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PRINCIPAL CONTENTS

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Foundry Exhibition

From a sort of *post scriptum,* the general public has learnt from the poster hoardings that there is to be held at Olympia from to-day until September 13 a Foundry Trades Exhibition, organised in connection with the Engineering, Marine and Welding Exhibition. Paradoxically, the Foundry Trades Exhibition is not really such at all, whilst the Engineering and Marine sections are largely so. For instance, amongst the exhibitors classified under A and B, there are an obvious 20 foundry owners. On these grounds alone we assert that the title "foundry" is worthy of more prominent publicity. The Foundry Trades Exhibition is actually a section in which foundry equipment and supplies are shown on 25 to 30 stands.

The aspect of the importance of the iron foundry to industry in general will be stressed by the Council of Ironfoundry Associations through their stand (A 15 Grand Hall). A new outlook is being given to this effort, for it is to be staffed by a rota of volunteers drawn from the actual industry. Moreover, they are nearly all well-known foundry proprietors, managers and so forth. All have been properly briefed for their task, which of course includes recruitment to its constituent bodies, the work of the C.F.A., training facilities afforded to youth, research, etc. For visitors to the Exhibition a call at this stand is an essential, as it is unique in character and outlook. Of other exhibits, one which will attract much interest is a new method of making castings. It is known as the "C" process, and though much has appeared in the technical Press about this process, it will be the first time in this country that the opportunity is given to examine it from the more practical aspect.

There is a friendly atmosphere about this Exhibition, not often encountered in the more extensively publicised shows, which standholders and the public both much appreciate. There is much controversy in foundry equipment and supply circles as to whether a separate trade show would be preferable. It would have the advantage of being visited by those who concentrate their activities on foundry practice, but it would have to forgo the very large number of potential customers, already at hand as fellow standholders, as are present at Olympia. A purely "foundry" exhibition, that is to say, one devoted to the showing of castings, would be a museum, rather than an exhibition, for in truth, many other exhibitions—such as those devoted to public works, laundries and so forth—are very much "foundry exhibitions." A visit to Olympia is an essential duty for all foundry owners, and their executive staff, for it is impossible not to pick up information of real help in the operation of one's business.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

To the Editor of the FOUNDRY TRADE JOURNAL

A CUPOLA CONVERSION

SIR,—Whilst travelling in Canada visiting steel foundries on a Mond Nickel Fellowship grant, I had the opportunity to visit an agricultural engineering foundry in a small town in Northern Ontario, where the metallurgist in charge of the iron foundry had changed over the cupola from acid lined to basic in the course of one week-end, without interrupting the production flow. I feel some of your readers may be interested in the story behind this.

The 60-in. Whiting-type cupola was stripped of its ganister lining and lined with magnesite bricks (basic-open-hearth arch bricks) up to the charging platform and a layer of magnesite-sodium silicate mixture was sprayed on using a "Basic Refractories Inc." refractory spray gun finishing to an internal diameter of 42 in.

When in operation the 800-lb. charge, of 40 per cent. pig-iron, 40 per cent. returns and 20 per cent. steel, was fluxed with 25 lb. of limestone and 15 lb. of fluorspar, with a blast pressure of 11 in. (against previous 14 in.) and an iron to coke ratio of 6.5:1. The iron was tapped intermittently into a receiver, at about 1,525 deg. C. From the receiver it was run into teapot-type ladles and either: (1) inoculated with Fe Si for soft-iron castings (11.1 tons tensile); or (2) inoculated with Ni-Mg alloy for "Ductalloy" castings (24.6 tons tensile, 16 per cent. elongation, 40 to 60 ft.-lb. Izod); or (3) cast direct as a hard iron (15.0 tons tensile).

The base iron, T.C 3.5 to 3.7, Si 1.8 to 2.0, Mn 0.15 to 0.25, P 0.05 to 0.07, S 0.02 to 0.04 per cent., with a residual nickel of 0.4 to 0.7 per cent., depending on the amount of "Ductalloy" returns, was controlled by a chill-test taken from the receiver. The slag was very fluid and was continuously blown off giving off a strong smell of SO_2 as it hit the sand floor. The drop was good and the stack clean needing only wire brushing and respraying, there being little refractory erosion.

The furnace has been running basic for two or more months up to the present time.

I think this may answer some of the smaller foundries' inquiries about basic cupolas.—Yours, etc.,

Fred R. H. Allon.

International Nickel Co. Inc.

Though we do not possess a "physical" enquiry bureau, a branch establishment will be opened at Olympia, where the FOUNDRY TRADE JOURNAL *has a stand (No.* 13, *Row F, Grand Hall). This will be in charge of Mr. L. Holt, the advertising director, but members of the Editorial staff will also be in attendance to assist with technical enquiries. Readers and especially those from overseas are invited to visit our stand, where they are assured of a courteous reception. Copies of the* JOURNAL *and sister publications—"Iron and Coal Trades Review," "Metal Treatment and Drop Forging," "Sheet Metal Industries" and "Ryland's Directory"—will be available.*

THE JULY BULLETIN of the British Iron and Steel Federation shows that employment as at the week ended June 9 was at 151,139, 404 fewer than a month earlier, made up by a loss of 426 male and a gain of female employees. There were also 29 fewer employed in the steel foundry industry, making the total 19,052. Here again the loss in manpower was 44 set off by a gain of 15 females. These figures are influenced by holidays. For the making of steel castings in June, the weekly average amount of metal melted was 9,900 tons. The delivery of steel castings improved to 4,600 tons.

Payment by Type and Weight

A payment scheme that has proved eminently satisfactory is that operated by Chamberlain and Hill, Limited, of Walsall, makers of light grey-iron castings for the electrical, textile and general engineering industries. The company found that the system of payment to moulders was unsatisfactory, as assessment largely depended on estimations between moulder and shop manager.

Disparity in pay packets was a cause of discontent and, realising that some method of stabilising the basic pay and standardising moulding prices was essential, the managing director called a general meeting of staff to decide on a "yardstick" which would be acceptable. The moulders elected representatives from the shop floor and, after several conferences, it was agreed to set a graduated scale of moulding prices corresponding to the weight and type of castings made. The pre-existing percentage additions to basic-wage, "stint" and war-bonus remained unchanged. As a result, production has increased by more than 30 per cent. and the moulders' weekly pay packet has advanced commensurately.

Sulphuric Acid Project

The formation of the United Sulphuric Acid Corporation, Limited, which will manufacture sulphuric acid in this country from anhydrite, has been completed. A factory is to be built at Widnes, on Merseyside, to produce about 150,000 tons of sulphuric acid a year, which is not far short of 10 per cent. of the country's current needs. Some 240,000 tons of anhydrite will be supplied by the British Plaster Board Company, Limited, from a new mine in Scotland, while the disposal of clinker cement, a major subsidiary product of this method of making sulphuric acid, is being covered by an agreement with the Associated Portland Cement Company, Limited, which is building a new cement factory at Widnes. The process will yield about 140,000 tons of cement a year.

Of the £4,200,000 capital required for the new sulphuric acid enterprise, £3,000,000 is being found in the City, the remainder being provided as ordinary capital by 11 businesses which are major users.

Aluminium Casting Alloy Data Sheets

The data sheet "Guide to the Selection of Aluminium Casting Alloys," issued by Alar, Limited, of 3, Albemarle Street, London, W.1, has been rewritten in terms of the British Standard 1490 "LM" specifications. This renders obsolete the earlier "Technical Data" folder. This series of specifications, which was introduced in 1949, is now sufficiently widely used to justify this step. If, however, readers are not yet familiar with the new LM numbers, they will be able to relate them to the older designations by referring to Tables I and II in which both are used.

Engineering and Marine Exhibition Foundry Trades Section

The Engineering and Marine Exhibition which opens at Olympia, London, to-day, and continues until September 13, has a large section in the Grand Hall devoted to exhibits of foundry plant and materials. Among these stands are the following:—

Beetle Bond, Limited, Stand A.14, are exhibiting for the first time at this exhibition examples of cores made from Beetle W.20 corebinder. This material is now gaining much wider acceptance in foundries, as will be evident from the many well-known foundries who have loaned cores for showing on the stand. W.20 is a urea-formaldehyde corebinder evolving less total gas during pouring than the most commonly used oil binders, although the gas is liberated more quickly. Knock-out properties are exceptionally good and wherever W.20 is used there is invariably a speeding-up of the drying process and consequent alleviation of that all-too-common bugbear, the oven-drying bottleneck. W.20 provides dry-strength only, 1 to 2 per cent. of the liquid resin, equivalent to ½ to 1 per cent. cured urea-formaldehyde resin, normally providing all the dry-strength required. Green-bond agents are added to provide the required green-strength.

The properties of Beetle-bonded cores will be amply demonstrated on this stand, which will be equipped with pilot plant for making core test-pieces from a variety of mixes. All the normal laboratory equipment will be available for carrying out the standard tests on the pieces so produced. In addition, there will be a good selection of cores, large and small, as used in ferrous and non-ferrous casting by the customers in the foundry trade of Beetle Bond, Limited.

Bradley & Foster, Limited, Stand G 14.—Bradley & Foster, Limited, and its associate company, Bradley's (Darlaston), Limited, will be showing on this stand a wide range of products. Bradley & Foster, Limited, are manufacturers of the well-known sand-cast and machine-cast refined pig-irons, and spectrographic control of raw materials and finished product enables them to supply materials of consistent uniformity and to the most exacting specification. The range includes refined cylinder pig-irons, refined malleable pig-irons, and refined alloy pig-irons. In addition, there are also electro-refined alloy irons and ingots, including Nicrosilal ingots, Ni-Resist, nickel and nickel chromium alloys and high-chromium alloy ingots.

The company also manufacture "Hypersilid" 14/16 per cent. acid-resisting high-silicon iron castings, which have high corrosion-resisting properties and which are extensively used throughout the chemical industries; a range of these castings will be exhibited. Bentonite is also supplied by the firm to the foundry trade.

Bradley's (Darlaston), Limited, are manufacturers of metallic abrasives used for shotblasting and peening. Their range of products include chilled-iron shot and grit. "Malleabrasive" (registed trade-mark), and "Brafos" sorbitic steel shot. Products which have recently been introduced and which are manufactured by the company include "Brafos" hard-drawn steel pellets, hard-drawn stainless-steel pellets, and hard-drawn copper pellets. The complete range of these products will be exhibited on the stand.

British Foundry Units, Limited, Stand No. E 17, will show a range of specialties manufactured by the company, suitable for use in all types of foundry practice. These will comprise a full range of Crulin core oils, Crudol and Crudex core powders, Corbeerite binder, and all core-making materials which have been developed over a period of years, resulting in considerable benefit in all classes of core production. There will also be exhibited a range of "Beecro" silica-free parting powders.

A range of high-grade plumbagos produced from specially selected ores, blended suitably for use in the production of all types of castings, and also a special range of bonded or prepared blackings for foundry use will be shown.

In addition there will be exhibited a range of Crulin mould dressings and paints for all metals, and a speciality will be made of the Alsica feeder-head compound for use on the heads and risers of iron and steel castings and ingots.

British Moulding Machine Company, Limited, Stand No. G 16.—The British Moulding Machine Company, Limited, of Faversham, Kent, are once again taking

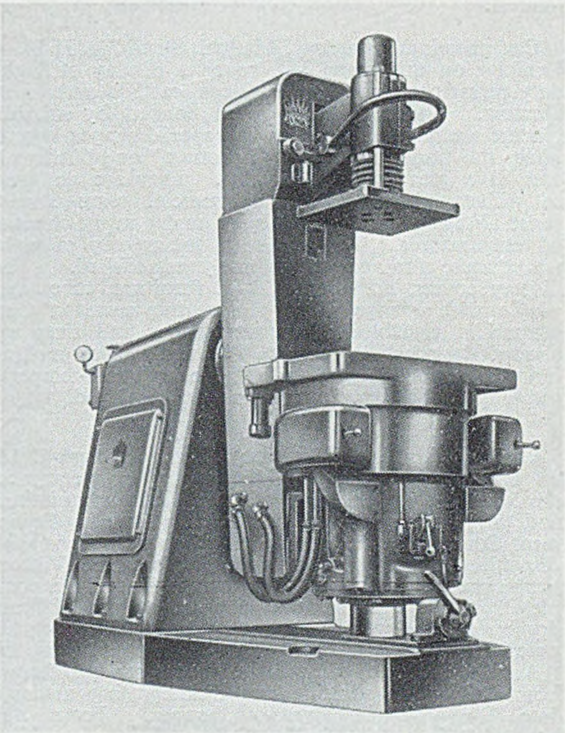


FIG. 1.—*Type B.T. Turnover Moulding Machine which British Moulding Machine Company, Limited, are showing for the First Time in this Country.*

Engineering and Marine Exhibition

part in the foundry section of the Exhibition and this exhibit is expected to be of particular interest to foundrymen in view of the fact that they are showing a new type of moulding machine, not previously advertised or exhibited in this country. The machine in question is the new type B.T. turnover moulding machine, several different sizes of which will be shown in operation. These machines have been exhibited and sold in the U.S.A., Switzerland, and other foreign countries, but until now no supplies have been available for the home market. (See Fig. 1.)

Type B.T. machines incorporate many new features, of which perhaps the most interesting is the built-in jolt timer which enables the machines to be set to stop jolting at any required number of jolts. All operations on this machine are controlled by push button. Streamlining has been effected to a point never before achieved with this type of moulding machine, and this is expected to be of assistance in keeping the machines clean under foundry conditions. In addition to automatic lubrication, built-in air filters and a patented fully-automatic anvil, there are a great many other new features and technical improvements, all calculated to enable the machine to operate at high production speeds for many years without the irritating breakdowns which have in the past been associated with turnover type moulding machines. Both large and small machines will be seen in operation and in the case of the larger size the sand will be hopper-fed into the boxes. This sand hopper arrangement, together with a new method of mould removal, are expected to attract considerable interest.

Carborundum Company, Limited, Stand No. H 17.—Exhibits on this stand will cover a display of high-duty refractory materials in silicon carbide and fused alumina. These materials when bonded by suitable binders are made into bricks and special shapes known under the trade names of "Carbofrax" and "Alfrax," and have great refractory value. They are designed to withstand the highest commercial temperatures, resist abrasion, and do not spall under rapid changes of temperatures. Their value in the upkeep of high-temperature furnaces is definitely established. The display covers bricks, tiles, kiln furniture, tubes and muffles with a range of high-temperature cements. Carborundum crucibles of varying shapes and sizes are shown, designed for use in the non-ferrous melting industry. In addition to these, "Globar" high-temperature electric heating elements are also displayed.

Coleman Wallwork Company, Limited, Stand C 11. As previously announced, this company now embraces the foundry-equipment side of Stone-Wallwork, Limited, and the manufactures of the Coleman Foundry Equipment Company which firm it has taken over along with the offices and works at Stotfold, Bedfordshire. Visitors to the stand will see displayed for the first time a complete range of equipment covering every part of foundry mechanisation, all sufficiently equipped to provide practical demonstrations. The main feature is the "Automold-controlled" section where sand is thrown from a Prosama aerating and disintegrating machine into an overhead rotary hopper. From this hopper it is automatically discharged into moulding boxes on the moulding machines. The machines are Automold controlled and the exhibit shows moulds being completely manufactured without assistance from operators, finished moulds will then be transported to a vibratory knock-out. In fact this section shows a completely automatic moulding system.

In addition, practical demonstrations will be given on types R.2 and R.4 horizontal core-blowers, a bench-type core-blower, a core-sand mixing machine, a runner-bush machine, core-stripping machine and an abrasive-wheel cut-off machine. A small section of the stand will be used to display the products manufactured by Foundry Tools, Limited, an associate company. These consist mainly of important small pieces of ancillary equipment, such as "Wonsover" parting fluid, slip-off and snap flasks, filters, moulding-box clamps, core-box air vents, bottom boards, and blow-guns, sprayers and vibrators.

Constructional Engineering Company, Limited, Stand F 11 and F 16, together with its associate companies, Adaptable Moulding Machine Company, Limited, and E. Tallis & Sons, Limited, are, as usual, displaying a wide range of foundry plant. The melting plant section on Stand F.16 will comprise an example of the "Titan" cupola, and also a Pari-Blast cupola, which gives individual instrumental air control to each tuyere. There will also be a working exhibit of modern air-volume and pressure recorders and indicators. The remaining items on this stand will comprise metal-handling ladles of various types; a "Titan" cupolette; a rotary barrel-type shot-blast machine, and examples of pattern plates and models made from "Titanite" stone mixture.

On Stand F.11 may be seen a complete range of Adaptable moulding machines, and Talbard moulding boxes. Both models of the "Titan" core-blowing machines will be demonstrating the production of various types of cores, both in green-sand and oil-sand, and, in conjunction with the use of these machines, the two sizes of core-sand mixers, and a new type of stationary sand dryer will be shown.

A further interesting exhibit will be a horizontal centrifugal casting machine with full electronic control, and, alongside this, a particularly interesting scaled working model of an automatic mould-changing plant, which, when used in conjunction with the centrifugal casting machine, will be capable of raising production from 20 castings per hour, to 100 castings per hour from one machine. The plant has only recently been developed, and is being shown for the first time, being primarily designed for the mass-production of all types of cylindrical castings, including soil pipes, cylinder liners, steel tubes, bushing, etc.

The Council of Ironfoundry Associations, Stand A 15.—This stand constitutes an information centre for ironfounders and for all users of grey-iron and malleable-iron castings. The exhibits have been arranged in collaboration with the British Cast Iron Research Association. The Research Association is affiliated to the Council and is responsible for research and technical development. The stand telephone number is RENOWN 1378.

The Council is the national organisation of iron-founding employers to deal with matters of common interest. Its membership is composed of 15 national trade associations and 20 branch associations. The chief activities of the C.F.A. are concerned with:—

(1) The modernisation and development of the iron-founding industry.

(2) Negotiating with Government Departments on matters affecting the industry and collaboration with other national trade associations, including associations of engineers and other users of iron castings.

(3) The adequate supply of raw materials (pig-iron, scrap iron and steel, coke, etc.) to the ironfounding industry and the fair distribution of supplies.

(4) Consideration of subjects such as costing, conditions of sale, import and export licences, tariffs on iron castings, etc.

(5) Transport problems, including consideration of the proposed charges scheme to be introduced by nationalised transport.

(6) The vocational guidance of young persons wishing to enter the industry, the stimulation of recruitment and the efficient training of apprentices, through the National Foundry Craft Training Centre at West Bromwich.

(7) To conduct an efficient information service for firms belonging to constituent associations.

The Council's exhibits include specimens of publications issued to members, including a Costing Handbook, Standard Conditions of Sale, recruitment literature, educational wall charts, etc. A list of the C.F.A. film and film strips is available. Particular attention is to be drawn by photographs and other means to the progress the industry has made in the implementation of the recommendations of the Garrett Committee's Report on Conditions in Iron Foundries. Representative castings and a quiz self-testing machine will be included.

BRITISH CAST IRON RESEARCH ASSOCIATION

Material supplied from the British Cast Iron Research Association laboratories at Alvechurch, includes the following:—

Two graphs illustrating the minimum strength requirements specified by the British Standards Institution for grey cast iron, whiteheart malleable and blackheart malleable cast iron from the date of the earliest specifications to the present day.

These graphs link up with a table display of various types of test-bars specified by B.S.I. in: (1) B.S. 1452-1948, General Grey Iron Castings; (2) B.S. 309-1947, Whiteheart Malleable Iron Castings; (3) B.S. 310-1947, Blackheart Malleable Iron Castings; together with a few specimens for tests not specified by B.S.I. In each case, the standard test-piece is shown before test and a further test-piece is shown giving the results of the test. Specimens include:—(1) Tensile test-bars for grey cast iron, including nodular cast iron. (2) Transverse test-bars for grey cast iron, including nodular cast iron. (3) Compression test-pieces for grey cast iron, including nodular cast iron. (4) Impact test-pieces for grey cast iron, including nodular cast iron. (5) Tensile test-bars and bend test-bars for both whiteheart and blackheart malleable cast iron. (6) Two flat bars of nodular cast iron which have been twisted after casting are shown to illustrate the ductility of this material. Also in the table display are a number of selected photomicrographs prepared in the B.C.I.R.A. metallographic laboratory, illustrating typical microstructures of cast iron, and a number of specimens of grey cast iron showing a few of the many finishes which may be used on this material.

Copies of B.C.I.R.A. publications will be shown, including "Journal of Research and Development," and the "Bulletin and Foundry Abstracts."

Electromagnets, Limited, Stand J 17.—A comprehensive range of permanent magnets and electromagnetic separators will be shown, including overband separators, magnetic chutes, swarf separators, and a large range of permanent magnetic separators of various types. An outstanding exhibit will be the newly-developed super-intensity magnetic feeder unit. As will be seen from the illustration (Fig. 2) the feeder unit takes the general form of a short-band conveyor, but the

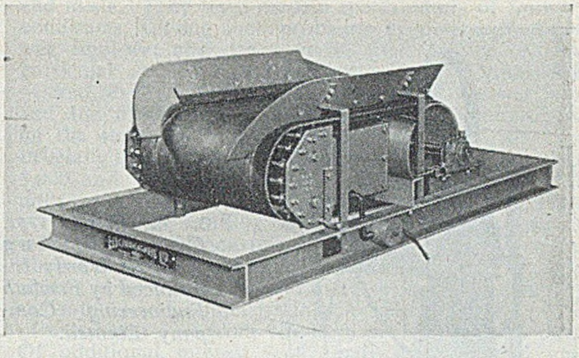


FIG. 2.—*Magnetic Feeder Unit Newly Developed by Electromagnets, Limited.*

conventional magnetic pulley which is widely used on such plants is replaced by a new magnetic head, around which is contoured the rubber and canvas conveyor belt. Limitations on space of magnetic circuit and windings, which are normally imposed by pulley or drum diameter, are completely removed, and an intensity of magnetic field three or four times greater than that given by a magnetic pulley or drum of equal size is obtained. Additionally, a continuous discharge of tramp metal is provided. This new development enables relatively small separators to handle large outputs, thus reducing initial costs and economising space.

As usual, a competent technical staff will be available at the stand, for giving advice on the application of magnetic equipments in all fields.

Fordath Engineering Company, Limited, Stand No. E 16

Core-making Machines. The Fordath Junior and Senior motor-driven rotary core machines will be on view and also the new Multi-plunger core machine (Fig. 3). New to this country the CorALL core-blowing machine (Fig. 4), a Swedish-developed machine for which Fordath hold the British manufacturing rights, will be demonstrated. This is a medium capacity, bench-type core-blower, having several novel features, notably the elastic sand reservoir in the blow-head which enables fairly high green-strength sands to be

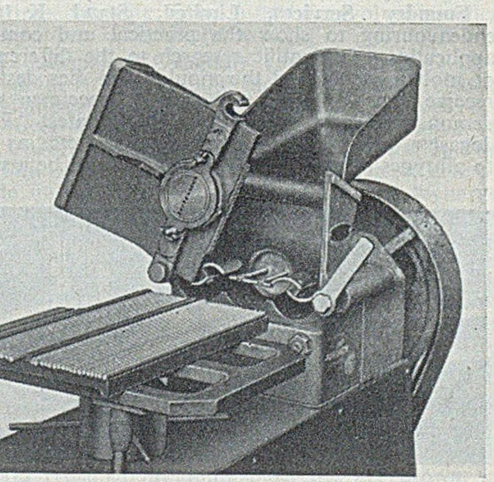


FIG. 3.—*Multi-plunger Core Extrusion Machine by Fordath Engineering Company, Limited.*

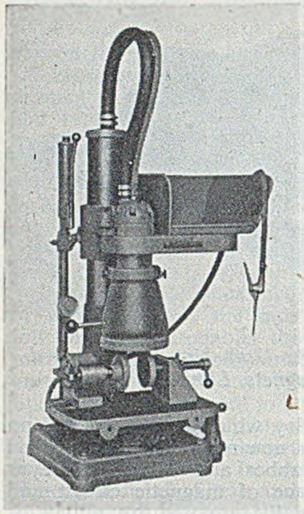


FIG. 4.—*Bench - type Core - blowing Machine Newly Introduced by Fordath Engineering Company, Limited.*

blown, without "piping" occurring in the sand reservoir; the sand reservoir is charged by simply swinging the blowhead beneath the hopper.

Core Binders. A comprehensive display of production cores bonded with the Glyso cereal binders, compounds and oils, is included on this stand. These will be representing modern practice in core-making. Special features will be the application of the new Airbond and Resyn quick-drying binders. The use of Airbond powder as a facing for green-sand moulds will be demonstrated. Cores bonded with Resyn will be made on the stand, and baked by high-frequency equipment in two minutes. The uses of Fordavol core and mould spray will also be demonstrated.

Machinery. The full range of Fordath New-type sand mixers will be on view. The range has been extended during this year by the provision of a ½-cwt. batch mixer and a 3-cwt. model, so that seven sizes between 1 ton and 20 lb. capacity will be available. Several of these machines will be seen in action. The mixer modified for use in mixing welding and electrode fluxes will be on show.

Foundry Services, Limited, Stand K 16, are endeavouring to show the practical and commercial application of scientific research to the different types of molten metal, and the moulds and dies destined to receive it. Exhibits will include specimen castings demonstrating the effective use of the latest "Foseco" degasers, grain refiners, covering fluxes, etc., as applied to all types of metals. Also included will be a selection of feeding compounds of outstanding interest to all foundrymen, together with an illuminated working model to show the application and use of "Feedex"—a mouldable exothermic compound. The illustration shows two castings made in a Continental foundry where "Feedex" was used for the casting on the right-hand side. This clearly shows the saving of metal in the feeding head. (Fig. 5.)

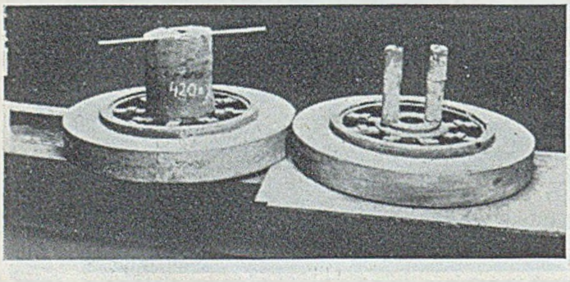


FIG. 5.—*Two Castings shown by Foundry Services, Limited, to illustrate the Advantages of a Feeding Compound.*

Fullers' Earth Union, Limited, Stand No. D 11.—The exhibit deals specially with "Fulbond," the well-known clay-bonding material made from British montmorillonite clay, that is, the kind of clay often described as "bentonite." The principal grades of "Fulbond" will be shown, and the sand-testing equipment installed will show the effects of adding "Fulbonds" to several different types of sand, such as silica sands for synthetic mixes and burnt red natural sand for regeneration. A number of castings in various metals, which have been made in "Fulbond" sands, will be displayed. Other uses of fullers' earth products, such as oil decolorisation and regenerating used mineral oils, will also be illustrated. Technical staff only will be on the stand, who will answer questions. Brochures explaining the properties and uses of "Fulbonds" will also be available.

General Refractories, Limited, Stand No. F 12.—General Refractories, Limited, show the refractories requirements of all types of industrial furnaces. Basic refractories exhibited will include a comprehensive range of magnesite and chrome-magnesite bricks for open-hearth, electric and reheating furnaces, cement kilns, etc. Specially featured in this section is the exhibit of "Ferroclad" metal-cased chemically-bonded basic bricks in which the steel casing and the brick material are pressed together by hydraulic pressure. Another interesting display is that of the G.R. "341" dolomite bricks, manufactured entirely fro mBritish dolomite.

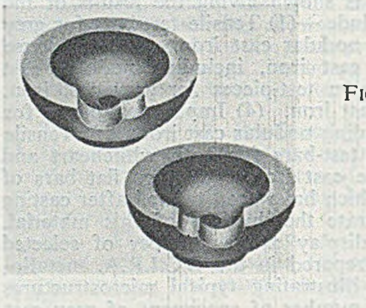


FIG. 6. — *Spinella "D." Refractory Shapes produced by General Refractories, Limited.*

Fireclay Refractories include the well-known "Glenboig," "Davison" and "Foster" ranges for boilers, locomotives, cement kilns, blast-furnaces, hot-blast stoves and industrial furnaces generally. Refractories for all types of suspended wall and roof construction are also displayed. Of particular interest is an exhibit of "Amberlite" heat insulating products in which their function in reducing heat losses in furnace structures with resultant fuel economies is demonstrated. A full selection of high alumina, sillimanite and carbon refractories is exhibited, together with many examples of fire cements, jointing materials and monolithic compositions. Also on view are samples of moulding and silica sands to meet every requirement. Members of the technical staff will be in attendance to give full information concerning the application of all types of refractory products.

Harborough Construction Company, Limited, Stand No. H.18 are exhibiting samples of iron, steel, malleable-iron, aluminium and copper-base castings with corresponding core assemblies showing the use of Harmark core compounds, Victol core-oils, Surfex mould and core dressings, Cellex synthetic-resin binders, Harbond cereal binders, Astex pattern-stone powder, Cert parting powder, Harmark iron cement, and other products. Also, there is a range of cast-aluminium and copper-base test-pieces, illustrating the effects of Harmark fluxes, together with samples of the fluxes in powder and tablet form. Illustrations of cores and foundry departments utilising the company's supplies will be displayed and members of the technical staff will be available to discuss production problems with visitors.

Heaton Foundry Company, Limited, Stand E.18 are showing two items of foundry plant:—The "Polford" dual sand unit, which is for reconditioning floor sand. This unit has a large hopper having a capacity of 15 cub. ft. under which a feeder belt runs on idler rollers over a permanent-magnet pulley, discharging the sand into a bucket elevator. The elevator in turn discharges the sand on to an aerator fitted in its spout before releasing the reconditioned sand for the moulding-machine hoppers. The second item is the "Polford" vibratory knock-out. It is of the positive eccentric type in which the grid is vibrated at high speed and small amplitude. These knock-outs are made in sizes to take from 5 cwt. to 5 tons and are used for knocking-out all types of foundry boxes which can be arranged over conveyor belts to take sand away or the units may be placed at any convenient part of the foundry.

Traughber Filter Company, Limited, Stand D.12 are specialists in the design and manufacture of equipment for the collection and disposal of industrial dusts, fumes

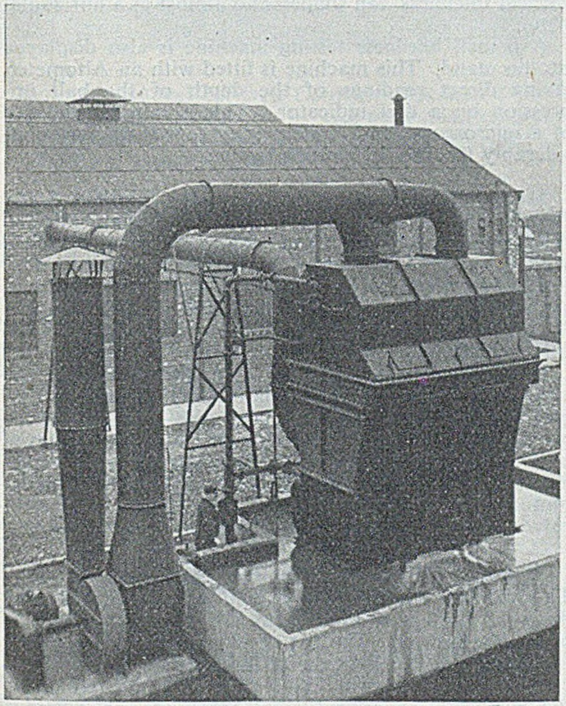


FIG. 7.—*Traughber Wet Filter, 8,000 cub. ft. per min. Capacity, installed at the Foundries of the David Brown Group.*

and mists. They have made a special study of foundry conditions, solving such problems by diverse methods, wet, semi-wet and dry systems, each having its own particular application to suit prevailing conditions and desired results. The general operation of the wet filter and the mechanical sludge conveyor is demonstrated on the stand by a sectional scale model. This type of plant is built to accommodate volumes of between 3,000 and 100,000 cub. ft. per min. (see Fig. 7). Such units are designed to suit specific problems and local conditions. A working model of the dry-wet cyclone unit is also demonstrated. Its operation can be observed through conveniently-arranged windows. This unit is coupled to a scale model of a typical foundry shake-out hood demonstrating the most efficient method of extracting dust from vibratory grids and shake-outs. Of additional interest is a small self-contained unit which incorporates all the main principles of wet dust collection, developed for the basis of research and on which experiments are conducted with dust samples affording data for the design of commercial-size dust suppression equipment.

British Non-ferrous Metals Research Association, Stand 35, Outer Row (Grand Hall, Gallery).

The exhibits of the Association will demonstrate research carried out on the following subjects:—

Properties of Metals at High Temperature

The rotating-load elevated-temperature fatigue-testing machine developed in the Association's laboratories will be shown in operation. This is being used to examine the mechanical properties under vibrating-load of aluminium-bronze and related alloys at temperatures of the order of 500 deg. C.

Research and the Non-ferrous Foundry

Gases absorbed in melting or casting non-ferrous metals usually have a harmful effect on the properties of castings, though in certain conditions their presence can be beneficial. The practical implications of research on gases in metals will be shown, as well as other important practical results of research on the grain refinement of light-alloy castings.

Shortage of Non-ferrous Metals

Immediate steps have been taken to assist members of the Research Association to make the most efficient use of metals in short supply. Special attention has been given to informing members about the best methods for the recovery of metals from pickle solutions and waste products in the copper-alloy industry, of practising economy of nickel in electroplating, and of zinc in galvanising. The latter has involved practical demonstrations in members' works.

J. W. Jackman & Company, Limited, Stand D 13.—Chief exhibits on this stand include a sand preparing plant comprising five units in one. The sand first passes over a mechanical sieve for the removal of coarse material and thence to magnetic drum for the separation of pieces of iron and steel. Direct delivery is made into a skip hoist which raises and discharges the sand into the patented conical-roll mill. In this latter rotates a conical roll on a sloping pan, thus giving a definite rubbing action of the sand grains without any breaking down of angularity. Side by side with this action is an intensive mixing, due to scrapers acting on the sloping pan effecting thorough turning-over of the sand cascading downwards. Bonding material is uniformly distributed and a first-class sand produced. Finally the prepared sand is discharged at one point over the side of the pan to a disintegrator and thence to barrow or truck. All units are motor driven with push-button control at a convenient point.

Several types of moulding machines are shown, including the Osborn jolt-squeeze-stripper. This is of a robust construction to withstand heavy wear with unvaried accuracy of pattern draw. The sand is jolted and pressed, control being through a single valve.

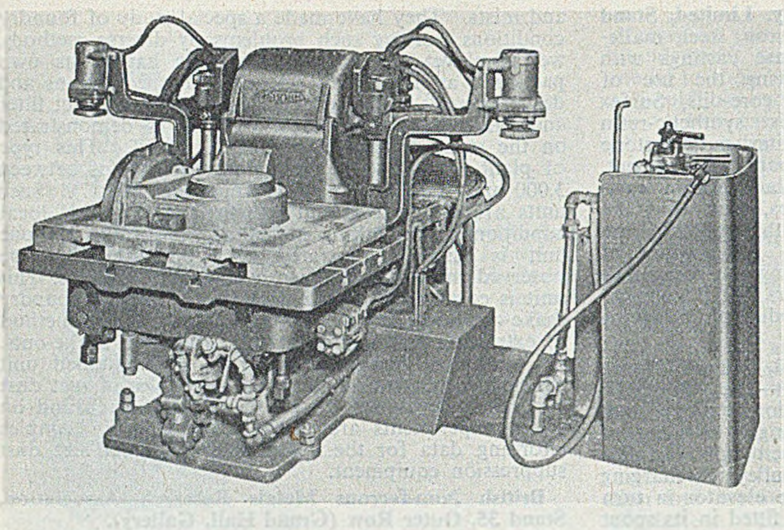


FIG. 8. — "*Osborn*" *Rockover Jolter Moulding Machines shown by J. W. Jackman & Company, Limited.*

Separation of mould and pattern is oil-controlled, with automatic acceleration from slow to fast draw. The lifting frame is arranged with square shaft to ensure continuous accurate draw. The Osborn rockover jolter is also displayed (see Fig. 8). In line with the rapidly increasing practice of core-blowing, two of the latest types of Osborn core-blowers are shown. One machine is arranged with pneumatic corebox clamps to secure the corebox in position during blowing. These are automatically controlled for instantaneous clamping and release. The other machine (Fig. 9) has rollers on the table, of particular use when horizontally parted coreboxes are used. To meet the heavy continuous duty and high rate of production the machines are of a robust construction. Also exhibited is the Osborn corebox roller draw machine.

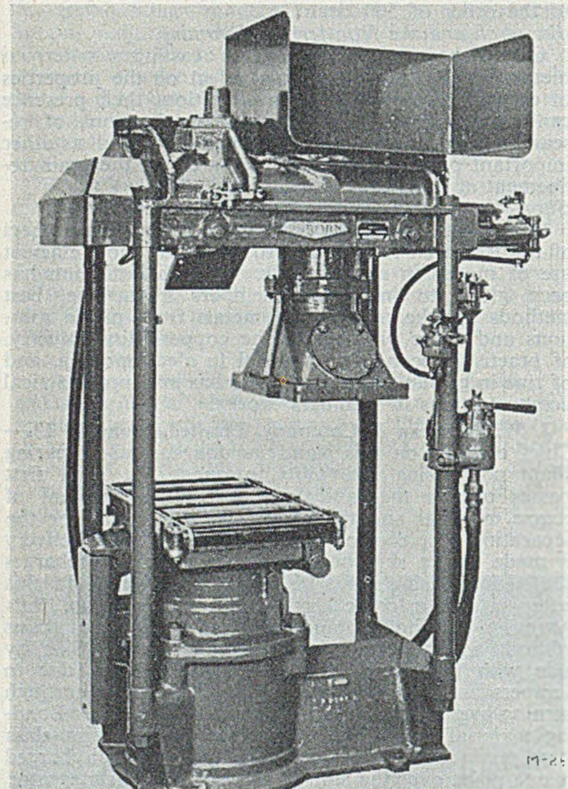


FIG. 9.—*Core-blower for Large Cores incorporating a Roller Table, exhibited by J. W. Jackman & Company, Limited.*

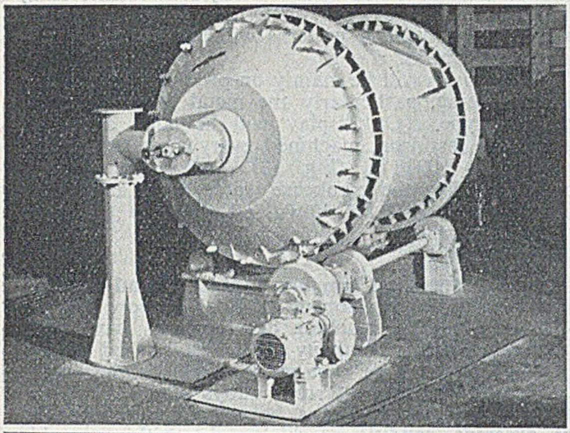
The airless shot-blaster exhibited embodies a new design of impellor so that the abrasive is brought to high velocity by frictional contact with the metallic surface, prior to being given a high final discharge velocity. The actual abrasive discharge is narrow in vertical thickness, fan shaped and almost in a horizontal plane.

A Brinell hardness testing machine is also displayed on this stand. This machine is fitted with an Altometer, giving direct readings of the depth of the ball impression on a dial indicator. This eliminates the use of a microscope, and consequently speeds up very considerably the rate of routine testing.

Monometer Manufacturing Company, Limited, Stand No. G 13, are exhibiting their latest-design oil-fired fully-mechanised continuous rotary furnace complete with retractable end-flue, for the melting of all non-ferrous metals, also for irons and steels (Fig. 10); and also their semi-rotary oil- or gas-fired melting furnaces for melting all non-ferrous metals, for ingotting and the production of castings.

Hydraulic-operated ladles, completely mobile for supplying hot metal from bulk-melting furnace to die-casting pots and holding furnaces, also for iron for the production of foundry castings, will also be displayed on this stand, together with a new design 1-ton white-metal oil- or gas-fired melting furnace fitted with direct motor-driven "Vortex" mixer, and a rotary sprocket valve for tapping direct from the pot.

Monsanto Chemicals, Limited, Stand No. J 16.— This exhibit will comprise a number of chemical products of particular interest to the foundry and engineering industries. The use of ethyl silicate as a bonding agent in the process of investment or precision casting is well known. This product is offered under the name of "Silester O." "Syton C," an aqueous suspension of silica in colloidal form, is offered as an alternative agent in this process. In the recent and



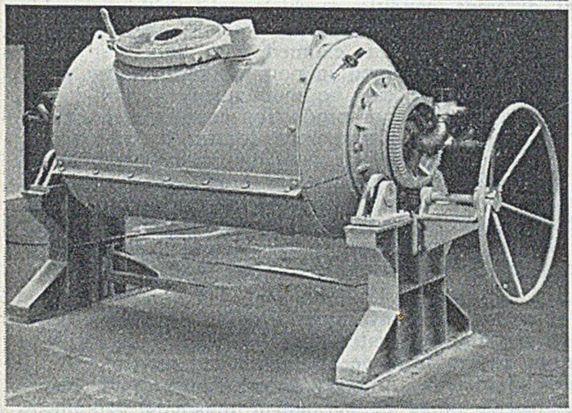


FIG. 10.—*(above) Oil-fired Continuous Rotary Furnace, and (below) Oil- or Gas-fired Semi-rotary Furnace, both shown by Monometer Manufacturing Company, Limited.*

important development of using ceramic moulds for the production of small numbers of castings in high-melting alloys, where the quantities involved would not justify the production of steel dies, ethyl silicate is again the recommended bonding agent, giving a finish equivalent to that obtained in gravity die-casting. Silester O is available for this purpose, as is also Silester A, an amine-modified ester.

Other useful applications for the Silesters are in the production of highly-refractory washes for use on furnace linings or on sand moulds. In addition to the Silesters, a range of products of value as heat-exchange media or as hydraulic fluids will also be displayed. This group comprises alkyl and aryl silicates and a number of chlorinated diphenyls known as the Aroclors. These products will be supported in the exhibit by cresylic acid for engine cleaning, pentachlorophenol for timber preservation, and sodium benzoate for metal corrosion inhibition.

Morgan Crucible Company, Limited, Stand No. A 17.—The stand will be devoted mainly to a display of crucibles, foundry accessories and crucible furnaces. A selection of Salamander and Salamander Super crucibles and foundry accessories will show the wide diversity of products manufactured in these materials. Of particular interest to all foundrymen will be the latest addition to the Salamander range—the Salamander Suprex crucible—developed for use in specially arduous conditions.

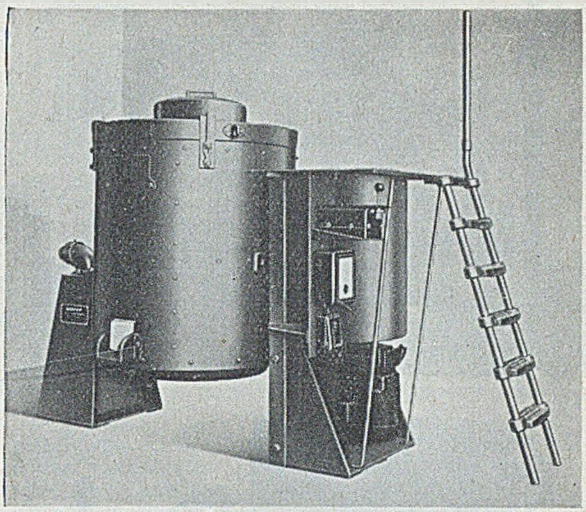


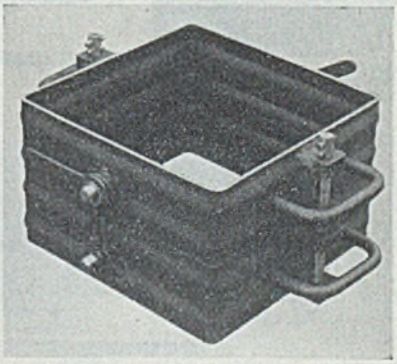
FIG. 11.—*Central-axis Tilting Furnace Type CA/MECH shown for the First Time by Morgan Crucible Company, Limited.*

Among the crucible furnaces on show will be the recently-developed power tilted central axis tilting furnace (Type CA/MECH) (Fig. 11). This furnace is being exhibited for the first time. The rotary crucible furnace (Type RCF) will also be displayed.

In addition a newly developed super-duty refractory will be shown. This is the Morgan M.R.1 refractory. Other exhibits will include "Morganite" carbon engineering components and "Reservoil" oil-retaining bearings.

Paget Engineering Company (London), Limited, Stand No. A 20.—Exhibits on this stand have been drawn from the range of Paget steel moulding boxes which vary in size from 9 in. sq. to 2 ft. 6 in. sq., and from 3 in. upwards in depth. The fact that these boxes are cold-swaged and bent at the home plant enables any size between the above limits to be made up quickly and accurately, and ensures an extremely light box which is both strong and rigid. The patent Paget quick-acting clamps are also on show. These provide a positive and quick method of locking the boxes firmly together.

FIG. 12. — *One of the Smaller Moulding Boxes in the Paget Engineering Company's Range. Note the Clamping Device.*



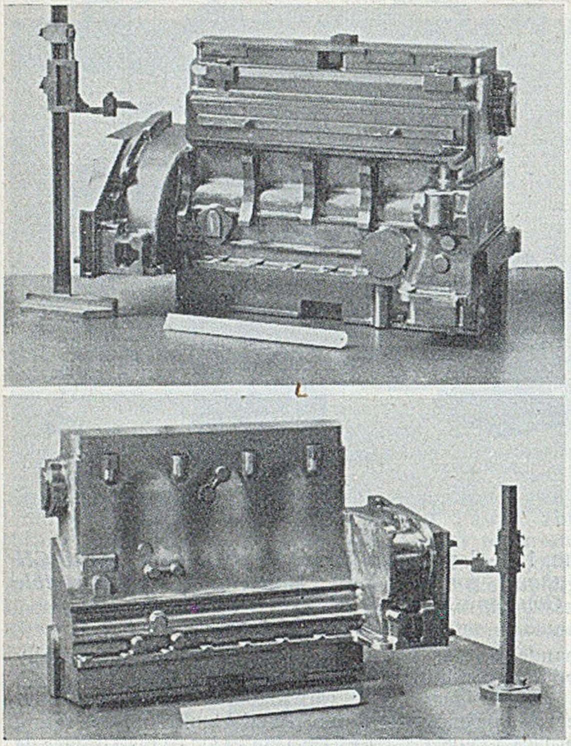


FIG. 13.—*Cope and Drag Patterns in Cast Iron for a Cylinder Block on the Stand of G. Perry & Sons, Limited.*

G. Perry & Sons, Limited, Stand A 19.—On this stand will be portrayed the wide range of pattern-making undertaken by this firm. Samples of work will be displayed where size allows and sample patterns of all types in pine, mahogany, aluminium, brass and iron will be shown. Metal coreboxes of various types designed for both hand-ramming and core-blowing will be on view. Double-sided aluminium match plates will be exhibited, also many other interesting examples of pattern work, including core-driers. The larger type of wooden patterns will be shown on full-plate photographs.

The emphasis will be mainly on precision and quality pattern-making, particularly the metal patterns of the precision type. On display will be cope and drag patterns in cast iron, machined everywhere to the fine limits of ± 0.003 in. (Fig. 13). Also several coreboxes, including the crankcase water-jacket and valve-housing boxes will be shown, all made to the same limits of accuracy.

Polygram Casting Company, Limited, Stand C.12 are illustrating the production of moulds and cores by the "C" process. Far-reaching developments have been made by Polygram Company and an established process for the production of castings in steel, stainless steel, cast iron and most non-ferrous alloys is now available. Varying moulding mixtures have been developed to suit different conditions which exist within moulds during the pouring of various metals. A very high degree of accuracy is claimed, with limits far closer than those encountered in normal sand-foundry practice. Uniformity can be maintained in mould and core and simplicity of production enables users of the process to enforce accurate cost control. By comparison with ordinary methods, a very low volume of material is required per ton of castings produced and this, of course, leads to extensive saving in indirect labour. The total floor space required for production of castings is reduced to a minimum. Dies, moulds, and castings produced by this process are shown in Figs. 14 and 15.

Rapid Magnetic Machines, Limited, Stand No. G 15, who recently celebrated their golden jubilee, will be exhibiting a wide range of electro- and permanent-magnetic equipment. Amongst items of interest will be the company's range of permanent magnetic equipment, which will include "Permaflux" drums and pulley-type separators, also a new welding clamp which is adjustable at all angles. Two typical types of swarf separators, which are also fitted with permanent magnets, will be shown in operation. Electro-magnetic percolators for treating wet materials such as potters' slip, glaze, etc., will also be available for inspection, as will the overband-type separator, which is widely used

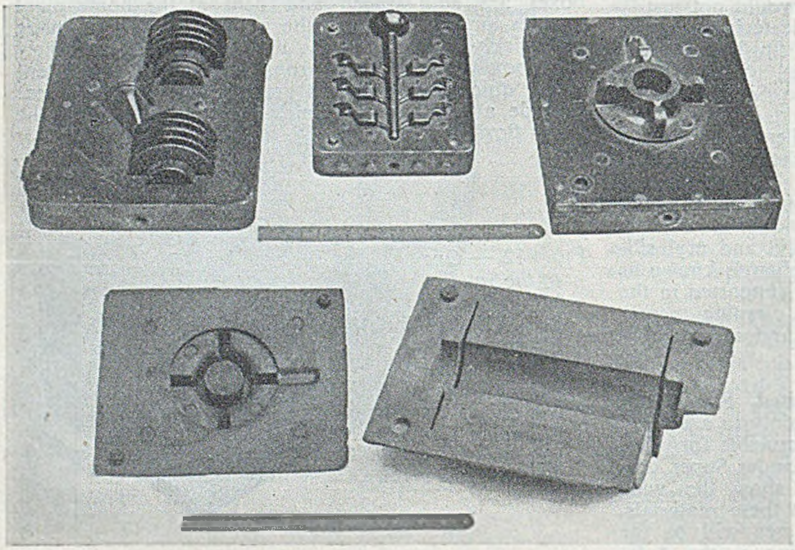


FIG. 14.—*(above) Pattern Plates and (below) Mould Shells for the Production of Castings by the "C" Process Developed by the Polygram Casting Company, Limited.*

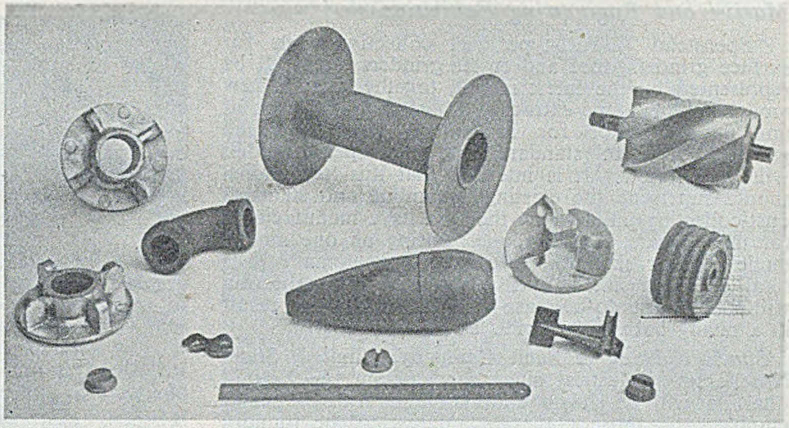


FIG. 15.—*Group of Finished Castings Produced by the "C" Process of the Polygram Casting Company, Limited.*

in foundries for extracting iron sprigs, etc., from foundry sand.

Ridsdale & Company, Limited, Stand A 16, are exhibiting the following Ridsdale-Dietert sand-testing machines, manufactured to the designs of the Harry W. Dietert Company, Detroit, for whom they are the sole licensees in this country:—Moisture Teller, with thermostatically-controlled hot-air stream and an automatic time switch; standard rammer for preparing 2-in. by 2-in. dia. A.F.S. test specimens, with attachments for ramming tensile and transverse test-pieces; permeability meter with new transparent dial, accurately calibrated for both standard orifices; universal strength machine, motor driven, for green and dry compression and shear tests, with attachments for tensile, transverse and compression tests of baked cores; sand washer, British Standard test sieves and Coombs gyratory sieve vibrator, fitted with time switch, for screen analysis; green hardness tester with large dia. "probe" and core hardness tester with tungsten carbide tipped "plough." This supersedes the mould hardness tester.

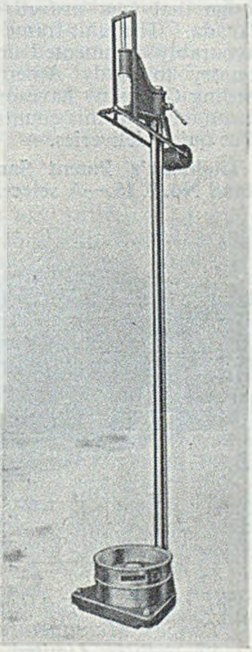
In addition to the American-design equipment, they are also exhibiting a number of new items of British design, foremost among which is a shatter index tester (Fig. 16). A special feature of this equipment is a lever-operated plunger device which is employed to eject the rammed sand specimen from the tube. By this means, specimens of the strongest of sands can readily be ejected from the specimen tube.

Other new items are a special low-capacity balance for the green-sand compression machine, enabling this instrument to be used for determining the green-strength of core-sand mixtures; an 18-in. dia. laboratory roller mill (driven by a directly coupled ¾-h.p. motor); a new design laboratory core-baking oven, with thermostatically-controlled circulating hot-air jacket to give superior temperature distribution; and a new design hydraulic compression machine with a double-acting pump and single direct-reading pressure gauge.

It is also hoped to show a new laboratory sand mixer (of about 5 lb. capacity) which consists primarily of an 8-in. dia. vertical cylinder, with fixed ribs, and two specially-shaped revolving blades, driven by a geared motor, which rub the bond and the sand together, ensuring rapid and even mixing.

Spencer & Halstead, Limited, Stand H 19, specialists in blast cleaning and dust exhaust equipment, will be exhibiting for the first time their airless rotary table and airless rotary barrel blast-cleaning machines, together with examples of their range of dust and fume extracting units. The "Centriblast" airless rotary table blast-cleaning machine will be fitted with auxiliary worktables which rotate as they pass through the blast chamber, thereby ensuring that all surfaces of castings are exposed to the blast streams projected by the twin impellers. The speed of rotation of these auxiliary tables is variable, relative to the speed of rotation of the main turntable, which can itself be speeded up or slowed down to give longer or shorter blasting periods, according to the nature of work to be handled. These changes in speed can be carried out in a few moments without dismantling, changing of gear ratios, or other cumbersome operations requiring skilled staff.

The "Centriblast" airless rotary barrel blast-cleaning machine is one of the most popular additions to the range of this type of equipment which has been put on the market within the last three years. The machine has a load capacity of 5 cwt. and can clean from four to six loads per hour, according to the nature of the work and the finish required.



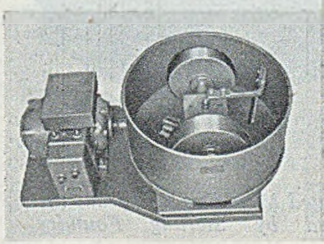


FIG. 16.—(*side*) *Shatter Index Tester of British Design for Sand, and* (*below*) *Laboratory-type Sand Mixer, both shown by Ridsdale & Company, Limited.*

Marine and Engineering Exhibition

"Spenstead" dwarf-type dust collecting units for surface grinders, tool and cutter grinders, etc., will be represented by the latest model, together with a new model welding fume extractor, whilst the latest type of unit dust extractor for attachment to floor stand grinders of both standard and high-speed models will be on view. It is intended that this new model should supersede the existing streamline and standard dust-collecting units which the firm have manufactured for many years, thereby concentrating on one model, made in four sizes, the two models now made in a total of seven sizes. This measure of rationalisation will enable units to be mass-produced and should result in a saving both of materials and overall cost.

Standard Brick & Sand Company, Limited, Stand No. K 14.—Industrial silica sands, from the Redhill quarries, will be shown on this stand, with particular emphasis on those grades of interest to the foundry trade both for coremaking and for the production of synthetic moulding sands, together with examples of actual cores, moulds and castings produced from Redhill sands. The suitability of Redhill sand for use with the new synthetic resin corebinders will be demonstrated by the display of a selection of cores bonded with this material.

In addition, the range of naturally-bonded moulding sands produced by the Mansfield Standard Sand Company, Limited, whose quarries have been serving the foundry trade for over 100 years, will be exhibited.

Sterling Foundry Specialties, Limited, Stand No. D 10, are showing a representative selection of their moulding boxes, known to foundries throughout the world. These boxes are made from sections of their own design, hot-rolled for the company to a special analysis (Fig. 17). The Sterling high-speed shakeout machine is also on display. This machine is also used in nearly 300 foundries in Great Britain and other parts of the world.

Sterling Safway are exhibiting a few examples of the structures that can be made up from their patented design of unit-frame scaffolding. This is an American design that has proved successful in the U.S.A. and Canada. The unit-frame type of scaffolding was very favourably commented on by the party sent from this country to study American building methods. The Sterling Company have only recently started large-scale manufacture in this country and at the present time can offer quick deliveries.

Tilghman's Patent Sand Blast Company, Limited, Stand No. E 15.—A selection of this company's "Wheelabrator" shot-blast machines will be on show at this stand. Machines being run for demonstration include the Wheelabrator Tumblast, for general work (Fig. 18), a tubular bag-type dust arrester, and a "Tilblast" liquid honing cabinet, for producing fine finishes on ground surfaces. The Wheelabrator two-table shot-blast machine will also be exhibited (Fig. 19); in this machine, which deals with castings up to 1,500 lb. weight, 2 ft. 6 in. deep, two 6-ft. dia. tables are continuously operated, one table being loaded whilst the other is rotated under the action of two wheels. Also shown will be a 6-in. bore two-cylinder single-stage compressor, Wheelabrator overhead conveyor plant and a cooling unit.

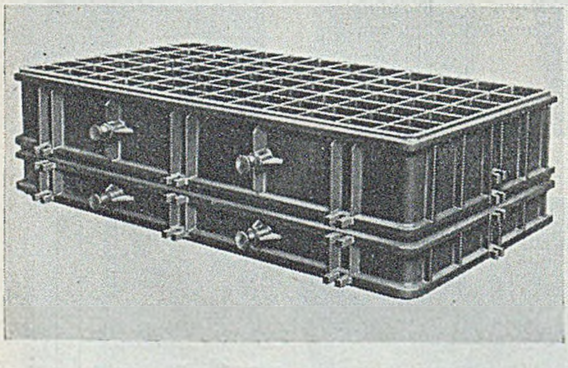


FIG. 17.—*Large Fabricated Moulding Box from the Range Manufactured by Sterling Foundry Specialities, Limited.*

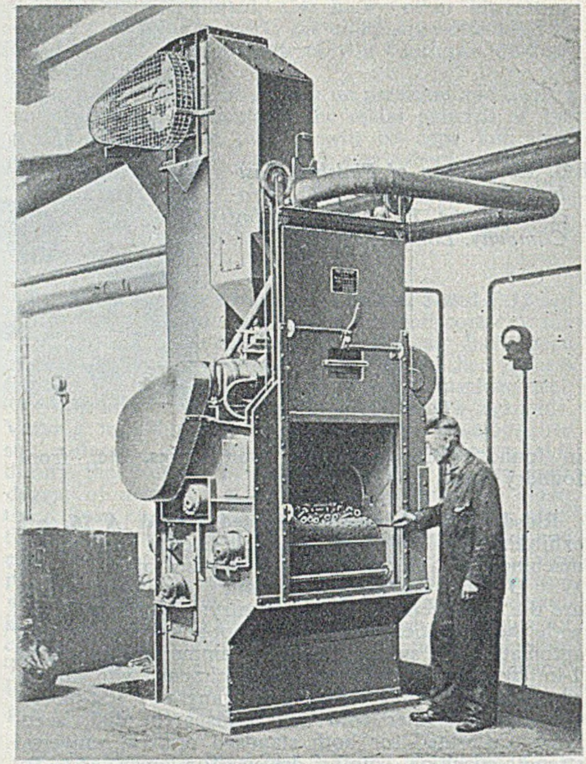


FIG. 18.—*Wheelabrator "Tumblast" Machine.*

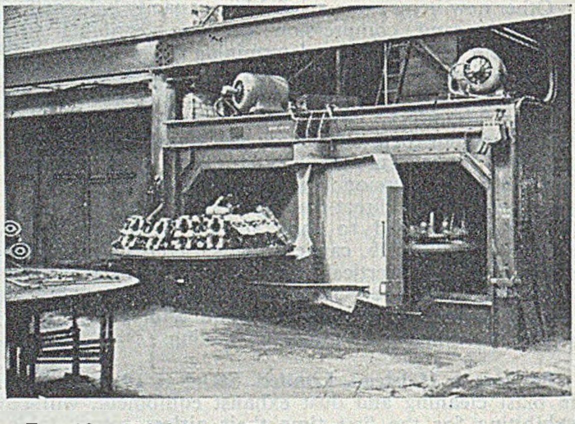


FIG. 19.—*Tilghman's Two-table Shot-blast Machine for Castings up to 1,500 lb.*

GENERAL EXHIBITS

Exhibits in the other sections of the Olympia Show which are of interest to foundrymen are the following, also in the Grand Hall except where otherwise stated:—

British Insulated Callender's Cables, Limited, Stand No. E 14, will be displaying a range of electrical products, including ship wiring cables, silicone rubber insulated cables and flexibles, welding flexibles, and a wire rope parting machine.

Mond Nickel Company, Limited, Stand No. G 2.—The stand of this company and their subsidiary, Henry Wiggin & Company, Limited, features the history of nickel since its discovery by the Swedish scientist, Cronstedt, 200 years ago. The individual exhibits will include a model of Cronstedt's laboratory, copies of classic papers in the history of the nickel industry, and photographs and drawings of production equipment and plant. Examples of uses of nickel and its alloys are shown. A full range of technical publications on the properties and uses of nickel and nickel alloys will be available on the stand.

Murex Welding Processes, Limited, Stand W 5 (Empire Hall).—Many new exhibits of outstanding interest are being shown on this stand. These include a new 50-amp. transformer welding equipment, a newly designed 250-amp. transformer equipment, a recently-developed low-voltage device for A.C. welding equipment, and some new types of electric arc welding electrodes.

Among the other types of Murex electric arc welding equipment being shown are some engine-driven sets which have been specially prepared with cut-away sections to show the internal components.

The exhibit is completed by a display of Murex arc welding electrodes, the range of which now covers over 70 different types, and displays of arc welding accessories and Murex welding literature. Practical demonstrations in both manual and automatic arc welding are being given.

Newton Victor, Limited, Stand M.9, National Hall, are showing X-ray equipment—the "Raymax" 250" unit (Fig. 20)—designed for operation at 250,000 volts and suitable for the examination of castings, welded joints and other fabrications up to a thickness corresponding to 3 in. of steel. The model will be shown as a mobile, jib-crane-mounted unit in which all components (X-ray generator, tube and control-panel) are supported on a rubber-tyred chassis ready for "on site" radiography in any part of the works, yard or shop where electric power is available. A special feature of the "Raymax 250" is the absence of trailing high-voltage cables—achieved by the oil-immersion, in a single dust- and damp-proof tank, of both X-ray tube and high-voltage generator. Although independent of water supplies the X-ray tube is so efficiently cooled by an oil-flow from the heat exchanger fitted to the chassis that it may be operated continuously at 250 kvp. and 10 ma. Also on show will be the company's "Raymax 140" industrial X-ray apparatus, a tube-stand-mounted unit designed for the radiographic testing of castings and fabrications in light alloys, and steel up to 1 in. thick.

Stewarts and Lloyds, Limited, Stand E 7, Grand Hall, with associated and subsidiary companies, are exhibiting a selected range of products on a double-decker stand. For the first time at a public exhibition, S. & L. electric-resistance welded boiler tubes (manufactured to B.S.1654) are on show. Also featured are:—A series of colour transparencies illustrating sequences in the manufacture, protection and laying of large diameter steel mains; samples and photographs of bituminised glass-tissue wrapping and bitumen lining for small-diameter tubes; Victaulic joints and Viking Johnson couplings; coils; steel castings, and several types of brass and gunmetal valves and fittings.

FIG. 20.—*Raymax* "250" *X-ray Unit, shown by Newton Victor, Limited.*

Broom & Wade, Limited, Stand No. B 12, are displaying a wide range of air compressors and pneumatic tools, amongst which a new portable air compressor, type SV.220, is of especial interest. The compressor is of the water-cooled V type consisting of four cylinders arranged in two banks of two cylinders, and is driven by a 5 L. W. Gardner, 5-cylinder Diesel engine developing 65 b.h.p. Actual delivered capacity is 210 cub. ft. of free air per min. at 100 lb. per sq. in. pressure when running at 1,200 r.p.m. The plant is mounted on an all-steel frame chassis of rigid design, with sprung axles and pneumatic-tyred wheels, is fitted with mudguards on rear wheels and provided with draw-bar and full trailer equipment.

David Brown Group, Stand No. 10 (National Hall).—For the first time since the formation early this year of the David Brown Corporation, Limited, a representative selection of exhibits from the organisation's gear, tractor and foundry groups will be shown together on one stand. As specialists in the production of steel castings for steam turbine plant, one of the most exacting tests of foundry technique, the David Brown Foundries Company, will show the bottom half of a high-pressure turbine casing, weighing approx. 3 tons (Fig. 21). This casting is part of an order for electrical generating plant which is being supplied to the Orlando Power Station, Johannesburg, for use in conjunction with a 30,000-k.w. turbo-alternator. Other examples of foundry capacity will include stainless-steel castings, high-tensile steel castings, centrifugally-cast heat-resisting castings for gas turbines, precision castings made by the investment process, and a variety of Taurus bronze castings produced by both sand and centrifugal processes.

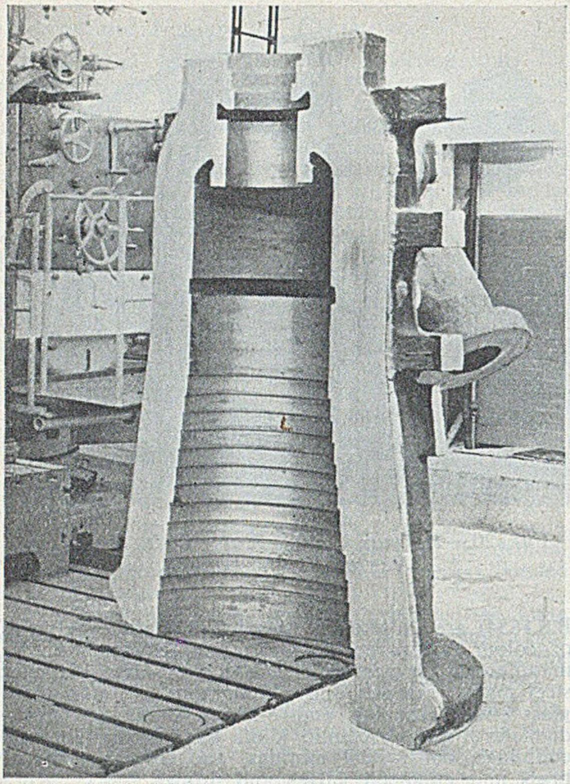


FIG. 21.—*High-pressure Cast-steel Turbine Casing, weighing 3 tons, shown by the David Brown Group.*

Consolidated Pneumatic Tool Company, Limited, Stand No. C 5.—A large range of equipment and tools will form the main exhibits at this company's stand in the Grand Hall, and typical examples will be shown from each class or group. The company make a specific tool in numerous sizes or speeds to suit individual requirements for drilling, grinding, polishing, riveting, chipping or scaling, as well as specialised equipment such as drills, pumps, and vibrators.

Crossley Brothers, Limited, Stand Nos. G 12 and H 16, are displaying marine and locomotive engines comprising Diesel power units up to 3,000 b.h.p. One stand also houses a cinema for showing Crossley sound and colour films.

General Electric Company, Limited, Stand No. V 6 (Empire Hall).—From the comprehensive range of A.C. welding plant manufactured by this company, portable single-phase and twin-arc welding sets will be on view, and demonstrations of the twin-arc set will be given.

G. A. Harvey & Company (London), Limited, Stand No. M 8 (National Hall), are showing a range of gilled tubes, displayed in varied diameters and pitch of gills, and photographs of other plant and equipment. An outstanding exhibit is the display of cold-rolled rings, flash-butt welded, which are an indication of the type of work produced.

Keith Blackman, Limited, Stand No. P 8 (National Hall), are exhibiting a selection of "Tornado" fan engineering, industrial gas, and dust exhausting and collecting equipment.

K. & L. Steelfounders & Engineers, Limited, Stand No. C 3, are exhibiting a selection of their equipment for industrial uses. Also on this stand, Browett Lindley, Limited, are displaying a range of air-cooled petrol/vaporising oil engines, and their air compressor, type 8a. George Cohen, Sons & Company, Limited, and others in the 600 Group of Companies are showing their industrial equipment on Stand No. L 3.

Metallizing Equipment Company, Limited, Stand A 11, are presenting for the first time their new METCO types 4E and 5E metal-spraying guns. The type 4E is a universal gun, capable of depositing all metals in wire form, primarily intended for the rapid reclamation of worn or mis-machined parts. The type 5E gun, which incorporates the new design-features of the 4E, has been specially produced for high-speed spraying of anti-corrosive coatings using $\frac{3}{16}$ in. dia. wires. It will apply 0.001 in. of zinc or aluminium to 1,200 sq. ft. of steel in one hour, the cost of the spraying process (exclusive of metal used) being approximately $\frac{1}{4}$d. per sq. ft. This equipment is well suited to spraying foundry pattern equipment.

Metropolitan-Vickers Electrical Company, Limited, Stand No. J 6, are showing a universal magnetic crack detector, type S. This device (Fig. 22) is the latest addition to the Metrovick range of crack detectors, and is already in use in many branches of engineering. The "current flow" and "magnetic flow" circuits enable cracks lying in all directions to be detected in a single operation, and both circuits can be used for demagnetising. Components up to 5 ft. in length can be tested in the machine. A special feature is the continuous control of both magnetising circuits.

Tangyes, Limited, Stand No. L 5 (National Hall).—Two of the latest types of horizontal Diesel engines are being shown, "WH4" type, capable of giving 27 b.h.p., at 370 r.p.m.; "P2" type, totally enclosed, completely

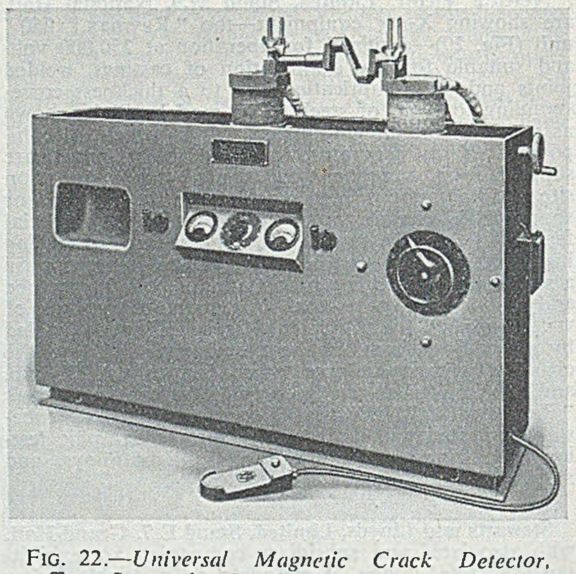


FIG. 22.—*Universal Magnetic Crack Detector, Type S, on the Stand of Metropolitan-Vickers Electrical Company, Limited.*

self-contained, giving 9 b.h.p. at 800 r.p.m. The Tangye 25-ton universal testing machine being shown is a special machine, capable of performing all types of tensile, compression, beam, shear and bending tests, and capable of carrying out many precision operations, such as bushing, forming, straightening, etc. This machine incorporates a new type of precision load indicator, is entirely self-contained, and requires no foundation. It is extremely simple to operate and service, and provides full protection to operator.

United Steel Companies, Limited, Stand No. C 10.—The United Steel Companies' stand will again provide a communal display on behalf of their various subsidiary and associated companies. Prominent amongst these as suppliers of steels, in various forms and finishes to the marine and engineering industries, are:—Steel, Peech & Tozer; Appleby-Frodingham Steel Company; Samuel Fox & Company, Limited; Workington Iron & Steel Company; United Strip & Bar Mills.

The display will illustrate the varied and modern plant in operation at their various works engaged in producing such widely differing products as strip down to 1/1,000th part of an inch or slabs of up to 17 in. in thickness, with intervening sizes and sections and many qualities, in addition to refined irons for foundry purposes.

Japanese Steel and Iron Output

Crude steel output in Japan in May was (provisionally) 556,281 metric tons, which compares with 541,682 tons in April and a monthly average during 1950 of 403,970 tons. The corresponding production figures of pig-iron were 264,456, 241,283, and 186,076 metric tons.

Export contracts for 86,000 tons of iron and steel products, including 78,000 tons of primary products, were obtained by Japan during May, according to a report issued by the Japanese Ministry of International Trade and Industry. Australia, Argentina, the United States, and the Philippines were the major customers.

Manpower Increases

The country's total working population increased during June by 35,000 (11,000 men and 24,000 women) to 23,324,000. Manpower in the basic industries rose by 19,000, the number of wage earners on colliery books declining by 1,000.

In the manufacturing industries, manpower fell by 11,000 to 8,676,000, a decrease of 9,000 being recorded in the number employed in the metals, engineering, and vehicles group.

The number of unemployed continued to fall, the mid-July figure of 185,800 comparing with the mid-June total of 190,800.

Samuel Osborn (Rhodesia), Limited, 17th Avenue, Bulawayo, have been appointed agents for the Ateliers de Constructions Electiques of Charleroi, Belgium.

The A.P.V. Company, Limited, of Wandsworth Park, London, one of the largest manufacturers of plant for dairy, brewery, food and chemical industries, make their first appearance at the Engineering and Marine Exhibition (Stand 7B, Grand Hall). Their foundry sales department is exhibiting castings in aluminium, gunmetal and stainless steel produced by their three foundries. This company has under construction a new foundry at Crawley.

The Ministry of Materials Act, 1951, and Associated Orders

By F. J. Tebbutt

The Ministry of Materials Act 1951 brings into being a new Government Department, whose functions will concern raw materials, etc., and in operation certain matters of the Board of Trade and of the Ministry of Supply come under this new Ministry. The *modus operandi* is through orders in Council and transferred from the Ministry of Supply are such things as various metals (*e.g.*, aluminium, copper, lead, magnesium, nickel, tin, zinc, and a number of others); ores and concentrates, and residues containing molybdenum, tungsten, vanadium; abrasives in raw or manufactured form; refractories and refractory materials; such materials as aluminum oxide; cobalt oxide; fluorspar; magnesium oxide and carbonate; iron powder and a number of others. From the Board of Trade come to the Ministry of Materials such things as chemicals; hides and skins; rubber, etc.; textiles and fibres; paper, etc. (*e.g.*, paper; board; fibrous paper-making materials); timber and a long list of miscellaneous materials (*e.g.*, cork; graphite; gums; horns; mercury; rosin; shellac; turpentine (gum and wood).

The fundamental principle, broadly speaking, is that the new Ministry will deal with all raw material questions and do everything possible to ensure adequate supplies of the materials with which it is concerned. That is to ensure regular and sufficient supplies whether on public or private account both for the short-term and the long-term requirements of industry as a whole. It has been stated, however, that the formation of this new Ministry does not mean entering into more public purchasing. The Ministry obtains the materials but then—if there is short supply—the Materials (Allocation) Committee apportions these between the various Departments who are responsible for the various sections of industry. The relevant Department designates how much goes to each particular industry domestic to it.

Pertinent Points

Roughly, the Ministry is responsible for raw materials up to the point at which they enter into manufacturing industry. In some cases there may be a departure from this rule; the line has been drawn at different stages of processing, and in some cases the Board of Trade and the Ministry of Supply retain their former responsibilities. The new Ministry is concerned with the supply of non-ferrous and light metals in unwrought form and with many metals of which a few have been mentioned earlier, but iron and steel remain under the Ministry of Supply, notwithstanding the fact that ores, concentrates and residues containing molybdenum, tungsten, and vanadium come under the new Ministry, as these are used for other industries besides iron and steel.

Timber is solely under the new Ministry (through the Timber Control as now); as are the following materials:—sulphur, and sulphuric acid and fertilisers; wood pulp and paper; the Non-Ferrous Metal Directorate at Rugby; all textiles and fibres, which term, of course, includes cotton, silk and wool.

In Parliament it was said that statisticians have stated that there is only 14 years proved supply of lead in the world and 21 years of zinc, but there is research proceeding for substitutes and for lead and zinc.

Book Review

Foundry Practice. By William H. Salmon and Eric N. Simons. Published by Sir Isaac Pitman & Sons, Limited, Parker Street, Kingsway, London, W.C.2. Price 30s.

This book sets out to cover the needs of the intermediate student in patternmaking and foundry practice based on the requirements of the City and Guilds of London Institute examinations, and it does so exceedingly well. The reviewer can find no section of the City and Guilds syllabus not covered, though the order of treatment is somewhat different, but still logical. Thus, there are two introductory chapters dealing with drawings and patterns, then moulding is covered very fully in five chapters, followed by metal, its preparation and use in chapters VIII and IX. Next, ancillary operations, fettling, heat-treatment, quality control, and the like are adequately looked after and, finally, appendices provide a bibliography and specimen answers to actual City and Guilds examination questions. The latter will be invaluable to the student because it is one thing knowing all the answers and quite a different matter writing a good answer to a specific question. Personal experience of marking foundry examination papers shows that more students fail by being unable to write down, not what they know, but what is asked for, than from any other cause. This is where the outstanding merit of this book is to be found. In this respect, too, the clearly set-out drawings and diagrams are noteworthy. It was a happy thought to enlist the aid of Mr. E. G. Gardner, himself a patternmaker, for these illustrations, as easily understood diagrams are half the battle to the student. These authors have made a masterly selection of illustrations; be it drawback, stop-off, loose-piece or what you will, the purpose of each is apparent at a glance.

The chapter order mentioned earlier enables the importance of pattern design and mould layout to be stressed *ab initio* and this theme is well retained throughout the book, good foundry and metallurgical practices receive preference to short-cut methods. With moulding machines, principles are rightly demonstrated instead of too great an attention to detail. Terminology, which varies much according to locality and "school," has been dealt with in novel fashion by printing alternatives in brackets, thus, "sprue-cup (runner cup, runner basin, pouring cup)"—a much better way, surely, than printing a glossary.

As in all works of this nature, it is possible to find mistakes of a minor character. The absence of reference to the Connor runner and centrifugal casting is excusable no doubt by there being no mention of these in the "intermediate" syllabus. In Table XXIV obsolete standard specifications are quoted. A printers' error in interchanging the page numbers for pin-hole and pig-iron on page 381 of an otherwise very excellent index is regrettable. On the metallurgical side, the reviewer doubts the wisdom of returning to the melting pot, there and then, a quantity of molten metal used for warming a ladle, especially as this recommendation is included close to a section dealing with hydrogen pick-up.

However, these are small points, some no doubt due to the extended delays in printing these days, and not to be set against the real good value of the book. To students and lecturers and not least to foundrymen themselves, this work will be the answer to a prayer. It fills a void in the training schemes of the industry and as such it merits the highest praise. The volume is especially opportune at this time of year when hundreds of students are newly embarking on, or resuming studies in our industry.

A. R. P.

Grain Refinement of Aluminium Alloys

Mr. A. Cibula has summarised a Paper he presented to the Institute of Metals on Grain Refinement of Aluminium by Titanium and Boron as follows:—

(1) Substantial evidence has been obtained which shows that the grain refinement of aluminium alloys by the addition of boron is caused by nucleation by aluminium boride crystal in the melt. This conclusion was supported by other results obtained by using the isomorphous borides of certain transition metals. The metal atoms in these borides lie on simple hexagonal lattices, in the close-packed planes of which the interatomic distances are similar to the corresponding interatomic distance in solid aluminium.

(2) When boron is added to aluminium-alloy melts containing titanium, marked grain refinement is produced which is thought to be caused by the formation of a boride with lattice dimensions similar to those of aluminium boride, which is probably titanium boride containing aluminium boride in solid solution. When the titanium content is over about 0.005 per cent., this mixed boride is precipitated at very much smaller boron concentrations than are required to form pure aluminium boride in titanium-free alloys, and the boron addition necessary for maximum grain refinement is correspondingly less. For example, grain refinement of an aluminium/0.14 per cent. titanium alloy was produced by as little as 0.0001 to 0.001 per cent. boron—a quantity very similar to the estimated amount of carbon required to refine an alloy of similar titanium content.

(3) Two combinations of titanium and boron contents have been selected from these results for practical use—0.01 per cent. titanium + 0.003 per cent. boron for alloys cast at low temperatures, and 0.03 per cent. titanium + 0.01 per cent. boron for alloys which have to be heated above 720 deg. C. before casting. Even the highest additions represent a considerable saving in the use of titanium, and the grain refinement obtained is little affected by overheating the melt. Mould reaction and the loss of refinement caused by remelting in alloys containing the above additions are slight and not likely to be of any practical importance, and grain coarsening due to gravity segregation during solidification is reduced.

(4) Excessive additions of titanium and boron cause segregation of titanium-boride crystals in the melt. As the loss of refinement on remelting is small, it should be unnecessary to make additions of titanium and boron to remelted scrap metal already containing these elements. Even with this precaution, however, segregation of titanium boride may still be encountered in quiescent melts unless the metal is stirred vigorously just before casting.

(5) Titanium and boron have also been added to aluminium-alloy melts by the simultaneous reduction of molten salts of these elements, but the grain-sizes produced by this method are affected by the temperature of addition and the composition of the melt, and the method may be completely successful in practice only if the magnesium content is small and the temperature of addition high.

(6) Experiments on the addition of boron with transition metals other than titanium indicate that low concentrations of vanadium and niobium also produce marked refinement in the presence of boron.

(7) Very little success was obtained in attempts to increase the carbon content of alloys containing titanium; the addition of carbon presented much greater experimental difficulties than the addition of boron, and is unlikely to prove as successful as the latter.

Operation and Design of Hot-blast Cupolas

By F. C. Evans, F.I.M.

There is considerable interest in hot-blast cupolas at the present time. Foundrymen have heard that hot blast not only saves coke but enables the charge to be cheapened considerably by substituting steel scrap for pig-iron. In this country, however, direct information is hard to come by as on the whole Great Britain has lagged behind Europe in the developmenet of hot-blast cupolas. At the time of writing only two installations are working in England with another one possibly in construction. In Europe, however, there are at least 25 installations working or in construction and some of these have production records extending over a number of years. This article sums up the operational and economic advantages of hot blast for different types of iron and reviews some of the engineering problems involved and how they have been solved.

Historical

The idea of hot blast is by no means new, and there have been several reviews of the subject already published.[1] [2] Before the last war there were a number of installations made in the U.S.A. of a design which developed blast at about 300 deg. C. These were mostly in car-wheel* foundries but the numbers were not extended during or after the war, and as far as can be found out many of the original installations have now fallen into disuse.

New installations of an improved design are being made now in the U.S.A. but the temperature of blast is still low. Just before the war Prof. Piwowarsky at Aachen Technical High School made experiments with hot blast at higher temperatures, *i.e.*, between 300 and 600 deg. C., and produced some interesting results.[3] This preliminary work showed that not only were coke savings possible, but hotter iron, lower sulphur contents and greater output also resulted.

This work led the Georg Fischer A.G. concern in 1941 to install an experimental hot-blast cupola for the melting of white-heart malleable iron at their foundry at Schaffhausen in Switzerland. The coke position in Switzerland was then very serious, as the only supplies obtainable were high in ash and sulphur content. The results obtained from this cupola, which had a separately-fired air-heater, were summarised in a number of Papers in Continental journals,[4] [5] but significance from the thermal point of view can be summarised in Tables I and II taken from the Paper by Bader.[5]

The next step was to build a recuperative system whereby the whole of the heating of the blast was accomplished by the waste gas from the top of the cupola. A large plant comprising four cupolas of 11 to 12 tons per hr. each was equipped in 1947 with a recuperative system at Georg Fischer A.G., Singen. The success obtained with this plant led to many other plants being installed for all types of iron, although those melting white-heart malleable have predominated.

The initial installations at Aachen and at Schauffhausen were supplied with air heaters to the Schack design (Rekuperator K-G of Dusseldorf), and the recuperative plant at Singen had tubular recuperators supplied by the same firm. This firm has predominated in the development of the hot-blast cupola and have to date installed eleven plants with a further eight in construction. Other firms such as Ekonomiser Werke, Steinmuller, Conduits D'Eau have built one or two plants only and a few other foundries have designed and built their own.

TABLE I.—*Comparative Thermal Balance of a Cupola of 650 mm (2 ft. 2 in.) dia. with Cold- and Hot-blast Working on Malleable Iron*

	Cold blast.	Hot blast at 300 deg. C.	Hot blast at 600 deg. C.
Heat content of coke, per cent.	97.00	88.70	79.30
Heat of combustion from the iron, per cent.	3.00	3.90	4.90
Heat input from hot blast, per cent. ..	—	7.40	15.80
Total	100.00	100.00	100.00
Heat content of liquid iron, per cent. ..	31.80	51.80	60.00
,, ,, ,, slag, ,, ..	3.34	6.40	5.65
Decomposition of limestone, per cent. ..	1.60	2.07	—
Steam from coke, per cent.	0.02	0.05	0.04
Decomposition of blast moisture, per cent.	1.90	2.02	3.06
Sensible heat of stack gases, per cent. ..	9.20	5.30	4.95
Heat of combustion of stack gases, per cent.	43.00	26.50	20.00
Cooling water loss, per cent.	0.94	0.80	1.90
Radiation losses, per cent.	8.20	5.06	4.40
Total	100.00	100.00	100.00
Thermal efficiency of cupola, per cent. ..	31.80	51.80	60.00
,, ,, ,, blast heater, per cent.	—	60.00	64.20
,, ,, ,, whole plant, per cent.	31.80	48.70	53.80
Temperature of stack gases, deg. C. ..	350	200	200

Choice of Blast Temperature

As previously mentioned, research at Aachen University had shown that there were many advantages in increasing the blast temperature above 300 deg. C. and temperatures up to 600 deg. C. have been used in the trials. In practice, however, most of the installations to date are using blast temperatures between 400 and 500 deg. C. This is partly due to practical considerations, which will be discussed later, but principally because it is impossible to obtain temperatures much in excess of 500 deg. C. by recuperative means.

When hot blast is applied to a cupola both the temperature and the carbon monoxide content of the top gas falls (see Fig. 1). This is believed to be due to the shorter melting zone which results from the faster combination of the carbon with the

* Cast-iron wheels for railway wagons.

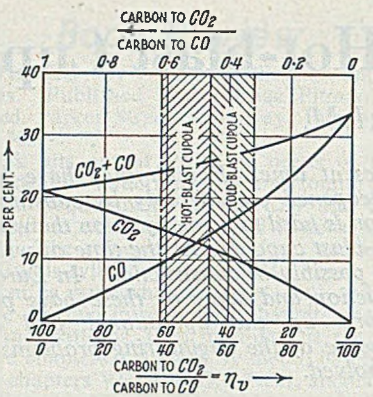


FIG. 1.—*Graph showing Composition of Cupola Top Gas.*

TABLE II.—*Influence of Blast Temperature on Fuel Consumption.*

	Cold blast.	Hot blast at 300 deg. C.	Hot blast at 600 deg. C.
Total coke consumption in lb. per ton of liquid iron	358	233	174
Anthracite consumption for blast heater (lb. per ton)	—	59	55
Total coke and anthracite in lb. per ton of iron	—	292	229
Coke saving over cold blast, per cent. ..	—	35.0	51.5
Coke consumption compared with cold blast, per cent.	—	65.0	48.5
Anthracite consumption as percentage of the coke for cold blast	—	16.5	15.3
Total wt. saving of fuel as a percentage of the coke consumption with cold blast	—	18.4	36.1

oxygen in the hot blast. The effect of the change in top-gas composition and temperature on the heat content of the top gas is shown in Fig. 2. The hotter the blast the cooler and leaner the top gas becomes with the practical result that, even with a recuperator of high thermal efficiency, blast temperatures in excess of 500 deg. C. are rarely possible if maximum coke economy is practised. The temperature attained by the blast is a function of the efficiency of the recuperator and the inlet temperature of the combusted cupola top gas. Fig. 3 shows how the theoretical combustion temperature changes with the CO content and sensible heat due to the temperature of the top gas. It will be seen clearly that in the hot-blast range the maximum theoretical

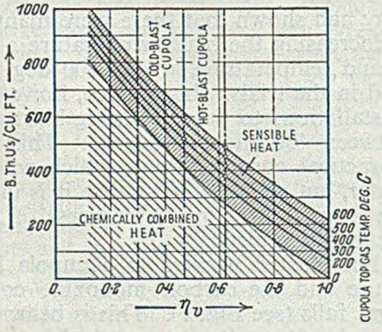


FIG. 2.—*Graph showing Heat Content of Cupola Gas in relation to Composition and Temperature.*

combustion temperature obtainable with a high sensible heat of the top gas at 600 deg. C. (which needs high coke ratios) is about 1,200 deg. C. To obtain blast at 500 deg. C. with this combustion temperature an efficiency of recuperation of $\frac{500}{1200} \times 100 = 42$ per cent. is necessary. Generally, however, maximum coke economy is preferred and the top-gas temperature and CO content is in the lower part of the range shown on the graph and the theoretical combustion temperature is in the region of 900 deg. C. Even, therefore, with the Schack recuperator which has a thermal efficiency of 58 per cent., practice has shown that the mean limit of blast temperature is 500 deg. C. under working conditions. Unless the plant is designed correctly so that there are no losses of sensible or latent heat from the cupola *en route* to the recuperator, the optimum of 500 deg. C. will not be reached consistently. With recuperators of lower thermal efficiencies than 58 per cent. the task is of course even more difficult and the plant more bulky.

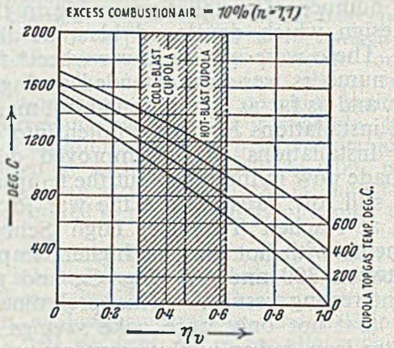


FIG. 3.—*Graph showing Theoretical Combustion Temperature in Relation to Gas Composition and Temperature.*

There are, of course, practical considerations against using blast in excess of 500 deg. C. First, the blast mains, tuyeres, etc., can no longer be made from mild steel and cast iron which have been found satisfactory only up to 500 deg. C. Secondly, there are indications that the attack of the refractory lining of the cupola is greatly intensified above this temperature. Lastly, silicon control, particularly for white-heart malleable, has been found difficult in the higher-temperature ranges due to silicon pick-up. This will be discussed in more detail later.

On the other hand, the high blast-temperatures offer interesting metallurgical possibilities, but these will have to be realised by utilisation of a separately-fired air-heater and the design of a special cupola. This presents no great difficulty, but as the exact advantages of higher blast-temperatures are not yet known they will not be discussed in this article, which is confined to practical results already obtained.

Advantages of Hot Blast

The advantages of hot blast as compared with cold blast can be summarised as follow:—

(1) Decrease in coke consumption; (2) ability to use poor quality cokes; (3) increased output

for a given size of cupola; (4) lower silicon and manganese losses; (5) greater ability to carburise steel scrap; (6) lower sulphur content of iron; (7) hotter iron; (8) iron less oxidised and more fluid; (9) lower iron loss; (10) simpler control of cupola; (11) hotter first taps; and (12) lower limestone consumption.

There is also the advantage that the emission of dust from the cupola top is very considerably reduced. The top gas from the cupola passes through dust traps and these with the recuperator itself retain a very large proportion of the dust.

The advantages listed are discussed in detail in what follows and the various points are illustrated by quoting practical results obtained in a number of plants. It must be remembered however that the full benefit of each advantage cannot be realised at the same time on the same plant, *e.g.* a maximum increase in iron temperature with maximum coke saving is not compatible.

Decrease in Coke Consumption

In general it is found that a cupola changing from cold blast to hot blast will use 25 to 30 per cent. less coke. Typical coke consumptions taken from working records are 10 to 12 per cent. for white-heart malleable, 10½ per cent. for high-duty grey cast iron, 9 per cent. for ordinary soft grey iron, and 16 per cent. for a cupola melting 100 per cent. steel scrap charge for converter iron. It should be noted that these figures are for the coke charge only but the figure also includes any coke used for carburisation of the charge.

Ability to Use Poor-quality Coke

High-ash coke can be used without difficulty when hot blast is used. Generally speaking, German and Continental cokes are poorer in quality than British coke. Even Ruhr coke has a lower fixed carbon content at 83 to 85 per cent. than British and this is of course one of the best that can be obtained in Europe. Hot-blast cupolas however can use gas coke without difficulty and with little increase in consumption.

Increased Output

Due to the lower coke consumption, the cupola output per given area is increased. The figure usually taken for white-heart malleable and grey cast iron is 1-ton per hour per sq. ft. of cupola cross sectional area. This increased output reduces the initial cost of a new cupola plant if hot-blast equipment is installed simultaneously.

Lower Silicon and Manganese Losses

There is no doubt that the manganese and silicon losses are lower with hot blast although the exact figure varies considerably with the type of iron being produced as well as the type of charge in use. The saving on manganese does not seem great and the figure has been variously reported. With white-heart malleable, a reduction from a 35 per cent. loss to 28 per cent. has been quoted and on converter iron the loss was reduced to 15 per cent. with hot blast as against 25 per cent. with cold blast.

With silicon the position is much more complex and the loss, *or gain*, depends very largely on the final silicon content of the iron as well as the blast temperature. The general tendency seems to be that the higher the temperature the lower the loss of silicon with a slight gain at lower silicon percentages (0.5 per cent.) with a blast temperature of 500 deg. C. and a slight loss starting at above 3 per cent. silicon (see Fig. 4 which gives a graphic approximation of the effect of hot blast on the silicon content). The general tendency is however to reduce silicon loss as the two following examples will show:—On a refined iron up to 2.0 Si. is charged in the form of 10 per cent. silicon pig or ferro-silicon briquettes with a charge of 100 per cent. light steel scrap. The silicon loss is nil with blast at 450 to 500 deg. C. On a white-heart malleable plant, using blast at 400 to 450 deg. C., there was no Si. loss on a charge consisting of 65 per cent. returned foundry scrap, steel and ferro-silicon. With higher temperatures, *i.e.*, 500 deg. C. on the same plant slight silicon pick-up was sometimes experienced. Another white heart malleable plant reported definite pickup of silicon at 500 deg. C. and later worked at 440 deg. C., where the silicon content was static.

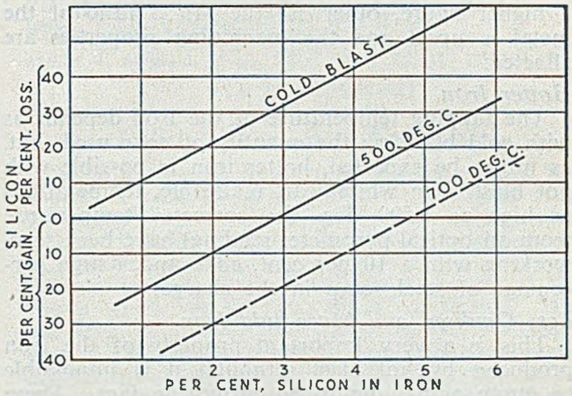


FIG. 4.—*Graph showing the Effect of Blast Temperature on the Silicon Content of Cast Iron.*

Greater Ability to Carburise Steel Scrap

This is one of the major advantages of hot blast and is of particular interest at the present time in Great Britain where pig-iron is of high cost and difficult to obtain. The hotter melting zone established in the hot-blast cupola, (reckoned by some investigators,[2] to be about 200 deg. C. hotter than cold blast) is no doubt favourable to carbon pick-up. This is borne out in practice for instance by the cupola plant making refined pig-iron from 100 per cent. steel scrap of a very light nature and producing pig with a content carbon of about 3 per cent. with up to 1.5 per cent, or even 2 per cent. silicon if required, when a blast temperature of 500 deg. C. is used. Other cupola operators producing high-grade cast iron for valves, pumps, etc., have found no difficulty when turning over to hot blast of substituting 10 per cent. or more of the pig-iron in their charge by steel scrap, this being due to the high carbon pick-up and lower silicon losses.

Lower Sulphur Contents

There is no doubt that with the use of hot blast the sulphur content of the iron falls, although the

Operation and Design of Hot-blast Cupolas

percentage fall has been variously reported. The minimum reported fall however is about 25 to 30 per cent. and corresponds to the fall in coke consumption and is of course to be expected. Some operators have reported larger decreases and advance the theory that this is due to the greater reactivity of the slag in the hotter melting zone.

On a white-heart malleable plant in Great Britain using British coke the addition of hot blast at 400 deg. C. to the cupolas caused the sulphur content to fall from 0.20 to 0.14 per cent. while the coke consumption fell from 14.5 to 10 per cent.; or a 30 per cent. fall in both coke consumption and sulphur content. On the hot-blast cupola melting 100 per cent. light steel-scrap with 16 per cent. coke charges, the iron produced has between 0.13 to 0.17 per cent. sulphur, when using a Ruhr coke containing 1 per cent. sulphur. It is interesting to note that, in the malleable foundry mentioned earlier, sulphur in the form of iron sulphide has to be added to the ladle to restore the sulphur to a higher figure, otherwise the Mn:S ratio of the metal is upset and the machining properties are affected.

Hotter Iron

The tapping temperature of the iron depends as with cold blast, on the quantity of coke used, but, as might be expected, hotter iron is possible with hot blast. On white-heart malleable, temperatures as high as 1,590 deg. C. (corrected temperature from an optical pyrometer reading) have been seen, working with a 10 per cent. coke and a high percentage of steel scrap in the charge.

Less Oxidised and More-fluid Iron

This is a very important property of the iron produced by hot blast although it is impossible to quote actual figures to prove the fact. There is no doubt, however, that for a given temperature, the iron produced by hot blast is more fluid than that produced by cold blast. This is of particular importance in the white-heart malleable foundries where the main production is of small fittings having thin sections. On changing over to hot blast, the reduction in scrap due to mis-run is most noticeable and one foundry manufacturing pipe fittings has stated that the saving of scrap alone pays for the hot-blast installation, apart from the considerable savings on coke and cost of the charge.

It should be noted that the greater fluidity is not due to the higher temperatures obtainable, although these can be obtained if necessary. In one malleable foundry which installed hot blast, the initial practice was to work at an increased tapping temperature of about 1,550 deg. C., but this temperature gave them difficulties with the finish of the castings due to "burn-in." They reduced the tapping temperature to that obtained with cold blast, *i.e.*, 1,450 to 1,500 deg. C., and found that the iron was so much more fluid that a very low scrap from mis-run castings was obtained.

Lower Iron Loss

This may mistakenly be thought to be of little importance, perhaps because many foundries have no true idea of what the melting loss is. Careful records have been kept, however, at the Schaffhausen works of Georg Fischer A.G., over a period of ten years; the first five years on cold blast and the second five on hot blast.[1] The figures are calculated from raw-material stock records and can be summarised as follow:—

	Per cent. loss.
Cold blast, 1937 to 1941	1.31
Hot blast, 1941 to 1946	0.58

This smaller loss is thought to be due to faster throughput of the hot-blast cupola and the quicker combination of oxygen in the melting zone which leads to less oxidation and thereby less loss.

Simpler Control of Cupola

It is generally assumed that a hot-blast cupola is a complicated piece of apparatus which will need skilled operators to handle it and will, therefore, not be suitable for operation by an ordinary cupola tenter. It is true that, to obtain the maximum benefits in respect of coke and charge economy, a considerable amount of skilled attention is required at the start-up. After, however, the change has been made and conditions stabilised, it will be found that the operation of the cupola is considerably smoother and more consistent. Scaffolding, blocked tuyeres, cold taps and all the other difficulties which arise, particularly in these days of poor coke, largely disappear and consistent iron throughout the melt is obtained.

Hotter First Taps

One of the troubles of mass-production foundries working on small- to medium-size parts is the disposal of the colder iron which is tapped first in the morning. With a suitable design of hot-blast apparatus, however, the first taps need be only a few degrees below the iron produced later in the day. If the recuperator is of small bulk (and therefore has but little thermal capacity), and is so designed that it can be preheated before the blast is switched on, the maximum blast temperature can be reached within 20 min. of starting to blow. This has the effect, as might be judged, of producing a hot metal at the first tap.

For instance, with a tubular recuperator of Schack design, hot blast at 440 deg. C. is developed 20 min. after the start of the blow on a normal weekday without preheating. After the same time, *i.e.*, 20 min., the first tap is made. This particular plant is continuously tapping into a fixed receiver and within 35 min. the iron is coming off at 1,440 deg. C. On a Monday, after the weekend shut-down, this programme is delayed only some 10 min.

This programme can be speeded up by preheating the recuperator or by boosting the heating rate with additional fuel. For instance, a Schack recuperator of spiral design was preheated for half an hour with town's gas using about 20 to 25 cub. ft. per min. The blast was then switched on and the gas burner kept going. After 13 min. the blast temperature was 430 deg. C. and after 25 min. it was 520 deg. C. The gas flame was then turned down to the normal pilot size of about 3 cub. ft. per min. and the blast was maintained at temperature by recuperation alone.

Lower Slag Volumes and Lower Limestone Consumption

The lower coke consumption and lower iron loss naturally makes possible a lower slag volume and thereby a reduced limestone charge. On the other hand, it might be thought that increased lining attack would tend to offset this. If, however, suitable refractories are used, the lining attack is not more than with cold blast (see later) and the general experience with hot blast is that slag volume and limestone consumption are reduced. For example, a malleable foundry with cold blast had a slag volume of about 6.7 per cent. reduced to 4½-5 per cent. on the introduction of cold blast.

Refractories for Hot-blast Cupolas

As has been already mentioned, the use of hot blast reduces the height of the melting zone but increases the temperature by some 200 deg. C. This has the effect of decreasing the length over which the slag attack takes place but increases the depth of that attack. In some foundries this means that the quantity of patching used per day is found to be about the same for hot blast as for cold blast, always provided that the tuyeres and blast pressures have been altered to suit hot-blast conditions.

It should be realised, however, that this rule is based on Continental experience, and where in any case it seems to be the rule rather than the exception to ram cupolas with monolithic lining rather than to brick them. Special refractories have been developed for hot-blast work, one of which is a natural material found near Cologne containing about 90 per cent. SiO_2 with 10 per cent. alumina. This, however, is not yet in common use and a safe rule with the more usual type refractories in use in Europe seems to be that the lining thickness of the cupola just above the tuyeres must be approximately 12 in. for a working day of 8-9 hrs. With the special material, longer working hours are possible as the following details from a refined pig-iron plant will show. The cupola was initially 28 in. int. dia. with a lining thickness of 8 in. When the special refractory mentioned earlier was used, the longest blow obtainable was 16 hrs. Subsequently, the cupola was enlarged at the bosh to give a lining thickness of 15 in. with the same internal diameter. At the same time a water jacket was placed on the exterior of the shell. With this arrangement, blows of up to 25 hrs. have been made and the standard day is now 18 to 19 hrs. with an average burn back of 12 in. a side. It should be noted, however, that this burn-out is limited to a height of 4 ft. above the tuyeres; above this height attack is negligible. Refractory consumption is about 35 lb. per ton of iron produced.

On the only hot-blast cupola working in Great Britain, so far, and working on a British rammed lining it has been found that refractory consumption is about the same with hot blast as with cold blast. Deepest burn back is about 6 in. a working day of 9 to 10 hrs., but this again is restricted to a height of 4 ft. above the tuyeres as against a shallower depth, but a greater height of 5 ft. for cold blast. A high-quality white fireclay is used for patching.

Other hot-blast operators have reported on the advantages of watercooling, which enables the cupola to work continuously.[5] This is accomplished both by spray water cooling of the shell and water-cooled tuyeres which protrude some way into the furnace interior. These presumably form a chilled slag lining to the cupola and thereafter the cupola works on this slag lining. There is nothing new in this conception and it has indeed been done before in other ways with cold blast.[7, 8] There seems to be some advantages in combining water cooling and hot blast, although the adaption of existing cupolas to both may be difficult; most plants can be adapted to hot blast only without great difficulty and without major alteration to the cupola itself.

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(To be continued)

Falkirk Foundry Exhibition

Social history in the form of scale models of bathrooms of different periods will be presented at the Municipal and Industrial Exhibition being staged in Falkirk Town Hall from August 29 to September 8. M. Cockburn & Company, Limited, ironfounders, Gowan Avenue, Falkirk, have constructed a group of three rooms which are on view at the exhibition. They are designed to show the progress in bathroom equipment during the last hundred years. Models are made accurately to scale, being ⅛th of the full size. In each case they are copies of bathroom furnishings taken from contemporary catalogues and other illustrations.

The first model is not strictly a bathroom at all, for in the year 1851 there were no separate bathrooms, except in very rare instances. The model shows a bedroom of the period with a painted iron hip bath placed in front of the fire. Water for this bath was brought to the bedroom in large ewers. The model is lit by the typical paraffin-oil lamps of the period, and the fireplace shown is a miniature reproduction of one actually produced by a foundry of the period.

By 1901, considerable progress had been made. Running water had been laid on, and the plumber was so proud of his work that he did not see any reason for concealing his pipes. Baths were of cast iron, and the interior of them was painted with enamel paint, usually to reproduce a marbled effect. In 1901, gas-lighting had become common. The third model shows a bathroom of the present day. Models of the rooms to be exhibited were made entirely, even down to the smallest ornament, in the workshops at the foundry. In charge of the work was Mr. Jack Stirling, who has succeeded in producing miniature masterpieces of household furnishings of the different periods.

TWENTY-SIX long-service employees of Lowe & Brookes, Limited, malleable ironfounders, of Blackheath (Staffs), received presentations of gold watches at a dinner held on August 17.

New Catalogues

Refractories. General Refractories, Limited of Genefax House, Sheffield 10, have sent us seven of their recently-issued catalogues. Now it so happens that there were at hand a number of earlier ones, so that it is possible to note publicity developments. Outstanding, and this constitutes a noteworthy advance, is the discarding of composite illustrations, which, when improperly delineated, the reviewer abhors. Dealing with the new arrivals in order of merit, into the highest class, the reviewer would place the leaflet covering "Durax 3"—a refractory cement. The purpose of the symbolic picture on the front cover is plain—to bring out the placing of the cement between the bricks in relief so as to make a net-work. The colours, text and illustrations have been well chosen. Next in order of merit the reviewer would place a 24-page catalogue covering Plastic K-N. The use of a rammer between the lower half of a pair of legs is intriguing, though not greatly inferior to page 1 which just repeats, on something under two-thirds of the page on a pale-blue section, the title of catalogue. Below is the monogram of the firm, whilst at the base, the name and address of the company are printed. The technical matter is also well presented. The front cover of "Sintex—Spraying and Hot-patching Cement" as arresting, for the spray pipe shown is such a very long one. The two covering Amberlite insulating material are so much alike that they must be bracketed; they are neat and dignified. Finally, there are two covering Durax; No. 1 is about a plastic firebrick composition, and No. 2 about refractory concrete. The former is of striking design in more senses than one and shows a pair of arms hammering in the refractory. This is a "cut-out" and in the background is a photograph of a man carrying out the task. The colour used, however, does not appeal to the reviewer. As to the leaflet covering Durax No. 2, the cover borders on the composite. There is as the centre-piece a shovel; it is a good shovel, but at the side the artist has incorporated a bucket rescued from the scrap heap. The complete range of publications shows versatility and thus a complete absence of the stigma of being stereotyped.

Core Binders. Full marks are accorded to Corn Products, Limited, Wellington House, 125-130, Strand, London, W.C.2, for the latest brochure covering cores, and castings made by use of the well-known Kordex group of binders. The excellently illustrated examples are first drawn from the iron foundry, then steel and brass and bronze, and finally from light-alloy foundries. These pictures—except one marred by a pendulous cigarette—have been well chosen and show a range of products of which the British foundry industry can justly be proud. The brochure is bound with a spiral wire, and for the front cover the repetitive design of the trade marks is used. This modern device may owe its origination to a 17th century Spanish architect, who decorated the walls of a palace with a shell pattern, the shadows from which gave a particularly intriguing appearance. This brochure is an excellent advertisement for the whole industry, and, because of this, it should find a place in every foundry "library." Copies can be obtained by writing to Wellington House (not 49, Wellington Street).

Since moving to Farnborough last year, the School of Gas Turbine Technology has been adding steadily to its range of instructional sectioned gas-turbine engines, and it is now claimed that the school possesses the best collection in the country, including a number of jet and turbo-prop types.

Nickel Earnings Up

Consolidated net earnings of $29,385,046 (U.S. currency), equal to $1.94 a share on the common stock for the six months ended June 30 last, are revealed in the interim financial statement of the International Nickel Company of Canada, Limited. This compares with $20,385,591, or $1.33 per common share, for the corresponding period a year ago. For the three months ended June 30 last, net earnings were $14,653,656, equivalent to 97 cents per share on the common stock, while in the March quarter net earnings amounted to $14,731,390, equal to 97 cents on the common, and in the second quarter of 1950 net earnings were $12,056,576, or 79 cents a common share.

Net sales for the six months totalled $131,567,537, compared with $106,125,254 for the corresponding period of last year.

London Aluminium Management

Following the resignation last month of Mr. Duncan Campbell and Mr. J. D. Campbell from the board of the London Aluminium Company, Limited, and the appointment of Mr. A. H. Johnson to the board and his election as chairman, an announcement on behalf of the company states that Mr. E. W. Wynn, a member of the shareholders' committee, and Mr. F. P. Webster and Col. C. A. B. Lindon have been appointed directors. Mr. Millership and Mr. Salvin have resigned their offices as directors and will devote their whole time to their duties as works managers.

A report by Peat, Marwick, Mitchell & Company, appointed in March to investigate the company's affairs, issued in May with the 1950 accounts, disclosed that the company had incurred a debit of £188,995.

Luxemburg Steel Output Declines

Although steel output in Luxemburg was lower in April and May than in March, it was, however, considerably higher than the average monthly production figure for 1950. Production in May totalled 250,841 tons, against 250,968 tons in the previous month. Pig-iron output in May totalled 259,758 tons, compared with 255,613 tons in April.

Under an agreement with Germany, the Grand Duchy will export 200,000 tons of iron ore by the end of this year. The mining industry is stated to be in a fairly satisfactory state at present. Exports to Belgium are increasing and France is now taking an interest in Luxemburg's iron ore. During April 392,777 tons were extracted; in March the figure was 406,167 tons.

Increased Tunisian Iron-ore Production

Exports of iron ore from Tunisia in the first four months of the year totalled 286,996 tons, of which 141,607 tons were shipped to the United Kingdom and 69,037 tons to the United States. Production in the four months ended April 30 was over 33 per cent. more than in the corresponding period of 1950, output in April being 85,783 tons, compared with 70,339 tons in March, with exports for the two months at 88,837 and 43,198 tons, respectively.

Stocks of ore at April 30 were 161,636 tons—113,574 tons at the ports and 48,062 tons at the mines.

Evaluation of Soundness in Cast Iron*

Report and Recommendations of Sub-committee T.S.20 of the I.B.F. Technical Council

(*Continued from page* 219)

ULTRASONIC FLAW DETECTION

Introduction

The use of ultrasonic waves for the detection of flaws in metals has become of considerable importance in recent years in steel and light alloy metallurgical practice and in the engineering and welding industries. Little information has been reported on the application of the technique to cast irons, and although it was known that the presence of free graphite greatly influenced the attenuation of ultrasonic waves, it was considered that some investigation of the application of the technique to cast iron should be made.

General

The simplest successful equipment for ultrasonic flaw detection consists of a transmitter capable of producing ultrasonic wave pulses in the frequency range ½ to 2½ megacycles per second, a receiver capable of detecting and amplifying weak ultrasonic wave signals, and a device for measuring intervals between the transmission and reception of ultrasonic wave pulses over a suitable time range. This time measurement is achieved by the cathode ray oscillograph. Such equipment may be used in two ways, the techniques being termed the shadow method and the echo-reflection method. These are discussed separately below.

(*a*) *Shadow Method*

If the transmitter and receiver probes are mounted opposite to each other upon two surfaces of a specimen, transmitted ultrasonic signals will proceed directly to the receiver, providing that (1) the attenuation is not excessive and (2) there are no major discontinuities blocking the direct path of the ultrasonic waves. A flaw will produce a shadow because there is almost total reflection at its boundary, providing that the flaw is more than a few wavelengths in width. If its area is sufficiently large to cover the whole of the receiver, the shadow will be virtually complete and no signal will be detected. If the flaw be smaller, a reduction in signal amplitude will be observed. The manner in which such reductions are observed is shown in Fig. 8.

It must be appreciated that since the energy is normally transmitted between the probes and the specimen by means of a fluid or plastic medium, signal amplitude will also vary with contact conditions. These contact conditions should be reasonably constant when comparing signal amplitudes upon various points on a specimen. Under ideal conditions, a machined surface would be used, but providing only relatively gross flaws are to be found, as-cast surfaces can be used.

A second requirement is that the attenuation due to the material itself should be constant. In this respect, graphite variation in cast iron would be expected to exert considerable influence when short ultrasonic wavelengths are used. This matter has been investigated and will be referred to later. For shadow testing, a directional beam of ultrasonic waves is desirable, and this condition is more closely approached as the diameter of the transmitting crystal is increased. Ideally, therefore, a large transmitter probe should be used. The receiver probe should be relatively small.

(*b*) *Echo-reflection Method*

In this method, the same general equipment is used. In brief, a pulse of ultrasonic waves is despatched from a transmitter *T* (Fig. 9), echoes from the opposite geometrical boundary, and is detected by receiver *R*. Echoes may also arise from the boundaries of flaws within the work itself, providing that the flaw is of sufficient size both in the direction of the beam and the normal plane to produce a detectable echo. The times between transmission and reception can be measured upon the cathode ray tube; the echoing pulse from a flaw *F* will return sooner than that from the boundary *B*. Thus oscillograms of the form shown in Fig. 9 can be obtained under suitable conditions.

Effect of Graphite Flakes on Ultrasonic Wave Propagation

Before presenting the results of experimental work, a short review of the effects likely to be produced by graphite flakes in grey irons is necessary. For ultrasonic wave propagation a grey iron is a far from homogeneous elastic medium. The graphite flakes present minute obstacles which produce scatter effects and hence more rapid decay in signal amplitude than a steel of similar matrix structure. The scatter will be more or less in all directions, and in an echo-reflection test some energy will be directed towards the receiver probe. Since scattered energy will be received from innumerable points at various distances the scatter effects will be observed over the whole time range. The echo-reflection oscillogram obtained is readily identified and is of the form shown in Fig. 10. The scatter pattern can be changed considerably by minute movements in

* Presented at the Newcastle-upon-Tyne Conference of the Institute of British Foundrymen by Mr. A. Tipper, with Mr. E. Longden, M.I.Mech.E., in the chair.

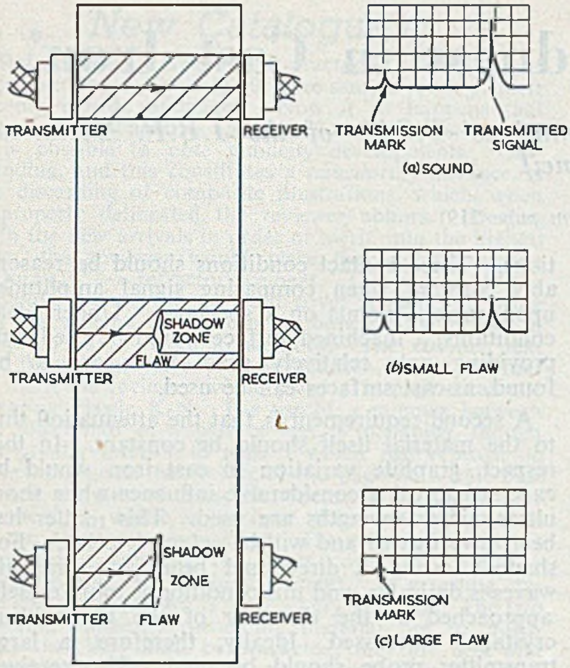

FIG. 8.—*Principles of the Shadow Method of Ultrasonic Flaw Detection.*

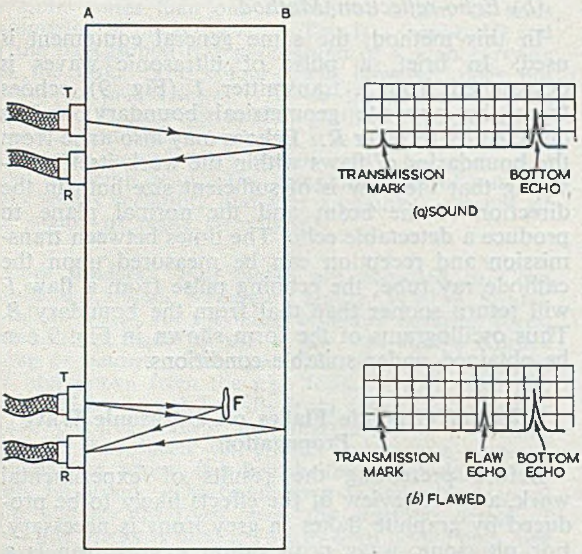

FIG. 9.—*Principles of the Echo-reflection Method of Ultrasonic Flaw Detection.*

the position of the receiver probe, whereas flaw echoes resulting from a specular reflection are not so affected, but the latter are not easily identified when accompanied by scatter.

Scatter can be reduced or even eliminated by an increase in wavelength due to the relative insensitivity of the waves to discontinuities appreciably less than the wavelength.* Doubling the wavelength for example will reduce scatter by a factor of four.

In carrying out a shadow or echo-reflection test, therefore, the wavelength should be as short as possible; if it is increased to overcome the masking effect of graphite flakes, porosity may escape detection if of the same size order as the graphite. It is important to appreciate this limitation, since it is the main factor affecting the application of the ultrasonic method to grey irons.

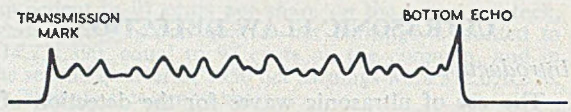

FIG. 10.—*Typical Diagram for Scattering Media (Reflection Test).*

With both methods it is to be expected that white and possibly malleable irons should behave similarly to steel and other homogeneous alloys, but grey cast irons will tend to exhibit scatter phenomena at higher frequencies and a relative insensitivity to the flaws at lower frequencies. Another effect of graphite flakes arises. There is an effect upon the velocity of ultrasonic waves which appears to be related to the low relative modulus of elasticity of cast iron. This has been generally confirmed for grey foundry iron, the velocity dropping to a minimum of some 5,000 metres per second as opposed to 5,970 metres per sec. for steel.

Relative Absorption Factor

In order to compare the absorption characteristics of different irons, the concept known as the "Relative Absorption Factor" has been developed. This is defined by—

$$A^1 = \frac{A_s - A_I}{A_s}$$

where A_s is signal amplitude through given length of steel, A_I is signal amplitude for same length of cast iron sample.

Thus for steel $A^1 = O$, while for irons exhibiting increasing absorption A^1 tends towards unity. Such measurements depend on amplifier linearity and hence do not have direct fundamental significance unless corrections are made. They do, however, provide a useful basis for comparison of irons in a given group.

Experimental Work and Results

(*i*) *Grey Iron Cubes* (*Code B1*)

This group of samples, designed to demonstrate the effect of varying graphite flake size, comprised a series of 6-in. cubes cut from three prismatic blocks cast with the long axis vertical. One pair of cubes was cut from each block as shown in Fig. 4, and the top and bottom faces of each cube ground. The six cubes were identified by the number 1, 2 or 3 of the block with the suffix TT or TB to indicate whether from the top or bottom half of the block.

* Frequency × wavelength equals the velocity (5,970 m. per sec. for steel). For a frequency of ⅝ mc., the wavelength is 9.6 mm.

Table II details the chemical composition of the blocks and summarises the results obtained from macroscopic, radiographic and general ultrasonic tests. Subsequent tests were carried out in an attempt to correlate the microstructure of 1 in. cubes cut from the larger cubes with ultrasonic absorption and velocity. The location of these smaller samples in the cubes is shown in Fig. 4.

Correlation of the reflection and shadow ultrasonic tests with the results of other tests is essentially qualitative, but a number of conclusions are possible.

(*a*) Samples 1TT and 3TT exhibited at low gain (*i.e.* trace amplification) a similar ultrasonic opacity which diminished with frequency. There was also a tendency to general scatter under higher gain conditions. These results are in accordance with the radiographic and macroscopic evidence if the effect of graphite is eliminated, *i.e.* from consideration only of results obtained at ⅝ Mc.

(*b*) Sample 2BT exhibited low opacity at ⅝ Mc with a much smaller amplitude gradient from edge to centre. This sample was found radiographically and macroscopically to be relatively sound.

This brief survey suggests that between the three samples 1TT, 2TB and 3TT there is a general cor-

TABLE II.—*Composition, Microscopic, Radiographic and Ultrasonic Properties of Test Specimens.*

Cube No.	Percentage chemical composition							Visual examination of top surface	Radiographic and macro tests	Micro tests ½ in. from edge of block at 60 dias.
	T.C.	G	Si	Mn	S	P	Ni			
1 TT	3.36	2.72	1.94	1.06	0.08	0.93	—	Somewhat "loose." Large irregular cavity on one side	Somewhat loose structure surrounding large contraction cavity	Top 1 TT : Long fine flakes (numerous) (¼ in. × 1 in.). Bottom 1 BT : Long flakes with slightly coarser characteristics (less numerous) (¼ in. to 1 in.).
1 TB								Somewhat "loose"	—	—
2 TT	2.88	2.02	1.11	0.92	0.10	0.27	1.19	Spongy central zone otherwise appears solid		
2 TB								Appears solid	Generally homogeneous. Fine porosity locally	Top 2 TB : Short and coarser flakes than 1TT. Bottom 2 BB : Shorter and finer flakes than 1 TT.
3 TT	3.09	2.20	1.41	1.12	0.09	0.59	—	Traces of fine porosity generally	Extensive shrinkage porosity in central zones	Top 3 TT : ¼ in. to 1 in. long flakes, fewer than 1 TT. Bottom 3 TB : ¼ in. to ½ in. long flakes, fewer than 1 TT.
3 TB								Traces of fine porosity generally	—	—

Cube No.	Reflection test axially			Shadow test axially		Rel. absorption factor	Velocity, m./sec.
	Frequency, Mc.	Bottom echo amp. in.	Notes	Transmitted signal amp. in.	Notes		
1 TT	⅝	—	No. echo	⅛–1	Max. at edge	—	—
	1¼	—	"	—		—	—
	2½	—	General scatter—low amp.	—		T. O.90 B. O.88	T. 5250 B.5100
1 TB	⅝	0–½	Local ¼ two positions	¼–1½	Max. at edge	—	—
	1¼	0–⅛	Plus general scatter	—		—	—
	2½	—	Well-defined general scatter	—		—	—
2 TT	⅝	½–¾	No echo in centre	½–1	Max. at edge	—	—
	1¼	1	Sharp in peripheral zone	—		—	—
	2½	—	General scatter ½ in. amp.	0–⅛	Max. at edge—zero over large central zone	—	—
2 TB	⅝	¼–½	Improves towards edge	1¼	General	—	—
	1¼	1	Sharp echoes	—		—	—
	2½	—	General scatter ¼ in. amp.	$\frac{1}{16}$	Barely detectable	T. 0.50 B. 0.90	T.5700 B.5700
3 TT.	⅝	¼–⅜	Very diffuse—no echo at centre	0–1¾	Max. at edge	—	—
	1¼	0–¼	Ditto, ¼ in. in two places	—	—	—	—
	2½	—	General scatter ¼ in. amp.	0–$\frac{1}{16}$	Max. at local spots on edge	T. 0.50 B. 0.90	T.5450 B.5450
3 TB	⅝	⅜–½	General scatter—low amp.	¾–1½	Over whole surface	—	—
	1¼	⅛–⅜	General scatter—diffuse	—	—	—	—
	2½	—	General scatter—½ in. amp.	—	Not discernible	—	—

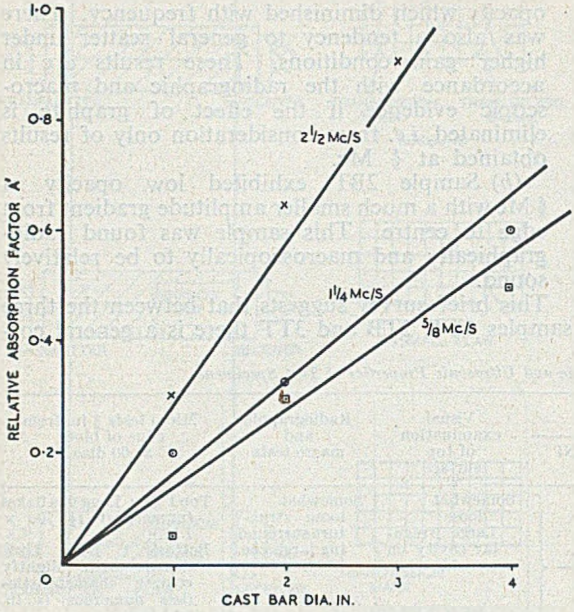

FIG. 11.—*Effect of Diameter of the Cast Bar on the Relative Absorption Factor.*

relation suggesting that unsoundness has had a greater effect on the ultrasonic characteristics than have the graphite flakes. Comparison of the results of micro-examination with the relative absorption factor and velocity results from Table II indicates, however, that the order of increasing coarseness of graphite corresponds with that of increasing absorption factor and decreasing velocity. (Note also that the graphitic carbon contents are similarly graded.)

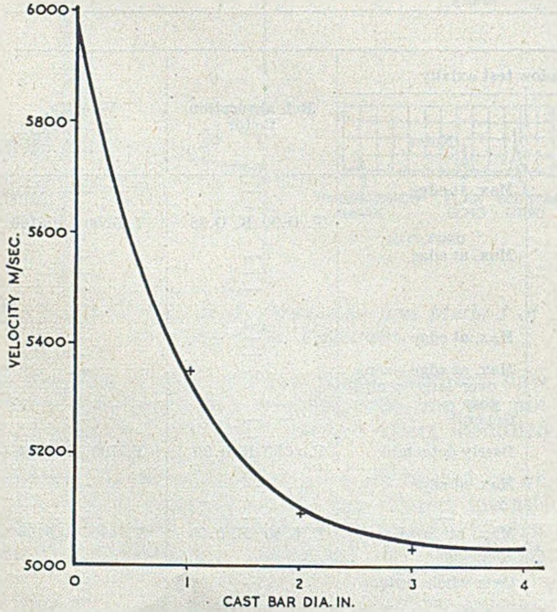

FIG. 12.—*Effect of Diameter of the Cast Bar on Ultrasonic Velocity (at 1¼ Mc.).*

Moreover, the reflection and shadow tests on cube 2TT, considered to be virtually sound, have indications of greater opacity towards the axis, probably due to the change in the graphite content and size towards the peripheral zone. Thus the graphite content and flake size and the unsoundness are seen to be fortuitously arranged in these samples in the same order and it is impossible to separate the effects of each for analytical purposes. At ⅝ Mc. the absorption attributable to graphite is low and any opacity under these conditions may be confidently attributed to unsoundness. Sensitivity to flaws due to the use of wavelengths of 9.6 mms. is low, however, and gross unsoundness only could then be detected, *e.g.*, a ¼-in. drilled hole could be detected in a 6-in. cube by suitable selection of gain and frequency.

Summary

The original purpose, to investigate the effect of graphite, has been defeated by the unexpected introduction of a second variable, unsoundness. The use of other methods of test on these cubes in addition to the ultrasonic method has, however, established that whilst practical results are obtainable by ultrasonic methods on the coarser graphitic irons, a serious reduction in flaw sensitivity must be recognised.

(ii) Cast Bars of Varying Diameter. (Code C)

This series designed to show the effects of varying graphite size, uncomplicated by unsoundness consisted of four cylindrical bars 4 in. long by 1 in. diameter, machined from the centres of four 6 in. long bars cast 1¼ in., 2 in., 3 in. and 4⅛ in. diameter, respectively, wide differences in graphite size being anticipated through differences in the rates of cooling of the various bars.

Percentage Chemical Composition (Si, 1.85; Mn, 0.86; S, 0.064; P, 0.16; and Ni, 1.09).

As cast dia.	1¼ in.	2 in.	3 in.	4⅛ in.
Total C, per cent. ..	2.97	2.97	2.97	2.97
Graphite, per cent. ..	2.21	2.195	2.195	2.20
Combined C, per cent.	0.76	0.775	0.775	0.77

Experimental

Shadow tests and ultrasonic velocity tests were carried out on all four samples in the axial direction and the relative absorption factor and velocity plotted as a function of the initial bar diameter. Three separate frequencies were used in the absorption tests, but velocity tests were carried out at 1¼ Mc. only. The results are given in tabular form in Tables III and IV and the various relations shown graphically in Figs. 11 and 12.

Results

There was a striking increase in the relative absorption factor with bar diameter, approaching complete opacity on the largest bar at 2½ Mc. Again at low frequencies there was appreciable absorption in the coarser graphite irons. There was a corresponding increase in opacity with frequency

TABLE III.—*Variation of Relative Absorption Factor with Bar Diameter.*

Cast bar dia. in in.	Relative absorption factor		
	2½ Mc.	1¼ Mc.	⅝ Mc.
Steel	0.00	0.00	0.00
1⅛	0.30	0.20	0.05
2	0.65	0.33	0.30
3	0.90	0.50	0.50
4⅛	0.95	0.60	0.50

TABLE IV.—*Variation of Velocity with Bar Diameter (at 1¼ mc.).*

Cast bar dia. in in.	Velocity, m./sec.
Steel	5,070
1⅛	5,350
2	5,100
3	5,030
4⅛	5,030

on any one bar. In this connection some very interesting results were recorded, *viz.*:—

(*a*) Whilst marked differences in the absorption factor resulted from the change from ⅝ to 1¼ Mc. in the 1⅛ in. bar, no appreciable differences were noted in the larger bars.

(*b*) The low absorption factor exhibited by the 1⅛ in. bar to ⅝ Mc. signals (closely similar to the behaviour of steel) suggested that some critical condition existed, possibly indicating that few or no graphite flakes approached in size the wavelength of the transmitted beam.

The curve shown in Fig. 12 indicates a progressive reduction in ultrasonic velocity with increase in bar diameter and in view of the similar composition of the specimens it is evident that this represents a variation in the coarseness of the graphite.

Summary

These tests, as far as they go, probably represent a sufficient freedom from complication to enable the effects of graphite alone to be studied. They confirm the marked attenuation of high frequencies already suspected and indicate that even at the lowest frequencies in practical use, attenuation is quite appreciable. The possibility of using ultrasonic velocity in the evaluation of unsoundness does not appear to be promising since it is clear that graphite will have a considerable masking effect on the variations due to unsoundness.

(*iii*) *White Iron Bars* (*Code G*)

A series of specimens was prepared in the form of rectangular bars 6 in. by 2½ in. by 1 in. in unannealed white iron, with graded unsoundness produced artificially. Specimens identified by numbers 0, 2, 2*A*, 3 and 5 were chosen as providing a progressive variation in the degree of unsoundness as determined radiographically.

The 6 in. by 2½ in. as-cast face of each bar was scanned by the shadow method using a frequency of 1¼ Mc. for direct comparison with radiographs taken normal to this plane, but additional absorption tests were made in the other two axial directions.

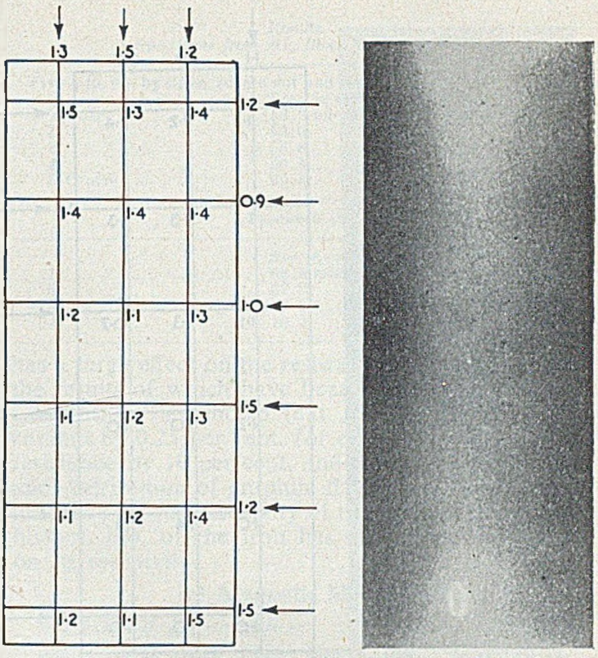

FIG. 13.—*Un-annealed White Cast-iron Bar (Code G) No. O. Scanned by the Shadow Method, shown alongside Radiograph taken Normal to the Plane.*

Results

A constant input signal amplitude was maintained and the transmitted signal amplitudes are plotted on an elevation of the bar in Figs. 13 to 17 respectively;

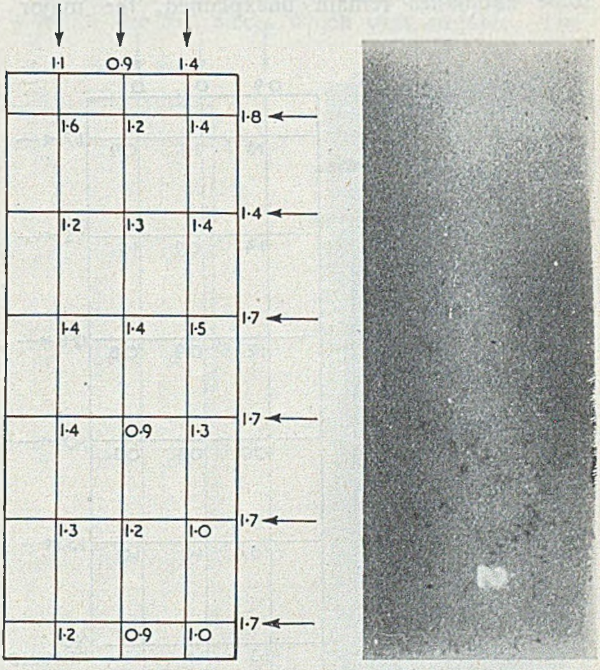

FIG. 14.—*Un-annealed White Cast-iron Bar (Code G) No. 2. Scanned and Radiographed in Similar Manner to Fig. 13.*

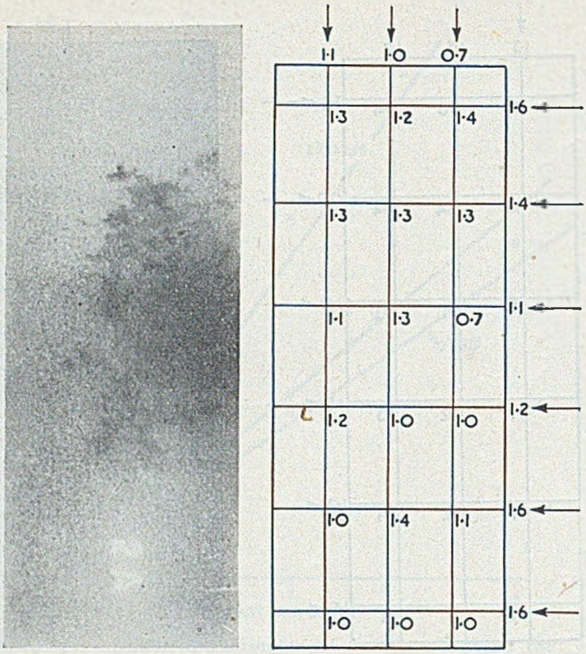

Fig. 15.—*Un-annealed White Cast-iron Bar (Code G) No. 2A; Scanned and Radiographed.*

for comparison, a print of the radiograph is mounted alongside with a similar orientation.

Summary

It is clear that a good correlation exists between the radiographic and ultrasonic results, and whilst some anomalies remain unexplained, the major defects are obviously located and the defective areas delineated by the method. The principal virtue of this technique is the opportunity offered to assign a quantitative measure to the unsoundness, but the quantities so quoted are not related by any simple function to any accepted scale of absolute soundness, *e.g.*, the relative proportions of solid material and cavities along the line of beam. Much more work would be necessary to establish the actual relationship. Fine defects again escape detection for the reasons previously outlined.

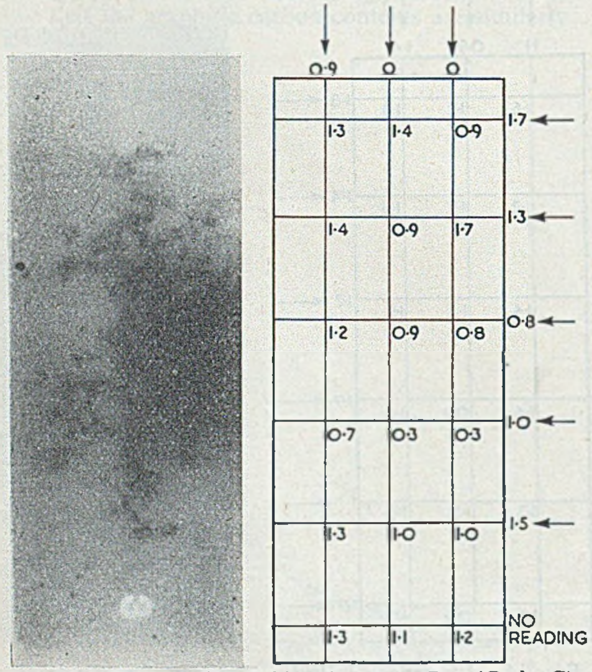

Fig. 16.—*Un-annealed White Cast-iron Bar (Code G) No. 3; Scanned and Radiographed.*

General Summary

Since ultrasonics and radiography appear to constitute the two most promising methods examined, it is reasonable to consider their relative merits. The principal advantage of ultrasonics lies in its application to thick sections beyond the range of X-rays. Both are affected by surface condition and are insensitive to uniform dispersion of fine porosity, but radiological methods will detect local concentration of porosity which may, particularly in grey cast iron, escape detection by ultrasonic methods. Whilst radiography provides a permanent record of the condition of a specimen, this is offset to some extent by the more rapid application of ultrasonics. Both require the services of an experienced operator particularly in interpretation of the results.

Of several possible ultrasonic techniques three have been investigated, *viz.*:—(i) Reflection method, (ii) Absorption (*a*) shadow method, (*b*) relative absorption factor method, and (iii) Velocity measurements. Of these, the last seems the least promising, and the second in one of its two possible variations appears to offer the greatest scope.

The limitations imposed on all three tests mentioned above by the marked effects of free graphite on ultrasonic transmission are a serious bar to its general application and also result in a marked difference in the use and sensitivity of the method to white and grey irons.

ELECTRICAL AND MAGNETIC METHODS

Introduction

The electrical and magnetic methods employed consisted of the measurement of (*a*) magnetic permeability, (*b*) electrical resistivity and (*c*) other magnetic tests. As far as is known, none of these methods has been used generally for the detection of unsoundness in castings, though some are known to have been of value when all the variables except the unsoundness sought have been eliminated; these applications have however been few and favoured by special circumstances.

(a) Magnetic Permeability

General

A disadvantage which applies to all the electrical methods is that in general the specimen must be of some simple geometrical form, which usually implies that a test piece must be cut out of the casting. In the case of permeability measurements there is a further disadvantage in that, although a rectangular or round bar or an annular ring for example can be used, the sizes are limited to those which can be accommodated in available apparatus.

Method of Examination

For the following tests a modified version of the equipment described in B.S.406 was used. The permeability results quoted were obtained by direct measurement of the field strength alongside the specimen for a flux density in the range 5,000 to 8,000 lines per sq. cm.; the permeability figures are thus directly comparable.

Discussion of Results

The permeability of malleable iron both annealed and unannealed does not seem to bear any relation to the soundness of the specimen; in the case of grey iron, however, there is an appreciable and

Results
Specimens A1 and A2

Condition	White iron	Annealed white iron	Grey iron	Steel
Sound ..	P.S.1.A. 354 P.S.1.B. 270	P.S.2.A. 1200 P.S.2.B. 1200	W.S.1. 242 W.S.2. 222	1630
Unsound ..	P.U.1.A. 341 P.U.1.B. –	P.U.2.A. 1280 P.U.2.B. 1440	W.U.1.A. 160 W.U.1.B. 168 W.U.2.A. 170 W.U.2.B. 181	

Specimens C.

Test bar	Permeability
1	200
2	227
3	227
4	203

fairly consistent difference between the sound and unsound specimens. The size of the graphite does not seem to have any great influence on the permeability.

(b) Electric Resistivity

General

Similar remarks to those under permeability apply in respect of specimen size, except that a ring is not suitable and that, for accurate results, the specimen should be long relative to its cross-section.

Method of Examination

The method used consisted in passing a d.c. current through the specimen to which were attached two pick-up points; the voltage between these points was balanced on a bridge circuit and the specific resistance obtained from this figure and the known cross-sectional area.

Discussion of Results

A marked degree of unsoundness is reflected in an appreciable rise of resistance, but insufficient work has been undertaken to say whether the change is proportional to the effect in other than this one extreme case. Here again the resistance does not seem to be greatly affected by the graphite size. This result is rather surprising, particularly as it is known from other work that chemical composition

Results.
Specimens from B1, Block 2, Section T.

Five ½ in. sq. by 6¼ in. pieces cut and marked :—

	Specific resistance
1 Outer	53.8 microhms/cm³ at 20° C.
2	55.0
3	55.8
4	56.1
5 Centre	69.5

Specimen C.

	Specific resistance.
1	68.4 microhms/cm³ at 24° C.
2	67.2
3	69.0
4	70.2

has a large effect on the resistance. This other work, the results of which have been made known to the Committee, has shown that increasing the silicon content by 0.25 per cent. for example, increases the resistance by 10 per cent. and that the size, amount and distribution of graphite flakes has a controlling influence on the resistivity of the iron. The thermal history, too, of the iron has an appreciable effect on its resistivity.

(c) Magnetic Methods

Method of Examination

Some tests were made using the "Magnaflux" method in which two poles of a strong magnet were bridged by the specimen. A suspension of magnetic particles in fluid contained in a transparent cell was used to make visible the distortion of the field due to defects in the specimen. As this method, however, is applicable only to surface and immediately sub-surface inhomogeneity, it was not further considered.

A magnetic sorting bridge method was tried with some of the test pieces which were suitable. The

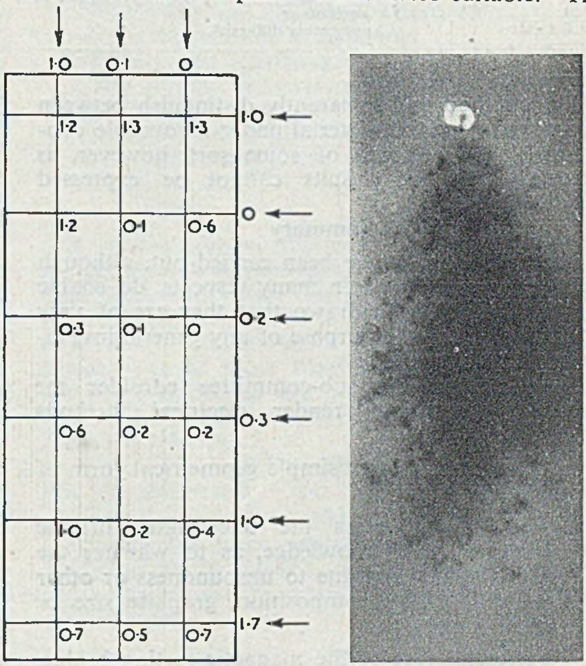

FIG. 17.—*Un-annealed White Cast-iron Bar (Code G) No. 5; Scanned and Radiographed.*

Evaluation of Soundness in Cast Iron

apparatus consists of two matched magnetising coils into which the specimens are placed. Two matched pick-up coils associated with the magnetising coils are connected in opposition so that if the specimens have the same magnetic properties the resultant output is nil. When suitably amplified, any out of balance of the pick-up coils, the result of a difference between the specimens, can be made visible as a pattern on a cathode ray tube or indicated on a meter. In these tests the former method was employed.

Results—Specimens A1 and A2

As the specimens have to be of comparable size within reasonable limits, only where there were matched pairs could the bridge be brought into balance. The apparatus was desensitised so that P.S.1.A. and P.S.1.B. appeared to be the same, and the indications then noted were:—

Ref. specimen	Comparison specimen	Remarks
P.S.1.A ..	P.S.1.B ..	Adjusted to be the same
	P.U.1.A ..	Slight difference
P.S.2.A ..	P.S.2.B ..	Same
	P.U.2.B ..	Considerable difference
W.S.1	W.S.2	Same
	W.U.1.A ..	Some difference
	W.U.1.B ..	Rather less difference
W.U.1.A ..	W.U.1.B ..	Difference comparable with their relative divergence from standard W.S.1.

Specimens from B1, Block 2, Section T.

Five ½ in. sq. by 6½ in. pieces cut and marked :—

1	Outer	Reference specimen
2	.. ..	Small difference
3	.. ..	Slightly different, but generally similar to each other
4	.. ..	
5	Centre	Appreciably different.

Discussion of Results

This method will apparently distinguish between sound and unsound material under favourable conditions. A reference of some sort, however, is necessary and the results cannot be expressed quantitatively.

Summary

The tests which have been carried out, although admittedly inadequate in many respects, do enable the conclusion to be drawn that they are of very limited value for the purpose of any general investigation into unsoundness.

In particular the sub-committee consider the following limitations render electrical methods unsuitable:—

(*a*) The need for a simple geometrical form of specimen.

(*b*) In many cases the uncertainty in the absence of other knowledge, as to whether the results obtained are due to unsoundness or other variables such as composition, graphite size or thermal history.

(*c*) In the case of the magnetic sorting bridge, the lack of quantitative figures.

(*To be continued*)

Engine Research Association's Officers

Last year's president of the British Internal Combustion Engine Research Association, Viscount FALMOUTH, was re-elected for the year 1951-52 at the recent annual general meeting. Chairman of the National Gas & Oil Engine Company, Limited, he is president of the Gas Research Board and since 1947 he has been chairman of the Imperial College of Science and Technology, London. In 1937 he was chairman of a Government committee on the production of oil from coal and from 1936 to 1941 he served on the Fuel Research Board. A past-president of both the British Electrical Development Association and the British Electrical Research Association, Viscount Falmouth was a member of the executive committee of the National Physical Laboratory from 1935 to 1940 and of the advisory council of the Department of Scientific and Industrial Research from 1936 to 1941.

The meeting also re-elected as vice-presidents of the association Air Commodore F. R. BANKS, technical manager of Associated Ethyl Company, Limited, DR. S. F. DOREY, F.R.S., chief engineering surveyor of Lloyd's Register of Shipping, who earlier this year was elected president of the Institute of Marine Engineers, Vice Adm. the Hon. D. C. MAXWELL, Engineer-in-Chief of the Fleet since 1950, and Lt.-Gen. SIR FREDERICK G. WRISBERG, who was Controller of Supplies at the Ministry of Supply from 1946 to 1949. A newly elected vice-president is Major-Gen. H. E. PYMAN, Director-General, Fighting Vehicles Division, Ministry of Supply.

Metropolitan-Vickers Directors

DR. C. DANNATT, the chief electrical engineer of Metropolitan-Vickers Electrical Company, Limited, has become the company's director of research and education, and assistant managing director. In 1921 he joined Metrovick as a college apprentice, later taking charge of the electrical and magnetic section of the research department. In 1936 he was awarded the degree of D.Sc. by Durham University and was appointed to the chair of electrical engineering at the University of Birmingham in August, 1940, but, at the request of the Admiralty, he continued part-time activities with the company. A recognised authority on electrical measurements, especially in regard to magnetism and the behaviour of dielectrics, he is the author of numerous Papers to scientific and engineering societies.

He succeeds SIR ARTHUR P. M. FLEMING, who is remaining on the board. Sir Arthur, who joined Metrovick in 1902, was president of the Institution of Electrical Engineers in 1938-39 and a member of the War Cabinet engineering advisory committee in 1941, in which year he was awarded the Faraday Medal of the I.E.E. MR. H. WEST, the company's assistant chief electrical engineer, has succeeded Dr. Dannatt as chief electrical engineer and has joined the board.

Application of Time-study Moulding Operations

By G. Martin

Time-study is still frequently considered to be in the main a means of obtaining standards for piece-rate payments or wage-incentive schemes. However, even more fruitful than this application of time-study is its utilisation as a basis for scientific progressing and planning. The following is an account of the method and application of time-study in a Continental foundry producing about 70 to 100 tons of grey iron and steel castings per day in sizes ranging from a few pounds to many tons. The foundry consists of two sections, one semi-mechanised for the production of smaller castings, and the other a jobbing foundry for the few-off type, mainly for the larger sizes. The present system was introduced about three years ago and by now covers the entire machine- moulded production and about three-quarters of all jobbing work.

Application of Time Study

The actual time-studying at the Continental foundry is carried out by a member of the production department, who is a trained production engineer with many years' experience in foundry work. No timing is ever delegated to any apprentice engineer and no job is timed without previous consultation with the foundry manager and the appropriate foreman. The actual timing is not done by means of a stop-watch, but with a special recording clock which marks a paper strip, thus producing a permanent and direct record. When important jobs are investigated, a shop steward is usually present during the test and the active interest of the workers is at all times encouraged.

Measurement and Computation of Standard Job Times

In accordance with the general method of time-study, each job is split into the elemental operations making up the production cycle, which are timed individually. All interruptions and ancillary operations forming part of the moulding operation are also timed. Each moment of the worker's time during the test is therefore accounted for. Typical job elements for a machine moulder would be:—(1) Clean the pattern plate; (2) lift the moulding box on to the machine; (3) dust the pattern; (4) sieve facing sand; (5) fill up; (6) jolt/squeeze; (7) level-off; (8) vent; (9) cut runners and risers; (10) vibrate and lift-off; (11) place the base plate on the conveyor; (12) place the mould on the base plate; (13) dust with mould dressing; (14) assemble the cope and drag, and (15) move the mould to the casting station.

Items 1 to 13 are timed separately for cope and drag. The sum of the averages of five to ten observations of each element is the actual time required to produce one mould.

Theoretically this should be multiplied by an effort-rating factor to allow for the worker's intensity of effort: he may have been idling, for instance. In practice, a suitable choice of moulder permits the observer to neglect this factor and the actual time becomes the normal time for the job.

Added to this are allowances for interruptions and ancillary operations, which are also determined from a time-study record. As they may amount to an appreciable percentage of the normal time it is important that their determination be accurate and their extent be agreed upon by all concerned. In this particular foundry, these losses, expressed as a percentage of the normal time, have for the mechanised section been determined to be as follow:

Preparation of work-place and flasks ..	2.5
Interruptions by foremen and charge-hands	0.6
Interruptions by other workers ..	0.5
Waiting for cores, fetching cores ..	0.4
Waiting for flasks and tools	0.4
Waiting for help	0.5
Fetching facing sand	1.4
Fetching nails, dusting powders, *etc.* ..	1.0
Brief mechanical breakdowns	2.1
Repairs and patching of moulds ..	3.1
Tea breaks, personal needs	6.0
Collection of pay	1.8
Helping others	0.3
Preparing moulds for casting	0.7
Cleaning up	3.7
Total	25.0

A further allowance is made for the decrease of performance with increasing weights to be handled. This allowance varies from 1 per cent. for a turnover of 300 lb. per hr. to 35 per cent. for a turnover of 10 tons or more per hour. Mechanical breakdowns of more than half-an-hour's duration are not included in the above list. The standard time (S.T.) is then computed from the normal time (N.T.) as follows:

$$\text{S.T.} = \text{N.T.} \times \frac{\text{p.c. loss allowance} + \text{p.c. weight allowance} + 100}{100}$$

Exactly the same procedure of time-study and computation is applied to the jobbing section, though of course the actual job elements and losses are different.

Compilation of Standard Tables

Generally, job elements can be divided into three

Application of Time-study to Moulding Operations

groups:—(1) Elements independent of size and complexity of mould, *e.g.*, placing the base plate on the conveyor, jolt/squeeze, etc.; (2) elements depending on the size of the mould only, *e.g.*, filling with backing sand, and (3) elements depending both on size and complexity of mould, *e.g.*, withdrawing the pattern and covering the pattern with facing sand. Three sets of tables are therefore prepared The first contains a list of all job elements (the performance of which can be considered independent of size and complexity factors) and the standard times required for each. In the case of job elements depending mainly on the size or weight of the mould, graphs are plotted of standard-time *versus* mould size or weight. Marked irregularities of these graphs immediately show up whether any other factors have influenced the performance time. Generally it has been found that smooth curves could be plotted and values between the experimental points extrapolated with considerable accuracy.

In the case where complexity affects the performance time, such as in most floor-moulding job elements, the standard-times for these elements are plotted as a function of the complexity and, where applicable, the size as well. For this purpose, all patterns have been graded into three degrees of complexity: simple single-piece patterns, complex single piece patterns and simpler patterns composed of several parts and complex patterns with many loose pieces, re-entrant angles, *etc.* These three degrees have been found sufficient for all purposes. The standard time for each job can then be worked out by selecting the standard times for the appropriate job elements and adding these times together.

Application of Results

The immediate result of the timing of any particular job is of course the determination of the standard-time for the completion of that particular job. It is, however, the complete breakdown of all results into their elements and the compilation of standard tables which give the system of time-study its universal applicability and use in every branch of foundry management. The following applications have been found particularly valuable:—

(1) The estimation of standard times and piece-rates for new patterns. As described above, this is carried out by the addition of the standard-times for the job elements. The process of working-out quotations for orders is also vastly simplified and invariably accurate.

(2) The planning and progressing of orders through the foundry. An exact knowledge of the time required for moulding enables accurate forecasts to be made of the daily number of moulds which will be produced and therefore of the metal requirements.

(3) Efficient planning of layout and handling methods in the moulding section. A knowledge of the exact time spent on each operational element, in particular the handling and transporting elements, enables the manager to note immediately any " bottlenecks " and any operations which are prone to complications. This knowledge also serves to indicate operations where modification of the existing processes would be particularly beneficial.

As the determination of the standard tables is always carried out in continuous consultation with both management and labour representatives, it has been found that the number of disagreements on piece-rates has been greatly reduced, as compared with those occurring under the old system, where piece-rates were more or less fixed by guesswork. The output per man per month was raised by 130 per cent. following the introduction of the present system, without any major changes of layout or equipment. It is planned to extend the time-study system also to core-shops and fettling-shops. The extra number of staff required was considered quite negligible compared with the far greater production efficiency achieved. Particularly interesting was the attitude of the labour force, who from being initially staunch enemies of all " scientific messing about with clocks," are now the most ardent supporters of the scheme and the first to call, on the introduction of new methods, for time-study checks to be carried out.

It should be stressed that it was found that jobbing work is just as amenable to analysis as machine production. Once the standard tables have been compiled for a given foundry, and of course they differ considerably in different works in their details, they can be brought up to date on the introduction of a new process merely by changing the data for the job elements affected by the new process. In the opinion of the superintendent of the foundry using this system, no other single factor can help so much in increasing production efficiency as the general application of time-study to all foundry production processes.

Export Trade Recovery in July

Britain's overseas trade gap has again exceeded £100,000,000. The adverse balance in July is provisionally estimated at £127,100,000, which is a reduction of £21,800,000 on the previous month, this being entirely due to a recovery in export trade. Imports, in fact, attained a new peak of £358,900,000, being £1,400,000 above the June record. This was, however, the smallest increase since February last. Exports in July, including re-exports, totalled £231,800,000, which was less than £10,000,000 below the record levels of April and May. North American exports also improved, while those to Canada totalled £15,600,000, setting up a new record. The visible adverse balance for the seven months of the year has now risen to £679,300,000, which compares with £347,900,000 for the whole of last year.

Exports in July amounted to £222,200,000, which was 7 per cent. above the average for the first half of the year, but still some £8,000,000 below the April and May peaks. The value of exports in the first seven months of the year was equivalent to an annual rate of 16 per cent. above 1950. Re-exports during July were valued at £9,600,000, which was £1,000,000 above the June figures.

News in Brief

MONTROSE FOUNDRY, LIMITED, propose to extend their premises.

DUNLOP RUBBER COMPANY, LIMITED, are to build a single-storey extension to their factory at Dunfermline.

GOLDENHILL FOUNDRIES, LIMITED, have had plans prepared to extend their premises at Longbridge Hayes, Newcastle, Staffordshire.

METALOCK (BRITAIN), LIMITED, on stand No. 52, outer-row gallery, grand hall, are showing at Olympia their process for joining fractured metals.

THE TELEPHONE NUMBER of the FOUNDRY TRADE JOURNAL stand at Olympia (Grand Hall, Ground Floor, Row F, Stand 13) is RENown 5122.

FROM SEPTEMBER 10, the address of British Insulated Callender's Cables, Limited, Dublin office, will be: 53, South William Street, Dublin, C.1.

THE REPORT on the American Brassfoundry Industry will cost 7s. 6d. each, with a discount of 10 per cent. for quantities of 20. It is expected to be available about the third week in September.

ALTERATIONS are to be carried out to a two-storey building at Burnbank Main Street, Bainsford, Falkirk, for Stirling County Council, to be used as a school for the training of apprentices in the light iron castings industry.

THE DIRECTORS of the A.B.C. Coupler & Engineering Company, Limited, propose to double the company's authorised capital to £200,000 and make a capital bonus issue of one new ordinary share for each ordinary 1s. share held.

A CONTRACT for the erection of 928 miles of high- and extra high-tension transmission wires in Northern Queensland, Australia, has been awarded to British Insulated Callender's Construction Company, Limited. The contract is worth £A1,369,489.

THE WORKS of Dean, Smith and Grace, Limited, lathe manufacturers, were thrown open to the public on August 25, and most of the firm's employees took advantage of the opportunity to show their families and friends over the extensive factory.

A COMPANY named the British Metal Corporation (Pakistan), Limited, has been formed by the British Metal Corporation, Limited, and Henry Gardner & Company, Limited, with registered offices at 7, West Wharf Road, Karachi, 2, Pakistan.

AN ORDER for a continuously-operating furnace installation for the carbo-nitriding of engine gearbox parts, the first of its kind to be built in the U.K., has been placed with the General Electric Company, Limited, by an important firm of motor-car manufacturers in Paris.

THE BRITISH IMPORT UNION IN DENMARK, an organisation founded to increase the flow of British goods into Denmark, is planning to hold a big British exhibition in Copenhagen in 1955, its silver jubilee year. Over 1,000,000 people visited the union's exhibition at Copenhagen in 1948.

AITON & COMPANY, LIMITED, pipe-work engineers, of Stores Road, Derby, had a record attendance of over 3,000 people at their annual Gala Day. The directors had also invited about 150 from the firm's Southwick works, Sunderland. The gala was held on the Sports Ground, Raynesway, Alvaston, Derby.

FROM A BROCHURE received from the Società Italiana Acciaierie Cornigliano of Genoa, we learn that the company *inter alia* operates both a heavy and light steel foundry, the combined output of which totals 10,000 tons a year, the weight of the individual castings ranging from a few pounds to 150 tons.

THE EAST KILBRIDE DEVELOPMENT CORPORATION, near Glasgow, announce that James Deere & Company, Limited, are to erect a works which will manufacture agricultural implements. This firm, which is entering business in Europe for the first time, is already well known throughout the United States and Canada.

THE City and Guilds of London Institute for the advancement of Technical Education, announce the appointment of Mr. J. W. Voelcker, A.C.G.I., B.Sc., A.M.I.E.E., as secretary of the Institute to succeed Mr. G. C. Stephenson, A.C.A., who has now retired, but who will continue to help and advise in the work of the Institute.

A. H. HUNT, LIMITED, electrical engineers, of Wandsworth, London, S.W.18, announce that to raise up to £50,000 for financing current requirements, shareholders registered on August 10 are to be offered 100,000 ordinary 4s. shares at 10s. a share by means of provisional allotment letters at the rate of four new shares for every 25 held. Subscription has been guaranteed by Kleinwort, Sons & Company.

DIVIDEND CONTROL has caused Johnson, Matthey & Company, Limited, precious metal smelters, etc., of Hatton Garden, London, E.C.1, to amend its offer to shareholders of 737,776 new ordinary shares at 58s. a share. The offer was based on a prospective dividend of 15 per cent., but the company now states that under the Government proposals it will be unable to pay more than 13½ per cent. The directors therefore now propose to offer the shares at 54s.

ALMIN, LIMITED, the parent company of the Associated Light Metal Industries group, will feature the products of the following firms in the Engineering, Marine and Welding Exhibition:—Southern Forge, Limited, Langley, Bucks (aluminium-alloy sections, tubes and forgings); Renfrew Foundries, Limited, Hillington, Glasgow (aluminium-alloy sand and die castings); Structural & Mechanical Development Engineers, Limited, Slough, Bucks (aluminium structures and prefabricated buildings).

SOME TIME AGO the Traders' Road Transport Association received a complaint from a member that because of existing customs regulations it was practically impossible for a "display" van from Britain temporarily to enter Belgium. As a result of representations the Belgium authorities undertook to revise their regulations provided the comparable British regulations were duly amended. This has now been done and it is possible for a "display" van to be sent from Britain into Belgium free of customs duty except in relation to the goods carried in the van.

WHAT APPEARED to be an attempt to sabotage the centenary celebrations of the Sheffield district committee of Amalgamated Engineering Union took place at Wortley Hall in the early hours of August 18, when intruders stole into the 200 acres of parkland surrounding the hall, unrooted hundreds of stakes round the enclosures, slackened off the guys of all the big marquees, created havoc on the running tracks, and pulled down ninety 9-ft. poles holding up an awning. When the trouble was discovered, the thirty A.E.U. members staying at the hall were called from their beds at 6 a.m. An appeal was sent to Sheffield for help and a hundred members rushed 12 miles to give a hand with the restoration. Order was restored just in time for the opening at noon.

Raw Material Markets

Iron and Steel

Some foundries are on short time, owing to shortage of pig-iron, while others continue to work from hand to mouth. There are signs of improvement in the hematite position, but there has been no expansion in the output of low- and medium-phosphorus iron. Users of high-phosphorus pig-iron are a little better off, due to the better working of furnaces in the Derbyshire area, although some of the iron is lower in silicon content than the foundries would desire.

There is no improvement in the scrap position, so far as the foundries are concerned. Foundries would like to get larger quantities of coke; in most cases the full summer allocation is not arriving, with the result that stocks will not be at the required level for the winter. Supplies of ferro-alloys are available without much difficulty, while deliveries of limestone, ganister, and firebricks are adequate.

Hopes that re-rollers will obtain increased supplies of foreign semis have strengthened of late. It is unlikely anyway that the output of English semis will be stepped up for some time. The re-rollers have plenty of orders on hand for the home trade and have export orders against bilateral agreements; they could, in fact, be working to capacity if they had full supplies of raw materials. Any supplies of crops or defective billets and sheet bars are being readily snapped up. In spite of their heavy bookings, re-rollers are inundated with inquiries for strip, sheets, small bars, and, in particular, ferro-concrete bars.

Non-ferrous Metals

A very strong tone has prevailed on the London tin market, and on Monday the settlement level was £1,000 a ton—the £1,000 level being attained for the first time since June 11. A further advance on Tuesday was followed by a recession yesterday (Wednesday), when the settlement level was £990 a ton.

The suspension of the cease-fire talks at Kaesong was mainly responsible for a fairly spectacular recovery in tin prices last week. Whether American stockpile buying will start again has yet to be seen, but the deterioration in the international situation has been such that this development would not occasion surprise. Last week's rally will encourage tin producers, some of whom have been perturbed by the downward trend of prices in London and Singapore. Actually, the latest available figures do suggest some decline in world production, for, according to the International Tin Study Group, the June tonnage of tin-in-concentrates—presumably calculated on a basis of about 70 per cent. metal—was 13,700 tons, compared with 15,600 tons in May. Exports from Bolivia declined to 2,737 tons from 3,862 tons a month earlier, a very sharp setback. World production of tin metal in June was 13,800 tons, against 14,400 tons in May, and world tinplate production 518,000 tons, compared with 499,000 tons.

London Metal Exchange official tin quotations were as follow:—

Cash—Thursday, £950 to £955; Friday, £945 to £950; Monday, £995 to £1,005; Tuesday, £1,055 to £1,065; Wednesday, £990 to £995.

Three Months—Thursday, £900 to £905; Friday, £885 to £890; Monday, £920 to £925; Tuesday, £957 10s. to £960; Wednesday, £900 to £905.

The usual monthly copper figures have been published by the Copper Institute in New York. Production of crude copper in July was 82,718 short tons, compared with 87,105 tons in June, while in refined the comparative figures were 93,258 tons and 105,127 tons. Deliveries of refined copper in July fell to 101,095 tons from the previous month's figure of 114,103 tons. Both these totals are exclusive of deliveries to the stockpile. The stock of refined copper in producers' hands at July 31 was 68,045 tons, a gain of about 7,000 tons over June 30 and the highest level reached for some months past. Stocks outside the United States also went up, the July figure of 159,338 tons comparing with 151,823 tons at the half-year.

Iron and Steel Scrap Prices Increased

The controlled maximum prices of iron and steel scrap were increased on Monday under the Iron and Steel Scrap (No. 4) Order, 1951. The increase is £2 per ton, except for compressed destructor scrap and two lower grades of unprepared process scrap. For these three grades the increase is 30s. per ton. The purpose of the higher prices is to stimulate the collection of ferrous scrap. A small part of the increase is needed to defray increased costs of collection, processing, and handling, particularly in the case of the smaller merchants and in the more remote areas. Subject to this, the National Federation of Scrap Iron, Steel and Metal Merchants has given an assurance that the increase will be passed on to the owners of scrap so as to encourage them to return as much as possible. The merchants have also assured the Minister of Supply that the rise in scrap prices will secure a substantial increase in the recovery of scrap.

The Iron and Steel Corporation of Great Britain and the British Iron and Steel Federation support the price increase. The new Order is regarded as fixing the maximum prices of ferrous scrap for some years ahead.

With the exception of two special grades of iron, the controlled prices of finished iron and steel are not being increased to consuming industries, but some adjustments are necessary, within the steel industry itself, in the prices of semi-finished steel. The Minister has accordingly made the Iron and Steel Prices (No. 3) Order, 1951, which also took effect on Monday.

Apart from small increases, mainly to meet additional transport costs, delivered prices of iron and steel scrap have been kept stable since 1937. The maximum prices for iron and steel scrap, other than alloy steel, have ranged from 41s. 5d. to 189s. 4d. per ton, but, in the main, have not exceeded £5 per ton.

Increased supplies of scrap resulting from this price rise will provide an additional volume of a relatively cheap raw material to the iron and steel industry, which, together with the economies resulting from increased steel production, will help to offset the increased cost of scrap. The iron and steel industry has therefore agreed to carry the immediate effects of the increase in scrap costs. The engineering and other steel-consuming industries, on the other hand, will benefit appreciably from the increased price for their scrap. Scrap is, of course, also used largely in the foundry industries. There will be no increase in the prices of those foundry products which are subject to price control, and, the Ministry considers that, in the main, it should be possible to avoid any general increase in the field of uncontrolled products also.

The price increases (per ton) covered by the Iron and Steel Prices (No. 3) Order are:—Cylinder and refined iron 25s., cold-blast pig-iron 15s.; semi-finished steel: billets 5s., sheet and tinplate bars 7s. 6d., forging ingots 25s.

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

(Delivered, unless otherwise stated)

August 29, 1951

PIG-IRON

Foundry Iron.—No. 3 Iron, Class 2:—Middlesbrough, £11 10s.; Birmingham, £11 4s. 6d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £13 0s. 6d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £13 12s. 3d.

Scotch Iron.—No. 3 foundry, £13 1s., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £15 7s.; South Zone, £15 9s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £14 12s.; South Zone, £17 5s. 6d.

Cold Blast.—South Staffs, £17 5s. 6d.

Hematite.—Si up to 2½ per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. Coast and N.-W. Coast of England, £12 17s.; Scotland (Scotch iron), £13 3s. 6d.; Sheffield, £13 13s. 6d.; Birmingham, £14 0s. 6d.; Wales (Welsh iron), £13 3s. 6d.

Spiegeleisen.—20 per cent. Mn, £18 15s. 9d.

Basic Pig-iron.—£11 15s. 6d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered.)

Ferro-silicon (6-ton lots).—40/55 per cent., £40 15s., basis 45% Si, scale 15s. 6d. per unit; 70/84 per cent., £56 2s. 6d., basis 75% Si, scale 16s. per unit.

Silicon Briquettes (5-ton lots and over).—2lb. Si, £48 5s.; 1lb. Si, £49 5s.

Ferro-vanadium.—50/60 per cent., 15s. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 9s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £175; ditto, copper-free, £190.

Ferro-tungsten.—80/85 per cent., 33s. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 35s. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent C, £74, basis 60% Cr, scale 24s. 6d. per unit; 6/8 per cent. C, £70, basis 60% Cr, scale 23s. 3d. per unit; max. 2 per cent. C, 1s. 8¼d. per lb. Cr; max. 1 per cent. C, 1s. 8¾d. per lb. Cr; max. 0.15 per cent. C, 1s. 9½d. per lb. Cr.; max. 0.10 per cent. C, 1s. 9¾d. per lb. Cr.

Chromium Briquettes (5-ton lots and over).—1 lb. Cr, £78 9s.

Cobalt.—98/99 per cent., 17s. 6d. per lb.

Metallic Chromium.—98/99 per cent., 5s. 11d. per lb.

Ferro-manganese (blast-furnace). — 78 per cent., £39 9s. 4d.

Manganese Briquettes (5-ton lots and over).—2lb. Mn, £49 10s.

Metallic Manganese.—96/98 per cent., carbon-free, £215 per ton.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—Basic: Soft, u.t., £21 6s. 6d.; tested, 0·08 to 0.25 per cent. C (100-ton lots), £21 16s. 6d.; hard (0.42 to 0.60 per cent. C), £23 14s.; silico-manganese, £29 10s.; free-cutting, £24 10s. 6d. Siemens Martin Acid: Up to 0.25 per cent. C, £27 11s.; case-hardening, £27 10s.; silico-manganese, £30 11s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £25 15s.; basic, hard, over 0.41 up to 0.60 per cent. C, £26 15s.; acid, up to 0.25 per cent. C, £28 4s.

Sheet and Tinplate Bars.—£21 16s.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £25 6s. 6d.; boiler plates (N.-E. Coast), £26 14s.; chequer plates (N.-E. Coast), £26 15s. 6d.; heavy joists, sections, and bars (angle basis), N.-E. Coast, £23 15s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £27 11s.; flats, 5 in. wide and under, £27 11s.; hoop and strip, £28 6s.; black sheets, 17/20 g., £35 15s. 6d.; galvanised corrugated sheets, 17/20 g., £49 18s. 6d.

Alloy Steel Bars.—1-in. dia. and up: Nickel, £44 17s. 3d.; nickel-chrome, £65 2s. 9d.; nickel-chrome-molybdenum £72 10s. 3d.

Tinplates.—49s. 6½d. per basis box.

NON-FERROUS METALS

Copper.—Electrolytic, £234; high-grade fire-refined, £233 10s.; fire-refined of not less than 99.7 per cent., £233; ditto, 99.2 per cent., £232 10s.; black hot-rolled wire rods, £243 12s. 6d.

Tin.—Cash, £990 to £995; three months, £900 to £905; settlement, £990.

Zinc.—G.O.B. (foreign) (duty paid), £190; ditto (domestic), £190; "Prime Western," £190; electrolytic, £194; not less than 99.99 per cent., £196.

Lead.—Good soft pig-lead (foreign) (duty paid), £180; ditto (Empire and domestic), £180; "English," £181 10s.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £210 10s.; rolled zinc (boiler plates), all English destinations, £208 10s.; zinc oxide (Red Seal), d/d buyers' premises, £205.

Other Metals.—Aluminium, ingots, £124; antimony, English, 99 per cent., £390; quicksilver, ex warehouse, £73 5s. to £73 15s.; nickel, £454.

Brass.—Solid-drawn tubes, 25½d. per lb.; rods, drawn, 28¼d.; sheets to 10 w.g., 30⅛d.; wire, 31¾d. rolled metal, 28⅞d.

Copper Tubes, etc.—Solid-drawn tubes, 26⅞d. per lb.; wire, 261s. 9d. per cwt. basis; 20 s.w.g., 288s. 9d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £277 to £281; BS. 1400—LG3—1 (86/7/5/2), £282 to £300; BS. 1400—G1—1 (88/10/2), £330 to £360; Admiralty GM (88/10/2), virgin quality, £350 to £360 per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £355 to £390; L.P.Bl, £316 to £322 per ton.

Phosphor Bronze.—Strip, 38¾d per lb.; sheets to 10 w.g., 40⅞d.; wire, 42⅜d.; rods, 38¾d.; tubes, 37d.; chill cast bars: solids 4s., cored, 4s. 1d. (C. Clifford & Son, Limited.)

Nickel Silver, etc.—Ingots for raising, 2s. 7½d. per lb. (7%) to 3s. 7¼d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 3s. 1½d. (7%) to 4s. 1¼d. (30%); to 12 in. wide × .056, 3s. 1¾d. to 4s. 1½d.; to 25 in. wide × .056, 3s. 3¾d. to 4s. 3½d. Spoon and fork metal, unsheared, 2s. 10¼d. to 3s. 10¼d. Wire, 10g., in coils, 3s. 7¼d. (10%) to 4s. 7d. (30%). Special quality turning rod, 10%, 3s. 6¼d.; 15%, 3s. 11d.; 18%, 4s. 3¼d. All prices are net.


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Imports and Exports of Iron and Steel in July

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in July. Figures for the same month in 1950 are given for purposes of comparison and totals for the first seven months of this year and of 1950 are also included.

Total Exports of Iron and Steel

Destination.	Month ended July 31.		Seven months ended July 31.	
	1950.	1951.	1950.	1951.
	Tons.	Tons.	Tons.	Tons.
Channel Islands ..	762	863	4,828	5,392
Gibraltar	116	30	958	393
Malta and Gozo ..	154	280	2,801	1,931
Cyprus	1,028	351	5,452	3,002
Sierra Leone	160	632	2,291	3,212
Gold Coast	1,438	1,284	15,465	10,874
Nigeria	4,415	3,256	36,468	34,467
Union of South Africa	14,042	10,777	100,793	80,740
Northern Rhodesia ..	2,603	929	17,893	8,889
Southern Rhodesia ..	8,268	3,598	46,636	22,898
British East Africa ..	7,361	3,763	58,166	48,698
Mauritius	631	452	5,463	4,187
Bahrein, Kuwait, Qatar and Trucial Oman ..	828	317	4,603	4,178
India	15,422	7,678	60,822	56,891
Pakistan	10,970	3,690	60,185	47,631
Malaya	4,621	6,396	47,559	44,444
Ceylon	3,518	1,312	22,586	17,371
North Borneo ..	326	790	3,971	3,392
Hongkong	3,522	2,561	28,885	38,252
Australia	42,617	28,480	205,532	205,344
New Zealand ..	12,834	6,383	103,556	62,831
Canada	24,482	26,974	101,307	149,504
British West Indies ..	4,411	6,480	37,701	37,120
British Guiana ..	485	328	4,637	3,568
Anglo-Egyptian Sudan	935	544	10,620	5,601
Other Commonwealth	1,368	741	8,361	6,961
Irish Republic ..	7,377	8,948	54,113	56,471
Soviet Union ..	29	—	513	2,230
Finland	7,246	3,592	38,871	21,556
Sweden	4,813	10,422	51,964	62,844
Norway	6,875	4,289	52,234	39,967
Iceland	621	306	2,994	1,744
Denmark	8,039	6,306	78,597	51,073
Poland	70	36	1,092	579
Germany	261	71	462	696
Netherlands	5,277	8,783	46,666	54,490
Belgium	929	770	7,860	7,507
France	2,115	193	14,870	3,957
Switzerland	721	933	7,029	7,502
Portugal	1,451	930	12,208	9,055
Spain	739	642	5,127	2,774
Italy	1,083	3,933	6,089	22,052
Austria	135	54	685	330
Hungary	65	—	321	23
Yugoslavia	5,195	1,150	8,457	6,159
Greece	451	179	3,547	1,749
Turkey	553	1,325	5,789	3,706
Indonesia	471	695	8,588	4,615
Netherlands Antilles ..	413	2,089	5,217	3,643
Belgian Congo ..	62	140	929	1,398
Angola	176	70	1,629	1,529
Portuguese E. Africa	251	255	2,963	2,208
Canary Islands ..	222	54	1,233	1,374
Syria	26	787	593	2,955
Lebanon	693	42	6,668	8,499
Israel	3,005	3,174	12,968	19,210
Egypt	2,979	6,954	37,741	26,549
Morocco	7	22	1,579	1,314
Saudi Arabia ..	32	78	1,764	314
Iraq	2,098	1,924	23,208	13,730
Iran	10,347	3,223	68,695	52,452
Burma	1,297	746	6,920	8,390
Thailand	633	913	3,770	9,852
China	23	—	1,961	4,597
Philippine Islands ..	810	449	6,888	2,368
USA	2,460	9,179	12,942	108,805
Cuba	324	165	1,134	2,686
Colombia	632	491	4,009	3,923
Venezuela	4,226	7,484	23,096	22,922
Ecuador	205	65	2,229	766
Peru	1,648	2,081	7,644	8,451
Chile	1,063	584	11,167	5,721
Brazil	4,401	2,591	19,676	14,484
Uruguay	732	413	5,467	8,027
Argentina	6,383	3,576	40,094	28,392
Other foreign ..	1,985	1,447	11,242	10,910
TOTAL	268,966	221,442	1,729,101	1,644,319

* The figures for 1951 are not completely comparable with those for previous years.

Total Imports of Iron and Steel (tons)

From	Month ended July 31.		Seven months ended July 31.	
	1950.	1951.	1950.	1951.
India	—	—	22,884	2
Canada	1,992	4,255	24,023	27,039
Other Commonwealth and Irish Republic	71	173	962	961
Sweden	885	1,868	7,041	12,963
Norway	5,169	5,039	29,781	29,531
Germany	7,748	3,838	54,949	12,569
Netherlands	2,361	9,467	35,413	42,760
Belgium	17,395	21,830	68,226	97,001
Luxemburg	5,953	6,497	30,347	48,211
France	29,295	16,482	169,271	139,512
Austria	198	3,718	2,485	12,796
USA	6,145	2,287	41,932	20,246
Other foreign ..	949	437	5,028	1,855
TOTAL	78,161	75,891	492,342	445,446
Iron and steel scrap and waste, fit only for the recovery of metal	227,266	59,473	1,442,072	377,868

Exports of Iron and Steel by Product (tons)

Product.	Month ended July 31.		Seven months ended July 31.	
	1950.	1951.	1950.	1951.
Pig-iron	2,280	392	15,531	13,657
Ferro-alloys, etc.—				
Ferro-tungsten ..	92	—	688	284
Spiegeleisen, ferro-manganese ..	145	209	1,241	782
All other descriptions	167	94	951	696
Ingots, blooms, billets, and slabs	825	409	4,217	4,909
Iron bars and rods ..	154	419	2,641	6,042
Sheet and tinplate bars, wire rods ..	3,901	1,499	5,761	9,206
Bright steel bars ..	4,305	1,726	24,743	22,638
Alloy steel bars and rods	1,019	1,844	8,526	9,503
Other steel bars and rods	20,290	9,234	138,547	120,810
Angles, shapes, and sections	13,101	9,742	85,508	103,737
Castings and forgings	515	1,446	4,894	6,853
Girders, beams, joists, and pillars* ..	5,730	5,515	38,359	26,204
Hoop and strip ..	9,987	7,082	63,019	41,539
Iron plate	239	289	1,495	1,325
Tinplate	19,636	25,279	143,151	148,525
Tinned sheets ..	228	283	1,856	1,758
Terneplates, decorated tinplates	234	193	511	826
Other steel plate (min. ⅛ in. thick) ..	33,112	20,436	188,828	170,910
Galvanised sheets ..	10,712	3,910	68,121	33,035
Black sheets	12,975	13,245	82,071	92,080
Other coated plate ..	999	789	6,976	5,751
Cast-iron pipes up to 6 in. dia.	5,319	8,909	45,250	46,172
Do., over 6 in. dia. ..	6,317	6,627	48,906	41,317
Wrought-iron tubes ..	31,328	31,911	209,515	234,126
Railway material ..	31,619	20,623	180,401	145,803
Wire	6,932	4,635	42,871	36,763
Cable and rope ..	3,285	2,642	19,983	18,019
Wire nails, etc. ..	3,030	2,371	12,361	17,312
Other nails, tacks, etc.	444	307	2,863	2,441
Rivets and washers ..	529	552	4,638	4,275
Wood screws ..	359	369	2,206	2,237
Bolts, nuts, and metal screws	2,558	2,282	18,206	16,112
Baths	1,338	1,264	8,446	8,159
Anchors, etc. ..	963	772	5,371	5,286
Chains, etc.	808	1,238	6,150	6,681
Springs	551	583	5,459	3,842
Holloware ..	7,024	2,665	41,025	21,606
TOTAL, including other manufactures not listed above ..	268,966	221,442	1,729,101	1,644,319

Personal

MR. T. G. FOSTER has been appointed a director of Church & Bramhall, Limited, of Darlaston, as from August 20, 1951.

MR. GEORGE URE has retired from the board of Smith & Wellstood, Limited, ironfounders, Bonnybridge, to take up a foundry appointment in Australia.

DR. E. GLAISTER has been appointed to the University Readership in Mechanical Engineering tenable at the Imperial College of Science and Technology, London, from October 1.

FORMERLY chief technical engineer of Richard Sutcliffe, Limited, manufacturers of mechanical handling plant, of Horbury, near Wakefield (Yorks), MR. H. STREETS has been appointed technical director of the company.

MR. CHARLES D. RAYMOND has been appointed managing director of Sinex Engineering Company, Limited, of 12, Rochester Row, London, S.W.1, manufacturers of foundry knock-outs, hoppers, chutes, and roller conveyors.

ON HIS RETIREMENT after 47 years with Geo. Clark (1938), Limited, marine-engine and boilermakers, of Sunderland, MR. CHARLES EDWARD SINCLAIR, works engineer, has been presented by the directors with a gold watch in recognition of his services.

MR. W. E. LOVERIDGE, who is to retire at the end of September from his active capacity as engineering director at the Hartlepool works of Richardsons, Westgarth & Company, Limited (while retaining a seat on the board of that company), has been appointed to the board of London & Overseas Freighters, Limited. He will act as consultant and adviser on technical matters.

FOR REASONS of health, MR. I. C. GREEN, for many years in charge of the Finnieston Diesel engine works, Glasgow, of Harland & Wolff, Limited, has retired and is succeeded by MR. ERNEST F. SOUCHOTTE, who has been transferred from the company's Belfast works. Another retirement in the company due to ill-health is that of MR. W. C. CRAWFORD from the position of manager of the Scotstoun works, Glasgow, where his successor is MR. FREDERICK H. DUNCAN, who has been assistant manager for a number of years.

Obituary

MR. EDMUND FARROW, who rose from general clerk to be a director of Douglas Bros., Limited, ironfounders, etc., of Blaydon-on-Tyne, has died at the age of 66.

COMPTROLLER-GENERAL of Patents, Designs and Trade Marks and Comptroller of the industrial property department of the Board of Trade from 1932 to 1944, SIR FRANK LINDLEY died on August 15 at the age of 70. From 1944 to 1945 he was scientific adviser to the appointments department of the Ministry of Labour and National Service.

BEFORE RETIRING about 10 years ago, MR. WILLIAM HAMILTON, who died suddenly at a Chertsey hospital, at the age of 75, was engineering works manager at the Dalzell Steelworks of Colvilles, Limited. He joined the company at the turn of the century. A year or two after his retiral he returned temporarily to assist at the firm's Mossend Works.

THE DEATH has occurred at his home in Guernsey of PROF. CADES ALFRED MIDDLETON-SMITH, formerly Professor of Mechanical Engineering in Hongkong University. Born in 1879, he was educated at the Portsmouth Grammar School and at the Royal Naval Engineering College, Keyham, Devonport, and after holding several appointments in England he accepted, in 1912, an invitation to go to Hongkong as the first Taikoo Professor of Engineering in the university there.

Increased Hollow-ware Prices

Manufacturers' maximum prices of galvanised hollow-ware are to be increased by 15½ per cent., while those for tinplate hollow-ware are to be freed from the former "standstill" (*i.e.*, an arrangement which limits the costs a manufacturer can charge to those ruling in a specified basic period) restriction and placed on a basis of cost plus 5 per cent. These changes are included in a new Board of Trade Order, the General Holloware (Maximum Prices) Order, 1951, which came into operation on August 28.

The increases in galvanised hollow-ware are mainly due to increases in the prices of zinc, steel, labour, carriage, and overhead charges. They follow a request by the manufacturers for increased prices and have been permitted after a careful investigation of these factors. The return to "cost plus" for tinplate hollow-ware prices will allow manufacturers of these goods to take account of the considerable rise in costs since the now out-of-date "basic period" prescribed in the old Order.

The new Order also lays down a new basic period, namely June/July, 1951, to which manufacturers' prices for all goods controlled under the Order (other than tinplate ware) shall be related. This supersedes the period June/July, 1949, prescribed in the revoked Order. Opportunity has also been taken to revise the form of the "cost plus" provisions in so far as they relate to the goods covered by the Order, and to delete the provision hitherto in force excepting goods sold to Government departments from the operation of the Order.

The Order, which has been made in consultation with the Central Price Regulation Committee, supersedes and revokes the General Holloware (Maximum Prices) Order, 1949, and its amending Order, the General Holloware (Maximum Prices) (Amendment No. 4) Order, 1951.

Iron-ore Imports

Imports of iron ore in July and the first seven months of the year, with comparative figures for 1950, are shown below. There were no imports of manganiferous ore during the first seven months of this year. In the first seven months of 1950, 10,876 tons of manganiferous ore were imported, against 6,976 tons in the corresponding period of 1949.

Country of origin.	Month ended July 31.		Seven months ended July 31.	
	1950.	1951.	1950.	1951.
	Tons.	Tons.	Tons.	Tons.
Sierra Leone	86,680	63,620	473,579	307,993
Canada	—	95,185	5,525	167,070
Other Commonwealth countries and the Irish Republic ..	2,210	2,232	17,499	15,206
Sweden	331,992	396,152	2,053,244	1,823,113
Netherlands	4,288	6,214	17,592	19,894
France	34,543	25,493	224,932	227,360
Spain	96,607	85,090	491,872	488,352
Algeria	126,789	159,591	880,693	788,846
Tunis	59,945	66,506	318,400	297,751
Spanish ports in North Africa	40,100	25,750	297,591	202,356
Morocco	51,380	34,058	206,096	162,710
Other foreign countries	38,775	38,585	132,278	106,145
TOTAL	873,309	998,476	5,119,301	4,606,796

M. MARJOLIN, secretary-general of the Organisation for European Economic Co-operation, said recently that the O.E.E.C. hopes shortly to standardise restrictions on the use of zinc and nickel in its 18 member countries. The O.E.E.C. had already agreed on standard rules for controlling copper, he said.