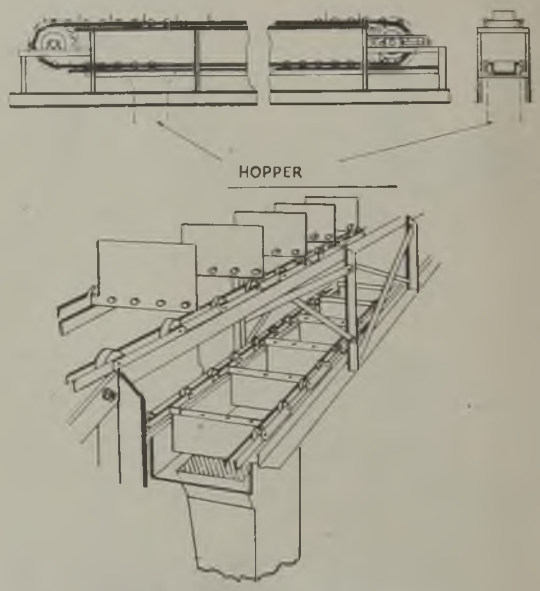


Fig. 5.—Push Plate Conveyor.

factory service from conveyors in foundries does not call for any radical difference in design from that necessary for belt conveyors in other industries handling similar materials, but cover plates should always be fitted between the top and bottom strands of the belt to prevent sand falling off the top strand on to the top side of the bottom strand, causing building up on the pulley resulting in mis-alignment and edge wear.

Mis-alignment, resulting from sand being deposited on to the tail pulley when the belt is used for elevating is prevented in a similar manner to that adopted for elevators, that is, by using a slatted pulley. Guide rollers should not be fitted to a conveyor as the only means of obtaining a true running belt but the tensioning pulley and idlers should be carefully adjusted to obtain this condition.

Flat belt conveyors have a lesser capacity than troughed belt conveyors for the same width of belt and speed, the normal speed of belt conveyors handling foundry moulding sand being from 100 to 150 ft. per min. They are installed to remove sand from knock-out hoppers and from storage hoppers when skid plates are fitted between the idler rollers to prevent sag in the belt. Flat belt conveyors are also widely used for distribution of sand to a number of stations such as hoppers over moulding machines, by ploughing the sand off the belt. Skid plates should be fitted between the idler rollers under the ploughs to present a firm surface to the plough skirt. A disadvantage with this method of sand distribution is that it is not practicable automatically to discharge the requisite amount of sand into the hoppers to maintain a working quantity, and the ploughs must therefore be controlled by an operator. The ploughs may be controlled from foundry floor level or by an operator on an overhead walkway.

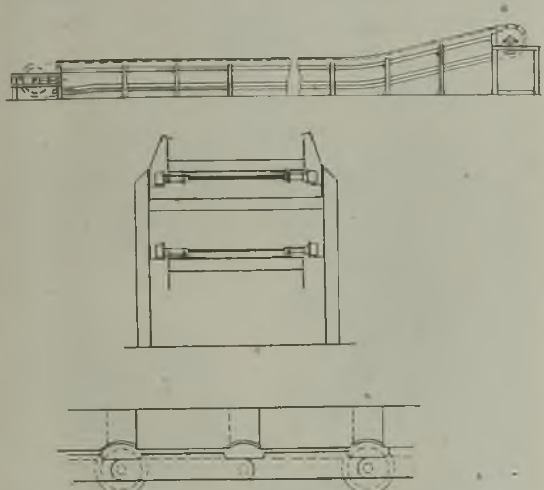


FIG. 6.—APRON PLATE CONVEYOR.

In mechanised sand preparation plants where the overband type of magnetic separator to remove metal is installed, the portion of conveyor below the separator must be flat, but the conveyor may then be troughed for the remainder of its travel. In all other cases of purely conveying, troughed belts are installed.

When handling sand from the knock-out station, damage may be caused to the belt by pieces of scrap metal becoming jammed in some part of the hopper and from burning by hot scrap. In an endeavour to overcome this latter fault asbestos type belts have been tried, but owing to the belt fasteners tearing out, have not always been successful.

Belt conveyors present opportunities for sand cooling, in that combs may be fitted with teeth projecting into the sand stream to turn the sand over, thus continually providing fresh surfaces from which the heat may be dispersed. When compared with the bucket elevator for elevating sand where space consideration is unimportant, belt conveyors are preferable from the point of view of maintenance, but the capital charge is higher.

Scraper or Push-Plate Conveyors

This type of conveyor (Fig. 5) is chiefly used as an alternative to the belt conveyor for overhead distribution of sand to hoppers. The principle of operation, which prohibits any change of direction in the horizontal plane, is that a succession of scrapers or plates push sand along a trough in which a hole is cut over each hopper. When certain types of heavily bonded sands are used there is a tendency for the trough to build up, but this may be overcome by fitting occasional heavy scrapers or by scrapers having a serrated edge.

Hoppers are fed automatically, and if the amount of sand passing along the conveyor is always slightly more than the total required all stations will be kept supplied, thus eliminating waiting time on the part of the machine operators. This feature is of special importance when, for reasons of construction and headroom it is not possible for an operator to be employed overhead to attend to the ploughs on a belt conveyor, or in any other circumstances where the labour necessary for this duty cannot be considered. Scraper or push plate conveyors represent a higher capital expenditure and maintenance costs are higher than for belt conveyors.

Apron Plate Conveyors

The plates being constructed of steel and each plate having an apron to seal the adjacent plate, these conveyors are employed when it is necessary to convey both castings and sand, say, from the knock-out station, or in other circumstances where the risk of damage to rubber belts would be considerable. Apron plate conveyors (Fig. 6) may operate horizontally or at an inclination, and while they may change from horizontal to inclined, and *vice versa*, they cannot change direction left or right. The inclination at which they will operate satisfactorily may be steeper than for belt conveyors.

A point of some importance is that an apron plate conveyor will operate successfully under some degree of intermittent loading, whereas a belt conveyor requires regular and continuous feeding. This condition is common at a knock-out station where the knocking out of moulds tends to produce a succession of sand piles rather than a continuous stream. Capital expenditure and maintenance costs are higher than for belt conveyors.

(*To be continued.*)

The Office of Price Administration has lifted price control within certain specified limits on small orders for non-ferrous castings.

Mr. Clyde E. Williams, director of the Battelle Memorial Institute, has been appointed technical consultant to the Association of American Railroads.

THE LOCATION AND JOINTING OF COREBOXES

By F. H. HOULT*

The manufacture of coreboxes very often necessitates the use of a corebox which is split into two halves. The method by which these two coreboxes are located and held together has always been the subject of much discussion, and there are many alternative ways of obtaining a satisfactory location joint. The operation of manufacturing a core necessitates that the method of jointing should be quick and accurate.

The main method used for locating the two halves of a corebox is by the use of dowel holes and dowel pins. This method is applied whether the box is in wood or metal. The practical coremaker will give an assurance that dowels are a source of trouble, due to (1) the dowel holes becoming filled with sand when the core is made in two halves and the sand becoming firmly embedded into the dowel holes; consequently

(*Continued on page* 220, *column* 2.)

* General Manager, Kent Alloys, Ltd.

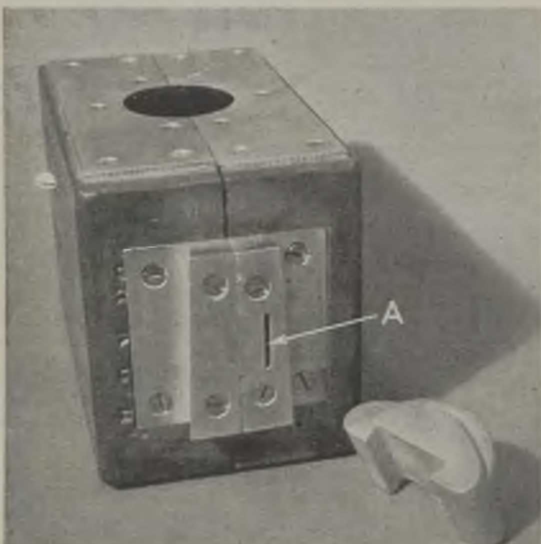


Fig. 1.

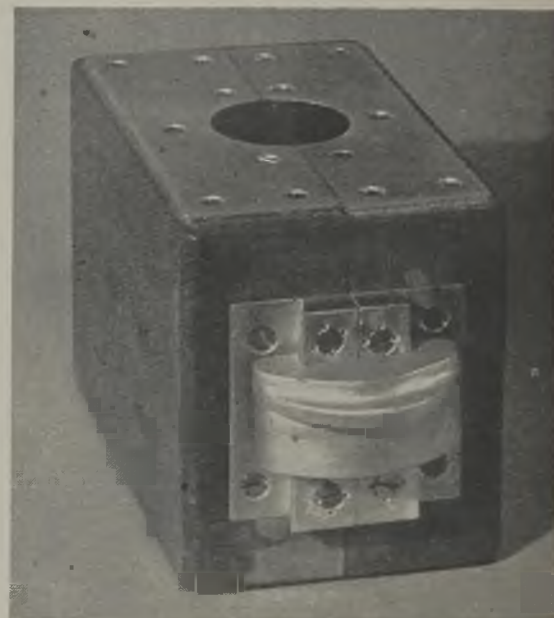


Fig. 2.

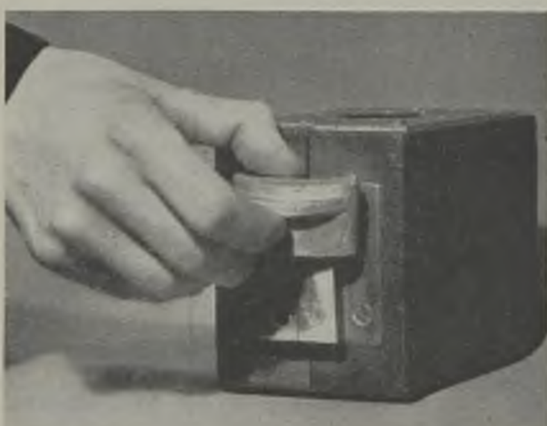


Fig. 3.

Fig. 4.

THE CONTROL OF COMPOSITION AND HEAT-TREATMENT IN 0.25 C 1.5 Mn STEEL CASTINGS*

Data of use and interest to steel-founders who have had no previous experience with this type of steel

By T. W. RUFFLE

The 0.25 carbon 1.5 manganese (commonly called carbon-manganese) type of steel is well suited for steel foundry use, as excellent physical properties can be obtained over a wide range of compositions and heat-treatments.

Composition

At the time when it was decided to adopt the carbon-manganese steel, the standard heat-treatment for low carbon steel castings was a simple normalising treatment of 4 hrs. at 900 to 940 deg. C., cooled in air; the castings being treated in bogie-type furnaces fired with pulverised fuel. Following the production of the first 50 heats, which aimed at the desired composition of 0.25 carbon 1.5 manganese, a careful study of the results obtained was made. All these heats were produced in basic electric furnaces with a silicon content of 0.2 to 0.32 and sulphur and phosphorus under 0.035 per cent. Contamination by other elements such as nickel or chromium from the scrap was negligible.

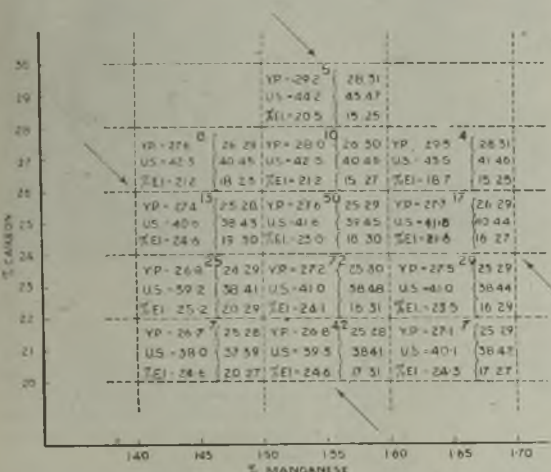


FIG. 1.—CORRELATION OF PHYSICAL PROPERTIES WITH CARBON AND MANGANESE CONTENT OF NORMALISED CARBON-MANGANESE STEEL.

The final de-oxidation practice yielded a fine grain size (McQuaid-Ehn 7 to 8). Test-pieces were all taken from clover-leaf test blocks† in which the three bars were slit axially with the oxy-acetylene flame before heat-treatment. All heats were given the simple normalising treatment described above. These 50 results indicated certain limits, which were later confirmed by an examination of 300 consecutive heats. Fig. 1 shows the yield point, ultimate stress and elongation in tabular form in the various ranges of carbon and manganese. The figure at the top centre of each rectangle indicates the number of results falling in the area, and after the values for physical properties the figures in brackets indicate the spread over each property by giving the maximum and mini-

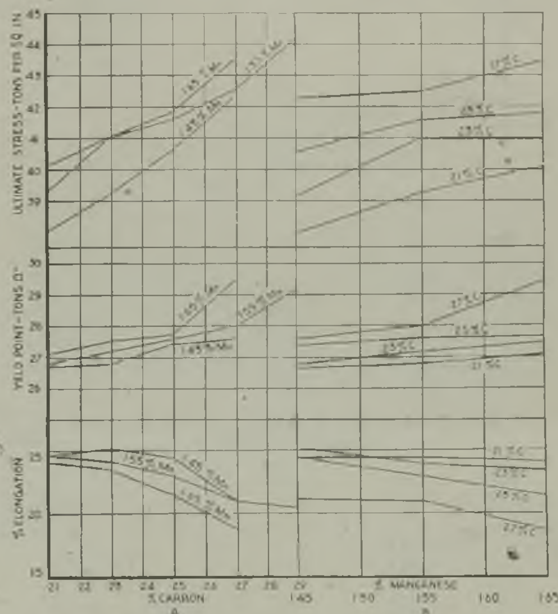


FIG. 2.—PHYSICAL PROPERTIES OF NORMALISED CARBON-MANGANESE STEEL.

* Paper read at the Forty-first Annual Meeting of the Institute of British Foundrymen. The author is metallurgist, Lake & Elliot, Limited.

† "Design of Test-pieces for Carbon Steel Castings," C. H. Kain and E. W. Dowson. Proc. I.B.F. Vol. XXXIII, 1939-40, p. 61.

0.25 C 1.5 Mn Steel Castings

mum values. These averages are graphed in Fig. 2 to show the variation in mechanical properties with (*a*) constant manganese and increasing carbon, and (*b*) constant carbon and increasing manganese.

From a study of this graph the following conclusions seem justified:—(1) Ultimate stress shows a fairly consistent increase with rising carbon and manganese content, the former being much more potent; (2) yield point is relatively stable in the lower ranges, but begins to increase sharply in the regions of 0.27 per cent. carbon with 1.55 manganese, and 0.25 carbon with 1.65 per cent. manganese. In this region air-hardening tendencies begin to develop, and (3) elongation shows a steady decrease with rising carbon and manganese, the decline being more marked above 0.25 per cent. carbon.

The compositional limits finally adopted are shown in Fig. 3 in the form of a parallelogram on the carbon-manganese chart. Heats with analysis falling within this area can normally be expected to give satisfactory test results after standard heat-treatment. Those falling outside were segregated and either scrapped or given special heat-treatment.

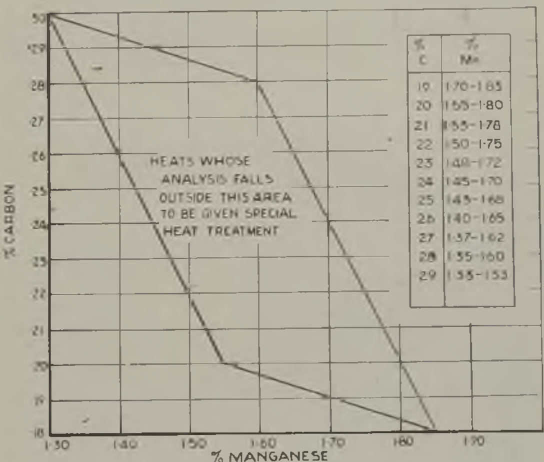


FIG. 3.—LIMITS OF ANALYSIS FOR CARBON-MANGANESE STEEL.

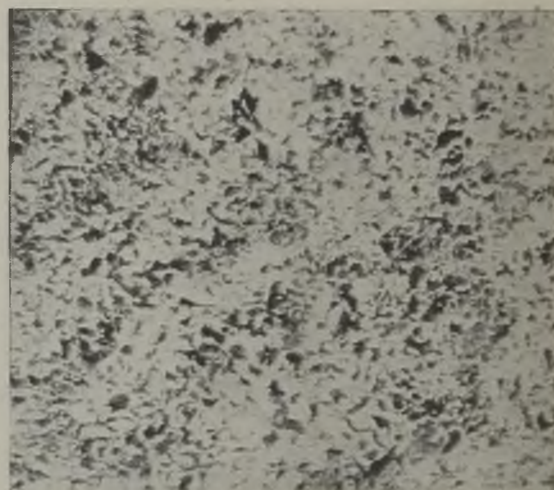


FIG. 5.—ETCHED 3 PER CENT. NITAL. × 100.

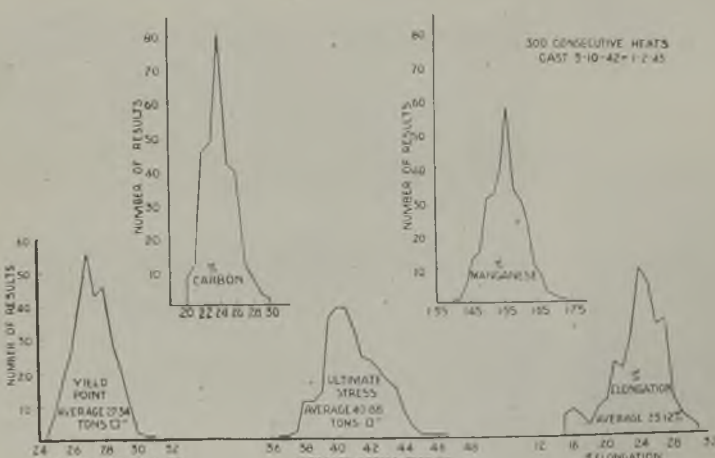


FIG. 4.—FREQUENCY CURVES. ANALYSIS AND TEST RESULTS FOR BASIC ELECTRIC CARBON-MANGANESE STEEL.

Heat-Treatment—Normalising

The castings were loaded on the bogies in a manner which allowed the maximum freedom for circulation of hot gases in the furnace and air during cooling. The bogies were pulled into the hot furnace and heated at approximately 75 deg. C. per hr. Variations occurring due to coal and the nature of the charge covered a range of 50 to 100 deg. per hr. A temperature range of 900 to 940 deg. C. was used for soaking; the load was maintained at this temperature for 4 hrs. This ensured that the load of castings (maximum section less than 2 in.) was thoroughly heated and given time for the "as-cast" structure to break down. No appreciable grain coarsening was found at/or slightly above 940 deg. C. After soaking, the load was withdrawn and allowed to cool on the bogie.

These limits of composition and range of heat-treatment have proved very satisfactory in practice, as may be seen from Fig. 4, which gives the analysis and test results of 300 consecutive production heats in the form of frequency curves. Less than 3 per cent. of the results are below 25.5 tons per sq. in. yield point and 10 per cent. below 20 per cent. elongation. The great majority of the low elongation results may be attributed to slight flaws in the test-bars. Fig. 5 shows the typical structure of the steel after this treatment.

The castings on the outer corners cooled somewhat more rapidly than those in the centre of the load. With plain carbon steels this had been found to produce a small variation in Brinell hardness. Tests made by placing castings of carbon-manganese steel in various positions in the load showed no variation in Brinell hardness attributable to position. This type of steel does not appear to be so sensitive to minor variations in cooling rate as the straight carbon type.

Heats Outside Composition Limits

A number of heats did not comply with the limits laid down. The normal practice was to segregate the castings whilst an experimental heat-treatment was applied to the test-bar. If the results from this were sufficiently encouraging, the castings and another test-bar were heat-treated accordingly. Some discretion is necessary in correlating test-bar results with those that can be obtained from castings. In this case the sections are similar, and good agreement has been found in numerous cases where bars cut from castings have been compared with the test-bar.

Heats low in carbon and/or manganese were dealt with in two ways. Those slightly below the desired standard can sometimes be sufficiently improved by full air cooling instead of the normal bogie cooling. This was effected by pulling the castings from the furnace and placing them on the floor to cool separately. This gave between 0.5 and 1.0 tons per. sq. in. gain in yield point at a slight sacrifice to elongation, which in such heats allowed an adequate margin. Heats appreciably below the desired limits were salvaged by water-quenching and tempering. This form of treatment is discussed later. Heats slightly above the desired limits were sometimes sufficiently improved in ductility by tempering after normalising. Results from this method are somewhat unreliable, high manganese with fairly high carbon content frequently giving very poor elongation values. Most of these heats were brought within specification by water-quenching and tempering.

TABLE I.—*Influence of Heat Treatment on the Properties of* 0.25 C, 1.25 Mn *Steel.*

Heat No.	Per cent. C.	Per cent. Mn.	Heat* Treatment.	Yield point, Tons per sq. in.	Ultimate Stress, Tons per sq. in.	Per cent. Elongation.	Per cent. Reduction of Area.	Izod, Average ft.-lb.
C. 12,499..	0.25	1.46	"A"	40.00	49.15	20	42.5	43.8
,,	0.25	1.46	"B"	36.70	46.70	23	51.5	44.7
A. 4,940 ..	0.24	1.25	"A"	29.10	40.98	25	45.5	52.8
,,	0.24	1.25	"B"	28.30	39.40	29	52.0	54.3
B. 5,320 ..	0.31	1.08	"A"	30.00	43.65	25	48.5	55.3
,,	0.31	1.08	"B"	29.75	41.70	28	56.0	61.5

* *Heat Treatment* :—"A"—4 hours 900—920 deg. C., W.Q., 3 hours 550 deg. C. Air cool.
"B"—4 hours 900—920 deg. C. Air cool, 1 hour, 850 deg. C., W.Q., 3 hours 550 deg. C. Air cool.

TABLE II.—*Influence of the Temperature of Quenching Water on the Mechanical Properties of* 0.25 C, 1.5 Mn *Steel.*

Heat No.	Per cent. C.	Per cent. Mn.	Temperature of Quench Water.	Yield Point, tons per sq. in.	Ultimate Stress, tons per sq. in.	Per cent. Elongation.	Per cent. Reduction of Area.	Yield Ratio.	Izod average ft.-lb.
			Deg. C.						
C. 12,499 ..	0.25	1.46	100	35.00	45.75	23	42.5	0.765	50.0
,,	0.25	1.46	15	37.95	48.50	22	44.0	0.785	48.0
A. 4,564 ..	0.25	1.44	100	31.50	42.75	26*	35.0*	0.740	—
,,	0.25	1.44	15	32.90	42.50	14†	32.0†	0.775	—
F. 16,042 ..	0.26	0.95	100	31.00	46.50	21	42.5	0.668	—
,,	0.26	0.95	15	32.25	46.85	20	38.0	0.690	—

* Slightly flawed. † Badly flawed.
Heat treatment :—4 Hours 900—920 deg. C., quenched in water at temperature shown ; tempered 3 hours, air-cooled.

0.25 C 1.5 Mn Steel Castings

Water Quenching and Tempering

The improvement in physical properties imparted by this form of treatment is sufficient to warrant the most serious attention. The danger of cracking and warping appears to have been over-stressed in the past, particularly in respect of the lower alloy or straight medium carbon steels. It is common practice to homogenise the castings, *i.e.*, break down the coarse "as-cast" structure by annealing or normalising as a preliminary operation and then to quench after a comparatively short heating at a lower temperature. This does not always give advantages commensurate with the additional furnace time and labour involved. Also, excellent results have been obtained from both carbon-manganese and straight carbon steels with a quench directly from the first homogenising treatment. Tests carried out to assess the advantages of the two methods are shown in Table I. There is appreciable gain in ductility and impact with the treble treatment, but some loss in yield and ultimate stress.

Quenching

In the case of intricate castings, it is sometimes of value to delay the quenching until the casting has cooled to just above the critical range. This practice reduces the possibility of undue stresses being set up, but needs very careful control and has not, so far, been found necessary in the present practice. All test-bars reported in this Paper were quenched immediately after leaving the furnace.

The temperature of the quenching water directly affects the rate of cooling. In order to investigate the effect of variation in the temperature of quenching water, three pairs of test-bars were heated together for 4 hrs. at 900 to 920 deg. C. and then quenched, one in cold and the other in boiling water. The bar in cold water was left in the water until it cooled to room temperature; the bar in boiling water was taken from the water after boiling had ceased and allowed to cool to room temperature in air. The bars were then tempered together for 3 hrs. at 550 to 600 deg. C. The results are shown in Table II. Rather higher tensile properties are given by the cold quench, the yield ratio showing the greatest increase. A slight loss in ductility accompanies these gains. The effect of considerable variation in quenching water temperature on this type of steel is apparently negligible.

A factor of great importance is the temperature to which the castings are allowed to cool before removal from the quench. Cracking probably takes place due to the stresses set up by delayed austenite transformation. If the castings are removed at a temperature of about 300 deg. C., the expansion accompanying the

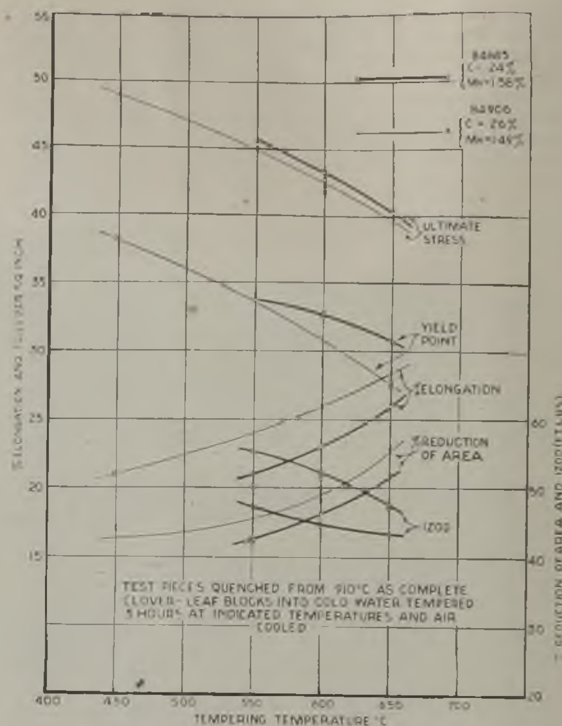


FIG. 6.—EFFECT OF TEMPERING TEMPERATURE ON PHYSICAL PROPERTIES.

TABLE III.—*Properties of Clover Leaf Test-Bars After Full and Partial Quenching.*

Heat No.	Per cent. C.	Per cent. Mn.	Heat Treatment.†	Yield point, tons per sq. in.	Ultimate Stress, tons per sq. in.	Yield Ratio.	Per cent. Elongation.	Per cent. Reduction of Area.
B. 4,695	0.25	1.49	Full quench	28.20	39.35	0.718	28	56.0
,,	0.25	1.49	Partial quench	29.70	40.00	0.745	29	58.0
C.12,467	0.23	1.49	Full quench	31.40	42.55	0.740	23	36.0
,,	0.23	1.49	Partial quench.. ..	32.55	42.60	0.765	23	47.0
A. 4,569	0.24	1.64	Full quench	32.20	41.30	0.780	12*	23.0*
,,	0.24	1.64	Partial quench.. ..	32.60	42.45	0.770	15*	30.0*

* Badly flawed. † *Full quench*: Kept in water until cold (15 deg. C.). *Partial quench*: Removed from water at 250 deg.—350 deg. C.

transformation takes place more gradually when the castings cool in air and the hardening effect is not decreased. It is safer to begin heating to the tempering temperatures before the castings have fallen to room temperature.

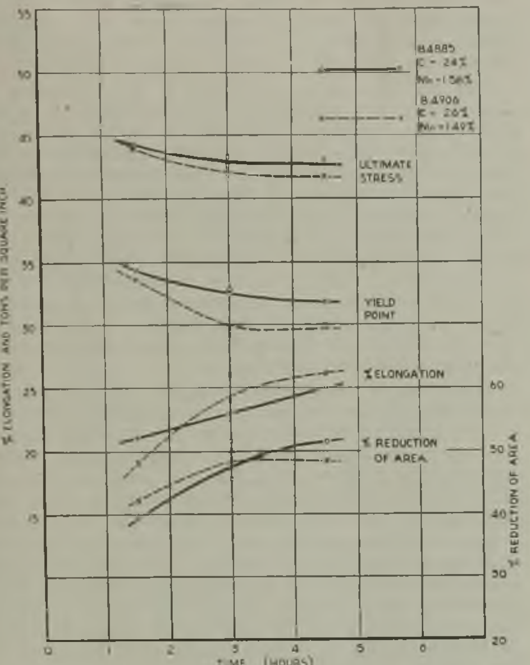


FIG. 7.—EFFECT OF TEMPERING TIME AT 600 DEG. C.

to 600 deg. C. and tempered for the usual time of 3 hrs. The results are given in Table III. It will be seen that those bars removed warm from the quench give somewhat better physical properties in all respects than those fully quenched. The most likely explanation seems to be that the greater internal stresses set up by the full quench have a detrimental effect even after tempering.

Tempering Temperature

The practice, in all cases, for tempering was to charge the castings into a furnace at the required temperature and to record the time from the moment when the couple again registered the tempering temperature. Fig. 6 shows the effect of increasing tempering temperatures on test-pieces quenched from 910 deg. C. in cold water (15 deg. C.). The yield point and ultimate stress fall steadily with increasing temperature, whilst elongation and reduction of area show a corresponding increase. Contrary to expectations, the impact value also declines in the range of 550 to 650 deg. C. Possibly this is due to the progressive coalescence and coarsening of the structure.

It will be seen that excellent properties can be obtained over a wide range. If high strength is the main object, it can be obtained by tempering at a lower temperature, such as 450 deg. C., where ductility is still at a high level. In practice it would probably be better to choose a composition permitting the use of higher temperatures, as higher temperatures give exceptionally good ductility and more complete stress relief whilst retaining a yield point still considerably above that given by normalising.

Time of Tempering

Fig. 7 shows the effect of increasing time at a constant tempering temperature of 600 deg. C. The rate of change of the tensile properties becomes very small

TABLE IV.—*Mechanical Properties of Two Heat-treated Bars, Showing Small Indication of Temper Brittleness.*

Heat No.	Heat Treatment.	Yield Point, Tons per sq. in.	Ultimate Stress, Tons per sq. in.	Per cent. Elong.	Per cent. Reduction of Area.	Yield Ratio.	B.H.N.	Izod, Average ft.-lb.
B. 4,885	W.Q.,T. 600 deg. C., 3 hrs.C.I.F.	31.75	43.00	—	—	0.740	217	49.3
,,	,, ,, ,, W.Q.	33.50	43.75	26	51.5	0.765	228	54.0
B. 4,906	,, ,, ,, C.I.F.	29.70	41.05	26	50.0	0.725	192	44.8
,,	,, ,, ,, W.Q.	30.40	43.40	25	45.4	0.700	196	48.7

Abbreviations :—W.Q. = Water quench. T. = Temper. C.I.F. = Cool in furnace.

In order to investigate what effect this practice had on the ultimate physical properties of the steel, three pairs of bars cut from clover-leaf test-pieces were used. In each case the two bars were heated for 4 hrs. at 900 to 920 deg. C., one being quenched in cold water until cold (15 deg. C.) and the other quenched for 30 to 40 secs. and then removed at a temperature between 250 to 350 deg. C. After allowing the latter to cool in air to about 100 deg. C., both bars were placed in a furnace at a tempering temperature of 550

after 3 hrs., although some gain in ductility is derived from further time. Three hours has been standardised for all castings of normal section. This time yields very consistent results, and it is found that more reliable control is obtained by adjusting temperature than by altering time.

Temper Brittleness

Carbon-manganese steel is sometimes accused of temper brittleness, and Table IV shows two sets of

(*Continued overleaf, column* 1.)

THE CONTROL OF COMPOSITION AND HEAT-TREATMENT IN 0.25 C 1.5 Mn STEEL CASTINGS

(*Continued from previous page.*)

bars treated to test this property. It will be seen that the water-quenched bars give slightly better properties, the impact values for the slower cooled bars being 8 per cent. lower than the quenched bars. This difference is not sufficiently great to indicate pronounced temper brittleness, and it is considered that in all castings of normal section, air cooling after tempering is sufficiently rapid to prevent any embrittlement.

Tropenas Converter Steel

A collection of data, similar to the above, but dealing with Tropenas converter steel, is being accumulated. It is considered undesirable to make this Paper unduly long by further statistics, but the following conclusions on normalised steels may be stated:—

(1) For the same carbon and manganese content, converter steel has an appreciably higher yield point and a considerably higher ultimate stress than basic electric steel. The yield ratio is lower.

(2) Elongation and ductility in general are poor and less consistent. This is often attributed to grain boundary inclusions due to unsuitable deoxidation procedure, but unsatisfactory elongation sometimes occurs with random distribution of inclusions.

(3) More drastic heat-treatment is necessary thoroughly to refine the structure than with basic electric steel.

(4) Impact values are generally lower and more variable.

(5) The greater resistance to breaking down necessitates a higher temperature (940 to 960 deg. C.), and this in turn leads to some coarsening of grain. Grain-size control is less easily effected with this type of steel.

(6) It has been found necessary to employ double normalising from 950 and 850 deg. C. to obtain results comparable with the single normalising treatment used for the basic electric steel.

The author wishes to thank the directors of Lake & Elliot, Limited, for permission to publish the information in this Paper.

In a lecture which Mr. Donald J. Reese gave to the New Jersey Chapter of the American Foundrymen's Association, he presented figures which showed the production of grey iron in the United States had fallen from 11,000,000 short tons in 1941 to 9,300,000 in 1943. It was now, however, regaining some of the business lost to steel, malleable and bronze. The production of plastics was now 15 times greater than in pre-war days, but at its present price it would not make great inroads into the foundry business. He thought the loss of ferrous castings to light metals after the war would be small. In fact, instead of providing competition, activity in these light metals might help by opening up new fields and broadening markets.

THE LOCATION AND JOINTING OF COREBOXES

(*Continued from page* 214.)

the box is not allowed to close correctly; (2) dowel pins and bushes become loose with continual vibration and rapping, and (3) the dowel holes become worn, with consequent cross jointing of the cores.

The method shown in Figs. 1 to 4 consists of tapered location pieces, which are attached on to each half of the corebox. These pieces locate firmly each in the other, and over the whole is placed the tapered clip as illustrated in Fig. 2. The tapered clip ensures that the two halves of the corebox are held very rigidly together; any vibration tends to tighten this clip. The taper is arranged so that when the box is in the ramming position the narrow edge of the taper is uppermost. After the core is made and the box is turned over in order to remove the core from the box, *i.e.*, to separate the two halves of the box, the taper is reversed so that a slight jolt of the box causes the clip to become detached.

The point to be noted with regard to the clip is that the flange shown on this clip is situated at the edge of the clip, which corresponds to the thin edge of the taper; this ensures that the operator can, without stopping to examine the clip, be confident that the clip is being applied to the wedge pieces in the correct position for locating. This is illustrated in Fig. 3.

Fig. 4 illustrates the two half coreboxes showing that there is no danger of sand becoming embedded in any portion of the box or clip and remaining there, preventing close jointing of the two halves. Should any sand remain in the portion of clip marked (*a*) as shown in Fig. 1, it will ensure that this sand will not prevent the box from completely closing.

PROFITS FROM IRONFOUNDING IN AMERICA

Amongst the numerous problems facing the grey-iron foundry industry discussed at two regional conferences staged recently by the Gray Iron Founders' Society, at New York, was the profits earned by the American cast-iron foundry industry. Mr. John L. Carter, cost consultant, Gray Iron Founders' Society, presented an interesting Paper, "Sound Costing in the Grey Iron Industry," in which he stated that business management is responsible for low profits experienced in average years by the grey iron industry. The industry's profits in 1936 to 1939 were only 4 per cent., and one-fourth of the companies operated at a loss. If the proportion of foundries having sound cost methods had been 75 instead of 25 per cent., Mr. Carter stated that the average profit margin in a normal period like 1936-39 would have been doubled or approximately 8 per cent. If the additional 4 per cent. had been applied to total sales for 1941, the gain would have mounted to approximately £6,000,000.

NEWS IN BRIEF

Murex Welding Process, Limited, Waltham Cross, Herts, announce the placing upon the market of a new electrode, "Bronalex," which is compounded for the welding of complex aluminium bronze alloys.

The Glacier Metal Company, Limited, of Ealing Road, Alperton, Wembley, announce that they are closing their London factories from August 25 to September 4, and two Scottish factories from July 21 to August 1 for annual holidays.

The partnership between Hindle Jones and Thomas Holden, carrying on business at Production Works, Leamington Road, Blackburn, under the style of Leamington Engineering Company, has been dissolved by mutual consent. Debts will be received and paid by Hindle Jones, who continues the business under the same style.

Owing to increased work in recent months, the Wrought Light Alloys Development Association has taken additional office accommodation adjacent to the present offices at Union Chambers, 63, Temple Row, Birmingham, 2. All communications should continue to be directed to the above address, but the telephone number has been changed to Midland 0847.

The Carborundum Company, Limited, have produced a new film, "First Principles in Grinding." The film is of particular value to potential operators of the modern grinding wheel, whilst the experienced hand will also find much to interest him. The company have suitable sound apparatus and competent operators, and all requests for an exhibition of the film will receive the utmost consideration, and should be addressed to the firm at Trafford Park, Manchester, 17.

Dr. Frank Leverick, consulting engineer, gave his views to the members of the Wolverhampton Production Exchange recently on future plans of the Exchange. He suggested that in the future the Exchange could offer the Midlands manufacturer very much help in order to improve products, to develop new ideas, and to obtain new commercial outlets. He proposed that attached to the present organisation of the Exchange there should be a research and development centre. This should have a really first-class library, subscribing to all the useful technical journals in the world.

A scheme for the recruitment and training of juveniles for the engineering industry in the post-war period has been drawn up by the Engineering Employers' Federation and the National Engineering Joint Trades movement, in conjunction with officers of the Ministry of Labour, the Ministry of Education, and the Scottish Education Department. Under the proposals juveniles will be free to select their employment, but entry into the engineering industry will be controlled by local industrial juvenile advisory panels. A national joint body will be set up. The adoption of minimum standards is suggested in regard to young persons passing from schools into the engineering industry, and guidance and advice will be continued up to the age of 18.

PERSONAL

Major Simon Green has been appointed managing director of E. Green & Son, Limited, fuel economiser makers, Wakefield, in succession to Mr. Harold Livsey, who has recently retired.

Mr. Norman G. Turnbull, chief surveyor at Newcastle-upon-Tyne, has retired after more than 30 years with Lloyd's Register of Shipping. He is succeeded by Mr. G. R. Edgar, of Belfast.

Mr. Wilfred L. Fletcher, assistant general manager of the Tees Side Bridge & Engineering Works, Limited, Middlesbrough, has been appointed assistant to the managing director of the company.

Mr. E. Charlton Glover, of Glover Bros. (Mossley), Limited, has been appointed joint managing director of the British Ropeway Engineering Company, Limited, to act in conjunction with the previous managing director, Mr. H. Bradshaw Glover.

Mr. William Brown and Mr. Patrick William McGuire have been appointed joint managing directors of the Chesterfield Tube Company, Limited. Mr. Brown has been with the company since 1918. He was appointed general manager in 1934, and was elected to the board of directors in 1937. Mr. McGuire served his apprenticeship at the Royal Naval Dockyard, Portsmouth, and was with several firms in this country before joining the Chesterfield Tube Company in 1936. Until his recent appointment he was works director of the company.

OBITUARY

Mr. John Henry Wright, of May Bank, North Staffs, who died recently, had been in business as an iron and steel merchant for nearly 40 years.

Mr. William Anderson Robertson, of D. & W. Henderson & Company, Limited, shipbuilders and engineers, of Glasgow, died suddenly at Giffnock on June 29.

Mr. Stanley Hodgkin, senior director of the Pulsometer Engineering Company, Limited, died suddenly on June 29 at his home at Reading. He was in his 85th year.

Mr. F. Hughes-Caley died suddenly on July 2 in Birmingham, with which city he had been identified for several years, having been manager of the Birmingham district office of the British Thomson-Houston Company, Limited, from 1923 until his retirement a few months ago.

PURCHASE OF WOLFRAM CONCENTRATES

The Ministry of Supply give notice that the arrangement announced in July, 1942, for the purchase of wolfram concentrates by Non-ferrous Minerals Development, Limited, at Plympton, South Devon, will be terminated on December 31, 1944. No concentrates will be accepted by Non-ferrous Minerals Development, Limited, after November 30, 1944.

COMPANY RESULTS

(Figures for previous year in brackets)

W. G. Allen & Sons (Tipton)—Final dividend of 7½%, making 10% (same).

Triplex Foundry—No dividend on the ordinary shares for the year ended March 31, 1944.

Allied Ironfounders—Final dividend of 7½% on the ordinary shares, making 12½% for the year to March 31 (same).

Tweedales & Smalley (1920)—Net profit to April 30 last, £78,838 (£102,943); dividend of 12½%; forward, £80,754 (£58,166).

Newman & Watson—Net profit, before charging income-tax and N.D.C., £4,822 (£13,094); dividend of 3% for the half-year ended March 31, 1944, on the 6% cumulative preference shares.

Watford Electric & Manufacturing—Net profit for 1943, £65,650 (£62,472); income-tax and E.P.T., £58,297 (£55,047); ordinary dividend of 15% (same); reserve for buildings, £1,000 (same); forward, after preference dividend, £21,546 (£20,443).

Anderston Foundry Company—Net profit for the year ended March 31, 1944, £10,676 (£8,530); to reserve, £2,000 (same); brought in, £14,125; dividend of 6s. per £3 share (4s. 6d.), plus a bonus of 3s. (nil) to mark the 60th year of incorporation; forward, £16,051, subject to fees and allocation to benevolent fund.

Harland Engineering—Profit for 1943, after providing for depreciation, taxation, deferred repairs, etc., £15,592 (£15,432); general reserve, £7,000; war damage contributions, £1,260; preference dividends, £3,000; written off A.R.P. expenditure, £448 (£600); ordinary dividend of 6%, less tax, £4,200; forward, £13,996 (£14,312).

Electric Construction—Net profit for the year to March 31, £149,120 (£118,201); preference dividend, £3,500 (same); tax, £100,000 (£55,000); deferred repairs, £4,600 (£25,000); general reserve, £15,000 (same); superannuation fund, £2,500 (nil); dividend of 12½% on the ordinary shares, £18,750 (same); forward, £38,411 (£33,641).

Garrard Engineering & Manufacturing—Net profit for the year ended January 31, 1944, after depreciation, taxation, etc., £22,869 (£20,964); final dividend of 5% on the preferred ordinary shares, making 10% (same); to general reserve, £10,000; final dividend on the ordinary shares of 1½d. per share, making 3d. (same); forward, £22,516 (£21,522).

Whitehead Iron & Steel—Trading profit, etc., for year to March 31, 1944, £488,489 (£600,935); net profit, after debenture interest and depreciation, £50,000 (£175,000) for E.P.T. and £203,000 (£190,000) for income-tax, £159,610 (£159,660); final dividend of 10%, making 20% (same); to general reserve, £75,000 (same); forward, £49,363 (£43,136).

Edgar Allen—Profit from April 4, 1943, to April 1, 1944, inclusive, £368,607 (£457,781); net profit, £54,299 (£46,455), after £37,408 (£37,262) for depreciation, £274,000 (£370,000) for income-tax and E.P.T., and £2,600 (£3,400) under War Damage Acts; to general reserve, £20,000 (same); ordinary dividend of 12½% (same); forward, £46,184 (£37,341).

Rotherham Forge & Rolling Mills—Trading profit, etc., £55,418 (£79,374); depreciation, £9,500 (£10,000); war damage and war risks insurance, £914 (£928); deferred repairs, £9,100 (£6,500); tax, £22,180 (£48,371); net profit, £12,974 (£12,825); ordinary dividend of 15% (same); no bonus (2½%); to reserve, £4,000 (same); forward, after preference dividends, £9,628 (£8,830).

Bradley & Foster—Trading profit for the year to March 31, £37,101; taxation, including E.P.T., £18,643; to depreciation, £3,010; net profit, £15,448 (£12,471); interim dividend on the ordinary shares at 4%, less tax, £1,537; final dividend of 6%, less tax, plus a bonus of 5%, less tax, £4,227; to war contingencies reserve, £7,500; to capital reserve, £655; forward, £14,381 (£13,932).

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Fairisle Engineers (Birmingham), 71, Temple Row, Birmingham—£1,000. A. J. Lawrence and C. Worsey.

John Keatley (Birmingham), 100, Snow Hill, Birmingham, 4—Metal merchants. £3,000. J. and E. H. Keatley.

Hampton & Dean, Clifton Works, Edward Street, Kings Hill, Wednesbury—Nut and bolt manufacturers. £50,000.

Marine & Industrial Engines, 7, Ford Park Road, Mutley, Plymouth—£200. R. W. Everard and F. S. Waldron.

N. C. Caslake, Lymington Road, New Milton, Hants—Metal workers, engineers, etc. £3,000. N. C. and D. Caslake.

Wright & Pedley, 79, Lichfield Street, Wolverhampton—Pattern makers, etc. £1,250. J. E. Pedley and J. W. Romrys.

Halgate (Contracts)—Manufacturers of radiators, boilers, stoves, etc. £1,000. W. H. and D. M. Southgate, and D. Halstead.

Sanco Trading Company, 24A, James Street, Newport, Mon.—Metal smallware manufacturers—£1,000. T. J. and J. A. Sparkes.

Lazalloys, Salisbury House, London Wall, London, E.C.2—Alloy and metallurgical flux manufacturers, etc. £5,000. H. Clayton, A. R. Neelands, W. A. Pickersgill and T. Lazenby.

S. Parkes (Birmingham), 32 and 69, Legge Street, Aston, Birmingham—Engineers, etc. £1,000. J. T. Stephenson, S., S. E., and D. L. Parkes.

Hardy-Johnson Engineering Company, 823, Warwick Road, Tydesley, Birmingham—£1,500. F. L. Genge, I. Oscar, W. J. Slater, and H. Copper.

Mr. W. Lister, who was shown as being elected as an associate member of the Institute of British Foundrymen in our issue of June 22, was actually admitted to full membership.

Raw Material Markets

IRON AND STEEL

The issue of licences for pig-iron for Period III has so far been on a limited scale. The guiding principle adopted by the Control seems to be the prevention of the accumulation of excessive stocks at the foundries, and only within these limits is the acquisition of further supplies sanctioned. This, of course, does not imply any lack of iron for essential purposes. Foundrymen are able to obtain their authorised tonnages of high- and low-phosphorus iron without difficulty, and average quantities of refined iron are also going into consumption, chiefly in the production of engineering and speciality castings in connection with war work. Scrap supplies are not forthcoming as freely as foundries would wish, and there are complaints from some establishments that they have been unable to secure licensed tonnages. The position is rendered more difficult by the refusal of the Control to sanction an increased use of pig-iron in place of scrap. Deliveries of coke to the foundries and blast furnaces are coming to hand more regularly, but the furnaces would welcome more generous allocations of high-grade imported ores, supplies of which have recently fallen below anticipated quantities.

The brightest feature of the steel trade is the high activity of the re-rolling mills, whose resources over the next few months will be fully extended to cope with the volume of Government orders for light structural material, small bars, etc. This, in turn, involves a high consumption of steel semis and a keen demand for all classes of defectives which can be used for re-rolling. Under official direction steelmakers have recently increased their deliveries of billets, blooms and sheet bars, and there has consequently been less need to make further encroachments on reserve stocks of imported material.

NON-FERROUS METALS

At the moment the non-ferrous metal markets in this country seem to be undergoing a slight lull. It is uncertain how long this period of relative inactivity will last. To a large extent the position depends upon the progress of the military operations on the Continent. Some time may elapse before it is possible to determine whether there is likely to be any quickening in the demand or whether production will continue at its present level or perhaps register a further decline.

For some time past it has been apparent that the peak level of manufacture has been passed. During over four years of intensive effort a large reserve of war materials has been accumulated, and now the time has come when it has been found desirable to tail off production in various directions in order to avoid a surplus of certain goods. There have, however, been no indications of allocations of material for the manufacture of goods for civilian consumption.

There has been little fresh news regarding copper supplies. In this country the position has been considered easy for the past few months and there have been no serious events to disturb this state of affairs. In view of the increased call on tonnage, shipments have been arriving here with surprising regularity. It has been announced that the miners who were on strike in the Northern Rhodesian copper belt have resumed work pending negotiations.

The tin position remains virtually unchanged, with supplies adequate for essential needs. There is still need for considerable economy in the use of this metal, but the general supply position seems to be reasonably well assured, both here and in the United States, where it has been officially announced that sufficient stocks are held to last until the middle of 1945.

BRITISH IRON AND STEEL RESEARCH ASSOCIATION

The British Iron and Steel Research Association has been registered as a company limited by guarantee without share capital, with an unlimited number of members, each liable for £5 in the event of winding up.

The first members of the council are Sir James Lithgow, Messrs. G. A. V. Russell, J. H. Andrew, G. W. Austin, C. A. Edwards, W. J. Rees, and directors and officials of leading steel companies. The registered office is at Steel House, Tothill Street, London, S.W.1.

JOHN BROWN DEBENTURE CONVERSION

John Brown & Company, Limited, propose to redeem the outstanding issue of £1,939,082 of 4½ per cent. first mortgage debenture stock on October 31 next. The stock is redeemable at 106 per cent. on three months' notice. Replacement of the stock on redemption will be made to the extent of £1,800,000 by an issue of £550,000 of a new 3½ per cent. first charge debenture stock at par, and 1,250,000 4¼ per cent. cumulative first preference shares of £1 each at par. The balance will be paid out of the company's own resources.

NEW TRADE MARKS

The following applications to register trade marks appear in the "Trade Marks Journal":—

"Ark"—Steel-cutting tools. William Jessop & Sons, Limited, Brightside Lane, Sheffield.

"Dural"—Engine and motor parts made of aluminium or of aluminium alloys. James Booth & Company (1915), Limited, Argyle Street, Nechells, Birmingham, 7.

"Spearide"—Unwrought and partly wrought common metals, and machine and hand tools made of metal. Spear & Jackson, Limited, Aetna Works, Savile Street East, Sheffield.

CURRENT PRICES OF IRON, STEEL AND NON-FERROUS METALS

(Delivered, unless otherwise stated)

Wednesday, July 12, 1944

PIG-IRON

Foundry Iron.—CLEVELAND No. 3: Middlesbrough, 128s.; Birmingham, 130s.; Falkirk, 128s.; Glasgow, 131s.; Manchester, 133s. DERBYSHIRE No. 3: Birmingham, 130s.: Manchester, 133s.; Sheffield, 127s. 6d. NORTHANTS No. 3: Birmingham, 127s. 6d.; Manchester, 131s. 6d. STAFFS No. 3: Birmingham, 130s.; Manchester, 133s. LINCOLNSHIRE No. 3: Sheffield, 127s. 6d.; Birmingham, 130s.

(*No. 1 foundry 3s. above No. 3. No. 4 forge 1s. below No. 3 for foundries, 3s. below for ironworks.*)

Hematite.—Si up to 2.25 per cent., S & P 0.03 to 0.05 per cent: Scotland, N.-E.Coast and West Coast of England, 138s. 6d.; Sheffield, 144s.; Birmingham, 150s.; Wales (Welsh iron), 134s. East Coast No. 3 at Birmingham, 149s.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, 140s. 6d., delivered Birmingham.

Scotch Iron.—No. 3 foundry, 124s. 9d.; No. 1 foundry, 127s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, 174s.; South Zone, 176s. 6d.

Refined Malleable.—North Zone, 184s.; South Zone, 186s. 6d.

Cold Blast.—South Staffs, 227s. 6d.

(NOTE.—*Prices of hematite pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton.*)

FERRO-ALLOYS

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

Ferro-silicon (5-ton lots).—25 per cent., £21 5s.; 45/50 per cent., £27 10s.; 75/80 per cent., £43. Briquettes, £30 per ton.

Ferro-vanadium.—35/50 per cent., 15s. 6d. per lb. of V.

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

Ferro-titanium.—20/25 per cent., carbon-free, 1s. 3½d. lb.

Ferro-tungsten.—80/85 per cent., 9s. 8d. lb.

Tungsten Metal Powder.—98/99 per cent., 9s. 9½d. lb.

Ferro-chrome.—4/6 per cent. C, £59; max. 2 per cent. C, 1s. 6d. lb.; max. 1 per cent. C, 1s. 6½d. lb.; max. 0.5 per cent. C, 1s. 6¾d. lb.

Cobalt.—98/99 per cent., 8s. 9d. lb.

Metallic Chromium.—96/98 per cent., 4s. 9d. lb.

Ferro-manganese.—78/98 per cent., £18 10s.

Metallic Manganese.—94/96 per cent., carb.-free, 1s. 9d. lb.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.—BASIC: Soft, u.t., 100-ton lots, £12 5s.; tested, up to 0.25 per cent. C, £12 10s.; hard (0.42 to 0.60 per cent. C), £13 17s. 6d.; silico-manganese, £17 5s.; free-cutting, £14 10s. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £15 15s.; case-hardening, £16 12s. 6d.; silico-manganese, £17 5s.

Billets, Blooms and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £13 17s. 6d.; basic hard, 0.42 to 0.60 per cent. C, £14 10s.; acid, up to 0.25 per cent. C, £16 5s.

Sheet and Tinplate Bars.—£12 2s. 6d., 6-ton lots.

FINISHED STEEL

[*A rebate of 15s. per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.*]

Plates and Sections.—Plates, ship (N.-E. Coast), £16 3s.; boiler plates (N.-E. Coast), £17 0s. 6d.; chequer plates (N.-E. Coast), £17 13s.; angles, over 4 un. ins., £15 8s.; tees, over 4 un. ins., £16 8s.; joists, 3 in. × 3 in. and up, £15 8s.

Bars, Sheets, etc.—Rounds and squares, 3 in. to 5½ in., £16 18s.; rounds, under 3 in. to ⅝ in. (untested), £17 12s.; flats, over 5 in. wide, £15 13s.; flats, 5 in. wide and under, £17 12s.; rails, heavy, f.o.t., £14 10s. 6d.; hoops, £18 7s.; black sheets, 24 g. (4-ton lots), £22 15s.; galvanised corrugated sheets (4-ton lots), £26 2s. 6d.; galvanised fencing wire, 8g. plain, £26 17s. 6d.

Tinplates.—I.C. cokes, 20 × 14 per box, 29s. 9d., f.o.t. makers' works, 30s. 9d., f.o.b.; C.W., 20 × 14, 27s. 9d., f.o.t., 28s. 6d., f.o.b.

NON-FERROUS METALS

Copper.—Electrolytic, £62; high-grade fire-refined, £61 10s.; fire-refined of not less than 99.7 per cent., £61; ditto, 99.2 per cent., £60 10s.; black hot-rolled wire rods, £65 15s.

Tin.—99 to under 99.75 per cent., £300; 99.75 to under 99.9 per cent., £301 10s.; min. 99.9 per cent., £303 10s.

Spelter.—G.O.B. (foreign) (duty paid), £25 15s.; ditto (domestic), £26 10s.; "Prime Western," £26 10s.; refined and electrolytic, £27 5s.; not less than 99.99 per cent., £28 15s.

Lead.—Good soft pig-lead (foreign) (duty paid), £25: ditto (Empire and domestic), £25; English, £26 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, ex works, £37 12s. 6d.; rolled zinc (boiler plates), ex works, £35 12s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £30 10s.

Other Metals.—Aluminium, ingots, £110; antimony, English, 99 per cent., £120; quicksilver, ex warehouse, £68 10s. to £69 15s.; nickel, £190 to £195.

Brass.—Solid-drawn tubes, 14d. per lb.; brazed tubes, 16d.; rods, drawn, 11⅜d.; rods, extruded or rolled, 9d.; sheets to 10 w.g., 11⅛d.; wire, 10⅞d.; rolled metal, 10½d.; yellow metal rods, 9d.

Copper Tubes, etc.—Solid-drawn tubes, 15¼d. per lb.; brazed tubes, 15¼d.; wire, 10d.

Phosphor Bronze.—Strip, 14¼d. per lb.; sheets to 10 w.g., 15¼d.; wire, 16½d.; rods, 16½d.; tubes, 21½d.; castings, 20d., delivery 3 cwt. free. 10 per cent. phos. cop. £35 above B.S.; 15 per cent. phos. cop. £43 above B.S.; phosphor tin (5 per cent.) £40 above price of English ingots. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 10d. to 1s. 4d. per lb.; rolled to 9 in. wide, 1s. 4d. to 1s. 10d.; to 12 in. wide, 1s. 4¼d. to 1s. 10¼d.; to 15 in. wide, 1s. 4½d. to 1s. 10½d.; to 18 in. wide, 1s. 5d. to 1s. 11d.; to 21 in. wide, 1s. 5½d. to 1s. 11½d.; to 25 in. wide, 1s. 6d. to 2s. Ingots for spoons and forks, 10d. to 1s. 6½d. Ingots rolled to spoon size, 1s. 1d. to 1s. 9½d. Wire round, to 10g., 1s. 7½d. to 2s. 2¼d., with extras according to gauge. Special 5ths quality turning rods in straight lengths, 1s. 6½d. upwards.

NON-FERROUS SCRAP

Controlled Maximum Prices.—Bright untinned copper wire, in crucible form or in hanks, £57 10s.; No. 1 copper wire, £57; No. 2 copper wire, £55 10s.; copper firebox plates, cut up, £57 10s.; clean untinned copper, cut up, £56 10s.; braziery copper, £53 10s.; Q.F. process and shell-case brass, 70/30 quality, free from primers, £49; clean fired 303 S.A. cartridge cases, £47; 70/30 turnings, clean and baled, £43; brass swarf, clean, free from iron and commercially dry, £34 10s.; new brass rod ends, 60/40 quality, £38 10s.; hot stampings and fuse metal, 60/40 quality, £38 10s.; Admiralty gunmetal, 88-10-2, containing not more than ½ per cent. lead or 3 per cent. zinc, or less than 9½ per cent. tin, £77, all per ton, ex works.

Returned Process Scrap.—(Issued by the N.F.M.C. as the basis of settlement for returned process scrap, week ended July 8, where buyer and seller have not mutually agreed a price; net, per ton, ex-sellers' works, suitably packed):—

Brass.—S.A.A. webbing, £48 10s.; S.A.A. defective cups and cases, £47 10s.; S.A.A. cut-offs and trimmings, £42 10s.; S.A.A. turnings (loose), £37; S.A.A. turnings (baled), £42 10s.; S.A.A. turnings (masticated), £42; Q.F. webbing, £49; defective Q.F. cups and cases, £49; Q.F. cut-offs, £47 10s.; Q.F. turnings, £38; other 70/30 process and manufacturing scrap, £46 10s.; process and manufacturing scrap containing over 62 per cent. and up to 68 per cent. Cu, £43 10s.; ditto, over 58 per cent. to 62 per cent. Cu, £38 10s.; 85/15 gilding metal webbing, £52 10s.; 85/15 gilding defective cups and envelopes before filling, £50 10s.; cap metal webbing, £54 10s.; 90/10 gilding webbing, £53 10s.; 90/10 gilding defective cups and envelopes before filling, £51 10s.

Cupro Nickel.—80/20 cupro-nickel webbing, £75 10s.; 80/20 defective cups and envelopes before filling, £70 10s.

Nickel Silver.—Process and manufacturing scrap; 10 per cent. nickel, £50; 15 per cent. nickel, £56; 18 per cent. nickel, £60; 20 per cent. nickel, £63.

Copper.—Sheet cuttings and webbing, untinned, £54 shell-band plate scrap, £56 10s.; copper turnings, £48.

IRON AND STEEL SCRAP

(*Delivered free to consumers' works. Plus 3¾ per cent. dealers' remuneration. 50 tons and upwards over three months, 2s. 6d. extra.*)

South Wales.—Short heavy steel, not ex. 24-in. lengths, 82s. to 84s. 6d.; heavy machinery cast iron, 87s.; ordinary heavy cast iron, 82s.; cast-iron railway chairs, 87s.; medium cast iron, 78s. 3d.; light cast iron, 73s. 6d.

Middlesbrough.—Short heavy steel, 79s. 9d. to 82s. 3d.; heavy machinery cast iron, 91s. 9d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 89s. 3d.; medium cast iron, 79s. 6d.; light cast iron, 74s. 6d.

Birmingham District.—Short heavy steel, 74s. 9d. to 77s. 3d.; heavy machinery cast iron, 92s. 3d.: ordinary heavy cast iron, 87s. 6d.; cast-iron railway chairs, 87s. 6d.; medium cast iron, 80s. 3d.; light cast iron, 75s. 3d.

Scotland.—Short heavy steel, 79s. 6d. to 82s.; heavy machinery cast iron, 94s. 3d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 94s. 3d.; medium cast iron, 77s. 3d.; light cast iron, 72s. 3d.

(Note.—*For deliveries of cast-iron scrap free to consumers' works in Scotland, the above prices less 3s. per ton, but plus actual cost of transport or 6s. per ton, whichever is the less.*)

SMALL ADVERTISEMENTS

SITUATIONS

CONSULTANT TRAINED STEEL-WORKS CHEMIST, basic electric steel manufacture, with personal development basic furnace linings, full laboratory and foundry routine, desires change.—Box 556, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

REQUIRED.—Progressive inside Sales Manager, with organising abilities and knowledge of foundry refractories; ample scope for determined tactful personality; permanent position.—State age, salary required, and full experience, in the strictest confidence, to Box 552, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

WANTED. — First-class Engineer; capable of taking charge of process planning, time and motion study, and engineering staff for large Foundry in the Midlands; excellent post-war prospects for the right man.

Applications will be considered only from those having previous experience, and who can give evidence of having obtained successful results in a similar capacity.

Applications to be made to the Secretary, BIRMID INDUSTRIES, Dartmouth Road, Smethwick, near Birmingham.

FOUNDRY SUPERINTENDENT required for medium sized General Engineering Works in North-East Lancashire; experience required in all types of iron castings in loam, green sand and dry sand up to approximately 6 to 7 tons in weight; experience in non-ferrous castings would be an advantage; approximate weight of iron castings produced per week 10/15 tons; excellent post-war prospects for applicant having good qualifications.—Write, stating age, experience, and salary required, Box 570, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

CHIEF FOUNDRY FOREMAN required for Non-Ferrous Foundry in large Engineering Works in Midlands. Must be good disciplinarian, and be familiar with all types of copper and aluminium alloy castings up to 10 cwts. weight. Machine moulding experience desirable, also experience of modern equipment and technical control.—Write in confidence, stating age, experience, and salary required, to Box 562, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

FOREMAN required for small Grey Iron Foundry in Midlands. Must be fully conversant with plates, hand squeeze and jolt squeeze machines.

Full particulars, giving age, experience and salary required, to Officer-in-Charge, MINISTRY OF LABOUR AND NATIONAL SERVICE, Ripley, Derbyshire.

MACHINERY

WANTED.—Small Pig Breaker.—Reply Box 550, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

3-TON capacity, HEROULT type, Electric Tilting Steel Furnace, having electrically-operated electrodes, automatic control panel and transformer, for 6,600 volts, 3-phase, 50 cycles supply.—NEWMAN INDUSTRIES, LTD., Yate, Bristol.

SKLENAR Patent Melting Furnaces; coke- or oil-fired; capacity 2 tons, 1 ton, ½ ton, 500 lbs.—SKLENAR PATENT MELTING FURNACES, LTD., East Moors Road, Cardiff.

THOS. W. WARD LTD.

SOLE AGENTS FOR

"POLFORD" CORE SAND MIXERS, TILTING and CRUCIBLE FURNACES, MOULD DRYER, RIDDLE, SCREEN, etc. WRITE FOR PRICES AND PARTICULARS.

ALBION WORKS, SHEFFIELD.

Grams: "Forward." 'Phone: 26322 (16 lines.)

PNEUMATIC MOULDING MACHINES.

Tabor (Macnab) Vert. turnover, table approx. 40 in. by 30 in.
Darling & Sellars turnover, table 64 in. by 20 in.
Adaptable Rollover Core - Making Machines, hand operated.
Mumford Type (Jackman) Swing Headpress, 13 in. by 15 in.
Mumford Pneumatic Core Jolters, tables 24 in. by 18 in.
Britannia No. 1 "Coventry" Turnover Jar Ram, table 30 in. by 28 in.
Universal Plain Jolt; 1-ton capacity; table 37½ in. square; one machine unused.
Sandblasting Plant; 50 Air Compressors; 500 Electric Motors, Dynamos, etc.

S. C. BILSBY,
CROSSWELLS ROAD, LANGLEY,
NR. BIRMINGHAM.
Broadwell 1359.

MISCELLANEOUS

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

NON-FERROUS FOUNDRY, capacity available, including sand blasting; competitive prices quoted.—ALBUTT, SON & JACKSON, Valve Makers and Brass Founders, Greenmount Works, Halifax.

FOR IMMEDIATE DELIVERY TO IRON & STEEL FOUNDRIES SEND TO:—

JOHN & C. DURRANS,
Est. 1934,
PENNINE WORKS, HAZLEHEAD, NEAR SHEFFIELD.
Penistone 128. Facings, Penistone

FOR

Blacking, Plumbago (Ceylon), Core Gum Part Powder, Facings, White Dust, Terra Flake, Talc, Ganister, and ALL Foundry Requisites.

Send P.C. for price and samples. Good stocks kept.

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

AUCTION

By Order of the Liquidator, M. W. H. Lancaster, Esq., M.C., F.C.A., *re* Rodney Foundry Co., Ltd., DEPTFORD GREEN, S.E.8.

HENRY BUTCHER & CO.,
in conjunction with
JOHN FOORD & CO.,
are instructed to offer for SALE BY AUCTION, IN LOTS, at the Baltic Exchange, St. Mary Axe, E.C.3, on Thursday, 27th JULY, 1944, at ONE p.m., the
FOUNDRY PLANT AND EQUIPMENT,
including

DRILLING, SHAPING and GRINDING MACHINES; S.S. and S.C. LATHES up to 11 in. centres; HORIZONTAL AIR COMPRESSORS; 3 TONS per hr CUPOLA; "GUTMAN" SAND BLAST PLANTS; ELECTRIC MOTORS up to 69 h.p.; "Devonport" JOLT AND ROLL OVER MACHINES; 6 ft. dia. Loam Mixing Mill; Tipping Ladles; Air Rammers; COMPRESSED AIR CHISELS AND GRINDERS; OVERHEAD ELECTRIC AND HAND TRAVELLING CRANES up to 7 tons by "Morris" and "Booth"; Core-Drying Stoves; Blowers; Fans and Ducting; COMPRESSED AIR JOLT AND SQUEEZE MACHINES; Geared Tipping Ladles up to 5 tons; 1-ton Breaking Ball; Moulding Hooks; C.I. Weights; Lifting Beams; "WAYGOOD" 10-cwt. ELECTRIC LIFT; "POOLEY" 5-ton WEIGHBRIDGE; Engineers' and Foundry Small Tools; Skips; Trucks; Barrows; 100 TONS FOUNDRY BOXES; "FORDSON", 1937, 4-ton LORRY; OFFICE FURNITURE AND FITTINGS.

Note.—The Freehold Factory, containing an approx. FLOOR SPACE OF 30,000 SQ. FT., IS FOR SALE BY PRIVATE TREATY.

Catalogues may be obtained of MESSRS. THORNE, LANCASTER & Co., Chartered Accountants, "Oakmead," South Hill Avenue, Harrow, of MESSRS. JOHN FOORD & Co., 56, Victoria Street, S.W.1, and of MESSRS. HENRY BUTCHER & Co., 73, Chancery Lane, W.C.2.

'Phone: 22877 SLOUGH

NEW SHOT BLAST CABINET PLANTS with motor driven Exhaust Fans, complete, all sizes; air compressors to suit in stock, also motors if required.

Britannia large size plain jolt and pattern draw moulding machine, 8 in. dia. cylinder, table 4 ft. x 3 ft. reconditioned.

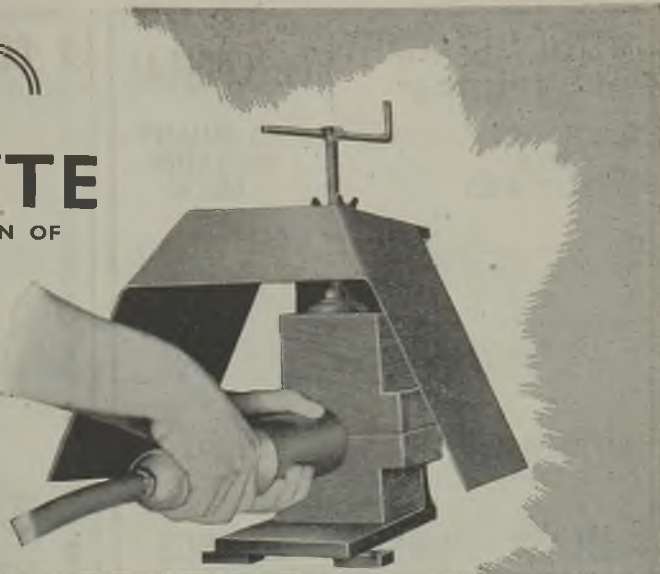
Genuine Morgan lip axis 600 lbs. capacity furnace.

Sand Drier, coke-fired, as new, £30.

Spermolin large size oil sand mixer, as new, £42.

Several good Foundry Ladles 1 ton to 10 tons capacity.

Alex. Hammond, Foundry Machinery Merchant,
14 AUSTRALIA Rd. SLOUGH
BUY FROM ME AND SAVE MONEY




ES
CO

SPECIAL "G" QUALITY and "ALITE D" for CUPOLAS

SILLIMANITE SUPER REFRACTORIES

P.3 QUALITY INSULATING BRICKS

E. J. & J. PEARSON LTD.,
STOURBRIDGE
ESTABLISHED 1860

REFRACTORY CEMENTS

BLAST FURNACE LININGS
STOVE BRICKS
"F.R.D." (High Silica) COKE OVEN BRICKS

COMPRESSORS & EXHAUSTERS

FOR AIR OR GASES

These Vertical double acting crosshead type compressors are built as single and two stage machines for pressures up to 40 and 120 lbs. per sq. in. They are built in a range of sizes for capacities up to 10,000 and 5,000 cu. ft. per minute respectively

For particulars of these machines and for other types write to : Ref. Y

REAVELL & CO., LTD,
RANELAGH WORKS, IPSWICH
Telegrams : "Reavell Ipswich." Phone 2124 Ipswich

L. H. & S.

IRON & STEEL CRUCIBLES

Made of Special Heat Resisting Metals

Iron Crucibles for melting Aluminium, Zinc, Lead, Babbit Metals, etc.

STEEL CRUCIBLES for melting Magnesium

THE ACTUAL MAKERS

LEES HALL & SONS LTD.
MIDLAND DRIVE, SUTTON COLDFIELD, WARWICKSHIRE - Tel.: SUTTON 3749

Rolled Steel
MOULDING BOXES
SPECIALLY DESIGNED RIBBED SECTION

ACCURATELY DRILLED AND REAMERED
ALL BOXES INTERCHANGEABLE
SIZES & SHAPES TO REQUIREMENTS
Also Makers of
THE 'BEE' CORE DRYING OVEN
COAL COKE OR GAS FIRED
BILSTON STOVE & STEEL TRUCK CO LTD
BILSTON STAFFS.

Published by the Proprietors, INDUSTRIAL NEWSPAPERS, LIMITED, 49, Wellington Street, Strand, London, W.C.2 and Printed in Great Britain by HARRISON & SONS, LTD., 44/47, St. Martin's Lane, London, W.C.2.

FOUNDRY TRADE JOURNAL

EST. 1902

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

VOL. 73. No. 1456. **JULY 13, 1944**

Registered at the G.P.O. as a Newspaper

Offices: 49, Wellington Street, Strand, London, W.C.2

Single Copy 6d. By Post 8d. Annual Su
scription, Home and Overseas, 21/- (Prepai