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PRINCIPAL CONTENTS

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Cupola Instrumentation

Three factors have recently focused our attention on the need for the better and more complete control of cupola operation. Primarily, there is on our desk awaiting review a book "The Instrumentation of Open-hearth Furnaces" which details the great benefits resulting from studies made by the British Iron and Steel Research Association. Next, there was a pamphlet issued by a firm supplying instruments for the cupola which very sensibly set out the advantages to be derived from the information these instruments supply. Finally, last week, we were impressed with the astounding economies to be derived from the complete instrumentation plus automatic control of a mould-drying stove. Taken together they show in the clearest possible manner the need for a similar sort of study to be made for the foundry cupola. There must be in the various iron, malleable and steel foundries some four to five thousand cupolas. The operation of these plants varies from the really efficient scientific control to the most inefficient rule of thumb. The consumption of ganister will vary from, say, 14 lb. per ton of throughput up to more than a hundredweight. Blast volumes and pressures are only too often what the fan will give, whilst the temperature of the metal poured varies from really sluggish to blazing hot, but only too seldom from *x* to *y* deg. C.

Fortunately, the instrumentation of cold-blast cupolas—which to-day represent 99 per cent. of the total installations—is relatively simple as compared with the open-hearth furnace. To be complete, there is need for a reliable weighing machine, gauges for standardising the daily relining, and for the height of the coke bed, pressure, volume and moisture meters for blast, pyrometers for temperature control, and gadgets for inoculant additions. Through the use of the instruments, representing as they do constants, true track can be kept of variables such as fresh consignments of coke, pig and scrap. With most concerns to-day, the effect of changes in supplies can only be guessed at, whereas by the use of modern controls, they can be properly assessed and steps taken to negative any detrimental influences.

There is more than one source to which the foundry industry can look for such a lead, but as it is really a job for a panel to correlate what instruments are available, what may be still needed, their use and the interpretation of the results indicated, another of those excellent sub-committees of the Institute of British Foundrymen could be brought into being. Such a Report would put the finishing touch to the findings of T.S.27—"Cupola Charge Materials." We are aware of the heavy programme being undertaken, yet in view of what has been done by B.I.S.R.A., we are confident that a similar piece of work on cupolas would improve, not production, but productivity.

International Conference of Manufacturers

A team of thirty leading British industrialists, formed by the Federation of British Industries and the British Employers' Confederation, will be leaving shortly for the United States to attend the first International Conference of Manufacturers in New York from December 2 to 5. The team will be led jointly by Sir Cuthbert Clegg, president of the B.E.C., and Sir William Rootes, acting as personal deputy for the president of the F.B.I. The Conference is being organised by the E.C.A. in collaboration with the National Association of Manufacturers of America and the National Management Council of America.

The purpose of the Conference is to enable industrialists of the United States, Britain and Western Europe to secure, by a personal exchange of views, a better understanding of each others' problems; to discuss the efforts now being made to promote higher productivity; and to consider ways of continuing these efforts in the future. Delegations have been nominated from Austria, Belgium, Denmark, Eire, France, Germany, Greece, Holland, Iceland, Italy, Luxembourg, Norway, Sweden, Switzerland, Turkey and the U.K. Those attending will have opportunities of visiting U.S. plants and industries and of meeting in Washington the heads of defence, E.C.A., commerce and state departments.

Delegates from the U.K. manufacturers will include, *inter alia*: Major-General K. C. Appleyard, C.B.E., T.D., D.L., J.P.; Dr. H. Clarke, D.Sc., managing director, James Booth & Company, Limited; Mr. C. Connell, M.A., M.I.N.A., chairman, Charles Connell & Company, Limited; Sir Vincent Z. de Ferranti, M.C., chairman and managing director, Ferranti, Limited; Sir Ernest Fisk, Hon. M.I.E.E., deputy chairman and managing director, Electric and Musical Industries, Limited; Sir Norman Kipping, J.P., director-general, F.B.I.; Mr. E. H. Lever, F.I.A., chairman and managing director, Richard Thomas & Baldwins, Limited, and Steel Company of Wales, Limited; Mr. F. A. Martin, O.B.E., B.Sc., director, Samuel Osborn & Company, Limited; Sir George H. Nelson, F.C.G.I., chairman of

(*Concluded at the foot of col. 2*)

Iron-work Exhibit at Bristol

A recent exhibit in the main corridor of Bristol Central Library deals with cast-iron work, pictures for this purpose being lent by the British Cast Iron Research Association. The display, in a series of first-class photographs, illustrates the scope and variety of the uses of cast iron. Included is a picture of the first iron bridge at Coalbrookdale, Salop, built in 1779; the suspension bridge at Chelsea; entrance gates at Kensington Gardens erected in 1851; entrance to the Sailors' Home at Liverpool; and iron-work to houses at Clifton. The Council of Industrial Design was responsible for the illustrations of cast-iron street-lamp standards, the front of Clock Inn, Liverpool, earlier and later Victorian G.P.O. street pillar-boxes in Birmingham, the approach and balcony to municipal flats, London, 1939, as well as typical designs on London regency-period houses; cast-iron bollards, grills, coal-cellar plates, etc.

Firms contributing pictures are: Federated Foundries, Limited (sink-drainers, tiles, electric heaters); Bratt & Colbran, Limited (old and new firebacks, dogs, baskets); Walter Macfarlane & Company, Limited; Students' Union, University of Liverpool (ornaments, iron stair railings, modern public telephone boxes, newels and public shelters); Coalbrookdale Company, Limited (ornamental chairs, seats, balustrades, gates at Kensington Gardens and Coalbrookdale cast-iron bridge); Lion Foundry Company, Limited (window surrounds and panel-flats, dock shelters, window frames and panels). In domestic fittings, such as stoves, radiators and kitchen equipment, the illustrations of early craftsmanship and of the latest modern designs show the wide range of uses to which cast iron is put. Also included are illustrations of the history of gas and water mains, in England, in 1810 and 1812; and in France, mains laid down in 1664, still functioning. America's 101-year-old water main is illustrated.

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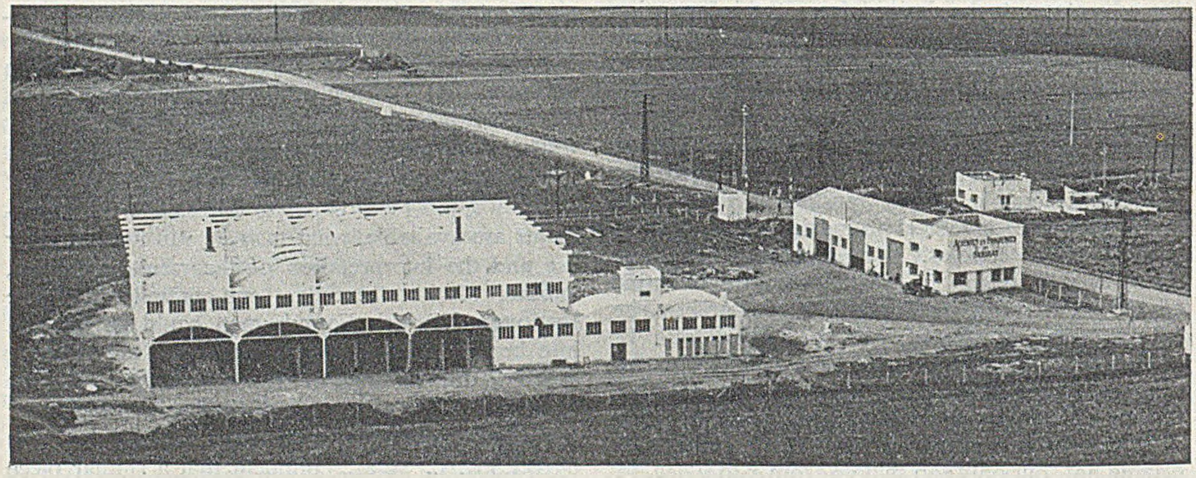
the English Electric Group of Companies, Mr. W. R. Vernon Smith, J.P., assistant managing director, Bristol Aeroplane Company, Limited; Mr. D. D. Walker, M.A., joint managing director, Evershed & Vignoles, Limited, and Mr. Harold Wilmot, C.B.E., chairman and managing director, Beyer, Peacock & Company, Limited.



When Visiting Foundries in the French Ardennes (see report on facing page), reference was made to the Opening by one of the Concerns Visited of a Foundry in North Africa. Above is a Picture of the New Works at Skirat, Morocco, which has been built for Gailly Frères, of Charleville.

Foundries in the French Ardennes*

By A. R. Parkes

A party from the London branch of the Institute of British Foundrymen recently paid a visit to a number of foundries in the French Ardennes, the trip being organised in collaboration with the " Syndicat des Fondeurs sur Modèles des Ardennes " (*the local foundry employers' organisation). Among what follows are listed features which appeared distinctive to the visitors or which stood out from domestic practice in five of the foundries viewed. One foundry, that of Faure et Cie, of Revin, has been given rather more detailed treatment mainly because a particularly unusual scheme of mechanisation has recently been inaugurated there. The whole of the sand-preparation systems at this foundry were installed by a British firm.*

FAURE ET CIE., REVIN

One of the most interesting foundries visited in the Ardennes group is the new iron foundry of Faure et Cie at Revin, which Company produces stove-plate work exclusively. The particular interest arises from the fact that a novel mechanised system of the firm's own conception is just getting under way. The novelty lies in the fact that the moulding arrangement comprises a suspended roundabout system in contradistinction to the conveyor-line or loops now firmly established in conventional British and American practice. It should be realised at the outset, however, that the installation has been designed around stove-plate production, that is, short casting-to-cooling cycles, and mainly un-cored work. These provisos must be remembered in considering the many somewhat peculiar features enumerated later. It is interesting also to record that all the sand plant for this new foundry is built by the Marco Conveyor Company, Limited, a London concern.

General Characteristics

A general idea of the new installation now being completed at Revin is shown in outline in Fig. 1, which is a plan view. There is one separate self-contained raw-sand plant to produce 7 cwt. per hour of dried, crushed and sifted yellow loam sand. This withdraws sand which arrives by rail-trucks directly by underground conveyor from storage bins adjacent. It is dried in a rotary drier shown at *K*, crushed in a ball-mill, *J*, and hoisted by bucket-elevator, *H*, to a storage hopper. From this point, quantities are withdrawn from time to time and transferred, in a bin carried by a monorail, *F*, to replenish one or other of the four independent sand systems.

Distinct from the new-sand treatment plant, there are ultimately to be four separate moulding stations each comprising (*a*) a continuous sand plant, (*b*) a group of moulding machines, (*c*) a turntable or roundabout-type of mould conveyor shown at (1), (2), (3) and (4) in Fig. 1, (*d*) a pouring station and (*e*) a knock-out. These, more fully described, comprise the following:—

(*a*) *Unit sand plants.*—These consist of 8 ft. dia. continuous Smedley sand mills (shown at *E*); hexagonal rotary screens, *G*; chutes leading to bucket elevators, *D*; and overhead distribution conveyors and hoppers, *B*. The quantity of sand circulated

* Report presented to the London branch of the Institute of British Foundrymen at the opening meeting of the session, with Mr. L. G. Beresford in the chair.

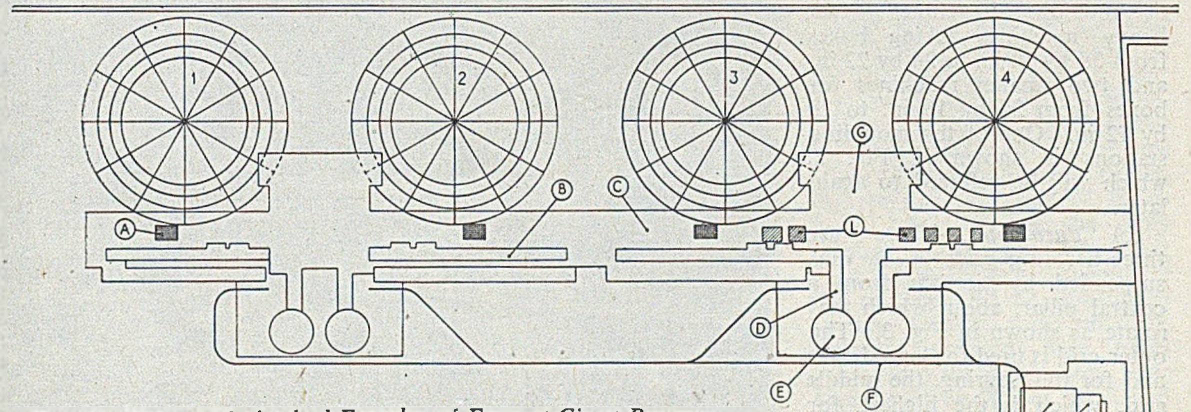


FIG. 1.—*Plan of Mechanised Foundry of Faure et Cie at Ravennes.*

Items 1, 2, 3 and 4. Mould Conveyor Turntables.
A. "Sinex" Vibrating Knock-outs.
B. Overhead Sand-distribution Conveyors and Hoppers.
C. Spill-sand Grids and Hoppers.
D. Chutes leading to Bucket Elevators.
E. Continuous Smedley Mills, 8 ft. dia.
F. Overhead Runway for New Sand.
G. Hexagonal Rotary Screens.
H. New Sand Bucket Elevator.
J. Ball-type Sand Mill.
K. Horizontal Drier for New Sand.

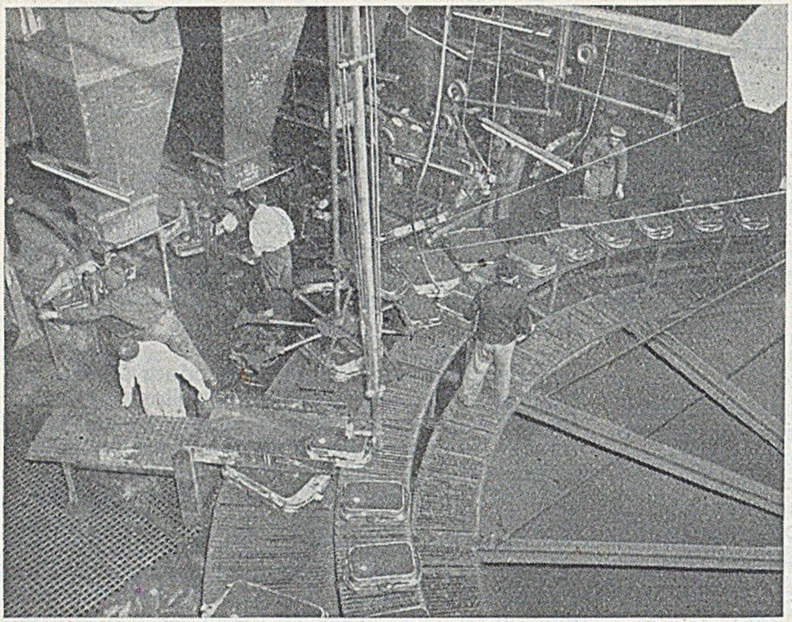


FIG. 2.—*View of a Moulding Station (and part of a Turntable Conveyor). In the Foreground is the Automatic Knock-out for Small Moulds, in the Centre, the Spoked Wheel for Half-mould Delivery can be seen and in the Background are the Hanging Rods and Pulleys used for Delivering the Larger Moulds.*

in each unit is 25 to 28 tons hourly, or 200 to 225 tons daily (800 to 900 tons daily for the four units). About 15 tons is the quantity of sand in each plant, about 12 being in motion. This gives a cycle for sand use of only 25 min., but it must be remembered the plant is engaged on thin plate work.

(*b*) *Moulding-machine stations.*—On each of two plants so far equipped, there are two pairs of moulding machines — two heavy machines taking boxes from 38 by 30 in. to 28 by 22 in. and two smaller machines for boxes from 26 by 18 in. to 18 by 12 in. One of the moulding stations is shown in Fig. 2, which will be referred to again later.

(*c*) *Turntables.*—These are three-tier ring grids 36 ft. dia., suspended by tie-rods from a central pillar, about which they rotate as shown in Fig. 3. The outer grid is used for large boxes and for the pouring, the middle grid, which is the highest, for smaller boxes, and the inside grid for the operator engaged on coring and closing. These turntable grids are friction driven at their periphery by a small rubber-tyred wheel coupled through a reduction gear to variable-speed $\frac{1}{4}$-h.p. motors. Their speed can be varied to give one revolution in from 10 to 20 mins. Of the complete revolution of a ring-grid system, 90 deg. is used for moulding and closing, 90 deg. for pouring and 180 deg. for cooling. From 12 to 21 large moulds and 20 to 39 smaller ones can be accommodated at a time on each turntable.

(*d*) *Pouring stations.*—One pouring station is to be arranged between each pair of turntables; eventually an overhead track will bring in the molten metal, and the pouring points will be raised grids of similar pattern to the floor grids around the moulding machines. Fig. 4 shows the present system of pouring from hand ladles, the operators in this instance standing on one of the moving grids.

(*e*) *Knock-out stations.*—Small boxes are knocked-out automatically by an ingenious device (see Fig. 2). At the end of their completed lap, the boxes close the contacts of an electrical circuit which brings into operation a swing arm carried from the roof and worked by an air cylinder. This sweeps the box across a bridge spanning the large-box conveyor, and on to a Sinex vibrating screen. On

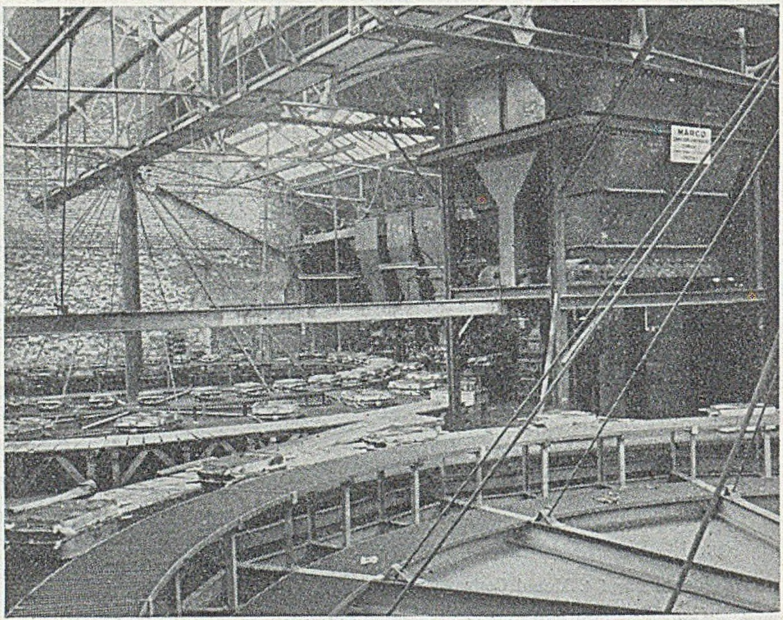


FIG. 3.—*Two of the Four Turntable Conveyors with Part of a Sand-preparation System between. Note the Suspension of the Three-tier Grids by Tie-rods from a Central Pillar.*

the way, there is a slight jerk or fall sufficient to disengage automatically the hook-type box-clamps. Empty box parts are then immediately re-available at the moulding point. Large boxes are at present knocked-out by manual transfer to the vibrating grid. All sand is returned underground to the treatment plants.

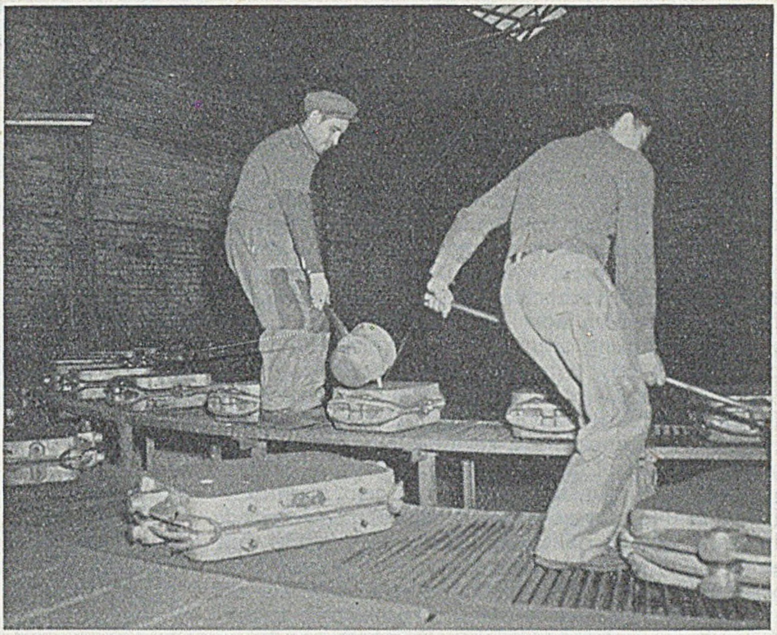


FIG. 4.—*Pouring Moulds on one of the Turntable Conveyors; for this, at the present time, the Operator stands on the Grid. Magnesium-alloy Box-parts are used.*

Mould Production

Small half-moulds produced on one machine are first placed on a spoked wheel support (centre, Fig. 2) whilst the second half is made, and then the parts are manually cored-up (if required) and closed on the upper tier of the rotating grid. Large moulds are carried to the turntables on vertical rods running on castors from suspended arms, and, like the small moulds, are closed on the grids—the rapidity of this transfer is amazing to witness. Large screw-claw type box-clamps are used on these boxes, and afterwards, the box-pins are withdrawn. The box-pins used in this foundry are themselves most unusual, consisting of taper spiral springs up to 12 in. long. The upper part of the pin provides a very rough and flexible location, but as the top-box is lowered over the pin, the clearance between pin and hole becomes progressively reduced until friction between the hole and the spring at the final point serves to compress and so enlarge the diameter of the pin, making a very accurate location*. Never has the Author seen boxes of such dimensions closed so rapidly or with such nonchalance, and minimum of skill on the part of the operators. The moulding stations are illuminated by fluorescent strip-lighting suspended close to the work.

Actual production figures for moulds range from 40 per hour average per machine for the 38- by 30-in. boxes to 180 per hour for the 18- by 12-in. boxes. The average casting weights for the same range of boxes are from 34 to 6 lb. as-cast (including runners, etc.) and 23 lb. to 3 lb. after fettling, the daily average from one unit being from 10 to 15 tons. Eventually the castings will be transferred to the fettling shop on continuous overhead wire ropes provided with hooks, the rope running at 6½ ft. per min., and hooks being placed at 16-in. pitch. Another unusual feature is that all the moulding machines are supported on flexible

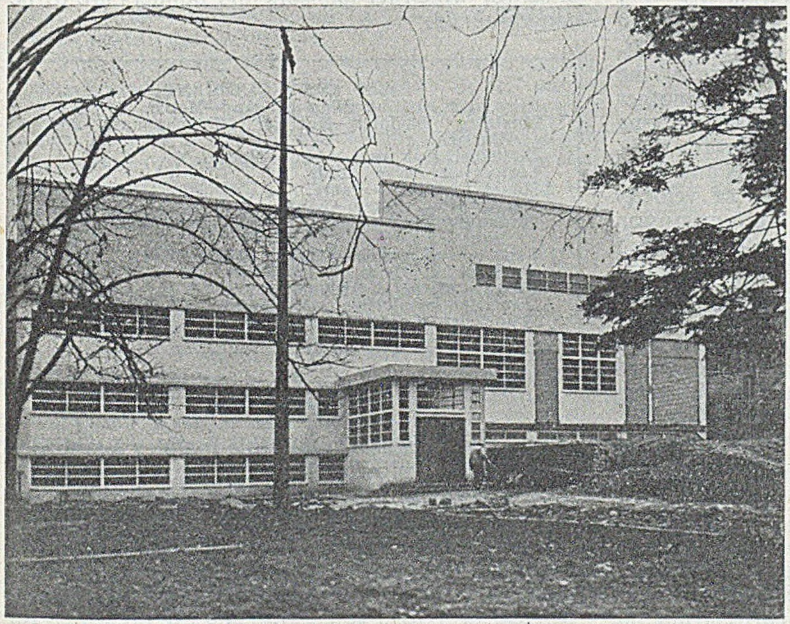


FIG. 5.—*Exterior of the New Offices and Administrative Buildings at Faure et Cie, Revin.*

* See FOUNDRY TRADE JOURNAL, June 22, 1950, p. 676.

Foundries in the French Ardennes

mountings without deep foundations—there being a basement running beneath most of the foundry.

Limitations

It should not be construed from what has been described, that everything about the new foundry to date of the visit has gone exactly according to plan. A number of snags have inevitably arisen, as one would expect when so radical a departure from established schemes is made. In particular, the Faure concern now find that the sand plants, which, in planning, seemed of ample size and which are actually now working to full rated capacity, are indeed limiting the mould output, by reason of the extraordinarily high moulding speeds attained. The raw sand chosen is a severe tax on plant capacity as a result of its " stickiness." With a fineness of A.F.S. 160, moisture 5 to 6 per cent. permeability of 15 and clay at 16 to 21 per cent. as received, the sand proves ideal for stove-plate work, but much trouble has been encountered in freeing hoppers, screens, elevators and the like from build up, and this has already rendered maintenance expensive. Raw-sand consumption lies between 1 ton and 9 cwt. per ton of finished castings produced.

Melting Plant

The melting plant comprises at present two identical cupolas 40-in. internal dia., rated at 6½ tons per hour; two rated at 3 tons per hour are to be added later. High up in the furnace shaft is a duplex wind belt (as described and illustrated later in the description of the " Fonderie Nouvelle " plant) and long tuyere pipes are among other design features. Ten tuyeres are arranged, for operating five at a time. Tapping is continuous with a syphon control and self-slagging device. Charging is by drop-bottoms skip on a completely-automatic cycle, the charges being assembled at ground level. Another unusual feature is the provision at the charging point of a refractory-brick-lined chamber for dust-catching, which connects the two cupolas and is of very substantial dimensions. The loss of velocity of dust-laden cupola gases resulting from expansion in this dust-chamber causes the separation and fall of much of the dust. The cupola not in use is sealed off from the chamber, and a door to the cupola in use opens automatically to admit each charge bucket as it is traversed horizontally after vertical hoisting. Pig-iron and other materials are stored at ground level, the former being handled by magnets. Typical metal composition is T.C., 3.0 to 3.5; Si, 2.0 to 2.5; Mn, 0.4 to 0.8; S, 0.06; and P, 0.8 to 1.5 per cent. Only three men are needed for the whole operation of the melting plant.

Ancillary Sections

There is a well-equipped laboratory at the plant, and the services of the *Centre Technique* are also utilised. The electricity supply is partly from the " grid " and partly home-generated to a maximum demand of 300 plus 178 k.v.a. All the equipment on the mechanised plant is regulated from a centralised control room, with grouped and integrated electric contactor gear.

A most interesting department at the works is that devoted to single-side matchplate making in aluminium-alloy, which produces the majority of the patterns used. Features of this shop are the adoption of a special frame-type jig by which location points, thicknesses and support bosses are automatically registered on matching half-plates; the storage control systems and protective treatment for the hundreds of plates in stock and, not least, the skill of the moulders who produce the patterns in fine sand—perhaps this is the only place in this foundry where the moulder's ancient craftsmanship is in daily evidence. An oil-fired crucible furnace of 400 points capacity is used for melting in this section.

Older Works

As a background to the new plant, it should be borne in mind there is still being worked an older foundry producing similar work by floor-bank and stall methods; this, it is expected, will be entirely replaced as the mechanised sections are completed. Complementary departments deal with the surface cleaning, vitreous enamelling (dry-powder process), and ultimate assembly of the company's products, which include a very wide range of domestic and industrial cooking and heating equipment, the models using various fuels. Amenities are well catered for, there being an entirely new installation of washing and changing rooms, with drying facilities, nearing completion in the basement of the new foundry. Office accommodation (Fig. 5) is tastefully furnished, building details, such as roof-glazing, are of most modern types, and the whole reflects a well-balanced scheme carried forward with enterprise, for which its sponsors and builders are to be congratulated.

PLANT AND EQUIPMENT

Treatment and handling of sand—Marco.
Moulding machines—Marillier, Zimmermann and Durlach.
Electrical shake-out screens—Sinex.
Compressors—Fives, Lille.
Mould turntables—Faure.
Box-handling system—Faure.
Magnesium-alloy moulding boxes, clamps and pins—Faure.
Cupolas and cupola-charging system—Faure.
Sand control—G. F. (Switzerland).
Pattern plates, A.S.4G—Faure.
Electrical installation work—Faure.
Main contactors—Telemecanique.

FONDERIES DES ARDENNES (AT MEZIERES)

This is a blackheart malleable foundry established as a family concern about 50 years ago and at present melting 15 tons per day, employing some 150 men. Melting is by cupolas, two of 3 tons per hr. capacity being installed for use on alternate days and feeding directly by means of a Y-form spout into a stationary pulverised-fuel-fired holding furnace of 7 tons capacity. The air preheater for the pulverised-fuel firing is arranged between the cupolas. A 15-ton open-hearth type furnace, also pulverised-fuel-fired, which was used for melting prior to the installation of the cupolas, now acts as a standby. Additionally, there is a 5-ton rotary furnace. Much interest for the visitors was centred in the foundry itself, the coremaking being especially admired. Green strength for a core mix consisting of white silica sand with 2½ to 3 per cent. proprietary oil and 1 to 1½ per cent. bentonite was considered phenomenally high. A similar mix incorporated up to one-third used core-sand which was crushed by a simple ball-mill from pieces collected at the knock-out. Batch-type core ovens heated by electric-resistance elements were in use.

For some of the hand-moulding jobs, an air vibrator is attached to the moulding boxes for helping to pack the sand. All sorts of patterns are adopted, much use being made of fine-plaster patterns, these being applied on both hand- and power-operated machines. The latter are mainly arranged around the walls of the spacious well-lighted shop, the floor-bank system of moulding being followed. Each moulder pours and knocks-out his own work, the average production being about 100 to 150 boxes per day per man. Many of the box-parts, even the quite small ones, are built up of four cast-iron sections bolted together and incorporating lightening holes which additionally serve the same purpose as ribs. Synthetic sand is used throughout, this being mainly prepared in Baillot, batch-type mills and distributed by monorail in drop-bottom hoppers.

Annealing of the castings is carried out in packed boxes in pulverised-fuel-fired furnaces on about a 100-hr. cycle. Experiments were in progress for accelerating the cooling, both after the soaking period and finally, by means of fan-induced cold air supplied to the furnace through pipes. Automatic firing control of the annealing cycle is arranged both for time and temperature, and indicators and recorders for all furnaces are housed in a separate control cubicle.

The pulverising plant, a separately-built section, was found to be so clean literally as to permit "eating off the floor," and this attention to cleanliness, as well as the general spaciousness and ample provision of clear gangways and good lighting were much remarked upon. Well-equipped washing and changing rooms are available for all workers.

(To be continued)

IN VIEW of the success achieved at the Ashorne Hill summer school on welding, held in May and June this year, the British Welding Research Association has decided to hold another school next year at the same place from July 16 to 25. On this occasion the school will be divided into two parts—the first concerned with the purely practical aspects and the second with design, inspection and manufacturing problems.

THE BRITISH STANDARDS INSTITUTION has recently published a standard method for the determination of tin in ferro-tungsten and tungsten metal (B.S.1121, pt. 22: 1951). The method is based on the isolation of tin as the sulphide using molybdenum sulphide as a carrier. Tungsten is retained in solution as a complex with ammonium citrate. Copies can be obtained from 24, Victoria Street, London, S.W.1 (price 1s. post free). The B.S.I. has also published recently B.S. 1747:1951—deposit gauges for atmospheric pollution (price 2s. 6d. post free).

Personal

DR. JOHN WARD, of Wheathouse Road, Birkby, Huddersfield, retired on October 31 from the headship of the Engineering Department of Huddersfield Technical College.

MR. C. S. JOHNSON has been awarded the Institution of Production Engineers' Medal for the best Paper presented to the Institution by a non-member during the 1949-50 session. His subject was "Modern Foundry Practice."

MR. J. D. REID, formerly employed as chief draughtsman with M. Cockburn & Company, Limited, Falkirk, has been appointed assistant general works manager with the Anderson Foundry Company, Limited, Middlesbrough.

CAPTAIN R. T. SHEPHERD, Rolls-Royce chief test pilot for the last 16 years, has retired, but will remain with the company as flying consultant. Altogether, Captain Shepherd has flown for 35 years. He was awarded the O.B.E. in the 1946 New Year Honours.

DR. D. G. SOPWITH, acting director of mechanical engineering research and until recently superintendent of the engineering division of the National Physical Laboratory, succeeded the late Dr. G. A. Hankins as director of mechanical engineering research at the National Physical Laboratory, Teddington (Middx).

MR. J. BARR, who has retired after 60 years' service with Thomas White & Sons, Limited, wood-working machinery manufacturers, Paisley, as chief draughtsman, has been presented with a clock and wristlet watch by his colleagues. Also, he was guest at a complimentary dinner given by the directors, at which were present all those who had over 25 years' service with the firm.

MR. D. M. BROWN has retired after 43 years' service with Babcock & Wilcox, Limited, Renfrew, as purchasing agent, and was entertained at a complimentary dinner in Glasgow by his colleagues. He joined the firm in 1908 and for almost 12 years was in the accounts department. In 1920 he was transferred to the firm's works in Spain and on his return to this country served for a time at Lincoln works before returning to Renfrew in 1933.

SIR JAMES MOIR MACKENZIE, deputy director-general of the Federation of British Industries, retired a few days after his 65th birthday. Sir James joined the federation in 1919, three years after its foundation, as a member of the overeas staff and from that time onwards he was closely associated with Empire trade and affairs. In the course of his duties, he has on behalf of the F.B.I. made many visits to Canada where he is a highly esteemed and well-known figure. He represented the F.B.I. at the Ottawa Conference in 1932, and on the invitation of the Treasury he accompanied the British Purchasing Mission which initiated war supplies in Ottawa in 1939.

MR. D. MCB. MCLACHLAN has retired after 17 years as shipyard manager of the Fairfield Shipbuilding & Engineering Company, Limited, Glasgow. He served his apprenticeship with R. Napier & Sons, Limited, which was later acquired by William Beardmore & Company, Limited, becoming shipyard manager at the Dalmuir yard in 1918. He went to China in 1920 to become shipyard manager of the Shanghai Dock & Engineering Company, Limited, returning to this country in 1923 as assistant manager at the Barrow-in-Furness yard of Vickers-Armstrongs, Limited, being promoted shipyard manager the following year, a position which he held until 1933. He was general manager of the Liverpool ship-repairing works of William Beardmore & Company before going to Glasgow.

Thermal Considerations in Foundrywork*

Discussion of Dr. V. Paschkis' Paper

(*Continued from page* 513)

Hot-mould Reactions

Mr. E. Longden wrote that he was puzzled by some of the facts reported. According to various investigators, the conductivity of sands increased with increasing temperature. It was not uncommon for moulds to be heated when making a certain type of border-line, near-mottled, high-duty casting. Indeed, the heating of moulds to produce the maximum of pearlitic structure in a metal which yielded a very high impact value was regularised by Lantz (Germany) in 1916. Lantz hot-mould iron was produced by introducing a metal to a heated mould, which metal, if the mould at ambient temperature had been poured, would otherwise produce white iron. The mould was heated up to suit the section of the casting, *i.e.* at ½ in. section the temperature required may be of the order of 500 deg. C. but for a section of 2 in. it might be in the region of only 250 deg. C. Silicon varied between 1 and 2 per cent., carbon from 2.5 to 3 per cent., and phosphorus below 0.3 per cent. Moulds were heated to retard the rate of cooling and thus give time for the dissociation of combined carbon and the retention of the cementite/ferrite, pearlitic structure. This was in contradiction to the fairly well accepted opinion that the conductivity of sands increased with increasing temperatures within certain limits. Where was the anomaly?

Narrowing a Field

It was stated that with the Analogue Computer one need not attempt to investigate, empirically, many sands with varying conductivities in a search for a prescribed value. One could determine on the Computer first what value of conductivity would be desirable and then limit the search for sand to the one with approximately the best value for conductivity. This could be of great value to foundrymen.

It would appear that the Analyser cou'd be used to compute the best refractory and conductivity values for the moulds employed to produce both steel and iron rolls. In the case of large steel rolls and cast-iron grain rolls it was now quite common practice to introduce a heat-absorbing, or heat-exhausting, medium behind the mould/casting face. In the case of chilled rolls, the barrel section was cooled quickly by an iron mould. An American firm used water as a coolant behind the mould/casting face and the writer once made 17-ton steel rolls by employing air cooling behind the mould/casting face. He would like to have the Author's opinion as to how helpful the analyser might be in the production of rolls; how helpful the measurement of the amount of heat and the rate of its transfer from the mould face could be; and what was

* American Exchange Paper presented to the Newcastle-upon-Tyne Conference of the Institute of British Foundrymen and printed in the Journal, June 21 and 28, 1951.

Table X.—*Hardness as Affected by Mould Medium and Section Size.*

Test No.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Thickness of the 4 by 3 in. test sample.	Green-sand.	Dry-sand.	Loam.	Graphite.	Ganister.	60 per cent steel shot, 40 per cent sand.	Silicon carbide.	90 per cent. steel shot, 10 per cent. sand.	Densener with a graphite wash.	Bare densener.
1 in.	212	200	212	217	220	235	241	248	248	255
2 in.	194	200	200	210	223	223	235	235	241	248
3 in.	184	190	197	197	212	223	217	223	223	217
Average Brinell	197	197	203	208	221	227	231	235	237	240

Table Y.—*Effect of Mould Surface Treatment on Hardness.*

Test No.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
How treated	1/8 in. Loam faced.	1/4 in. Loam faced.	3/8 in. Loam faced.	1/2 in. Loam faced.	7/8 in. Loam faced.	1/8 in. Graphite faced.	1/4 in. Graphite faced.	3/8 in. Graphite faced.	Green sand faced.	Dry sand.
Brinell	212	212	210	200	200	235	230	228	194	197

Table Z.—*Hardness Related to the Use of Denseners.*

Test No.	21.	22.	23.	24.	25.	26.	27.	28.
Cast-iron Densener, size 4 sq. in. by 2 in.	1/4 in.	1/2 in.	3/4 in.	1 in.	1 1/4 in.	1 1/2 in.	1 3/4 in.	2 in.
Brinell on treated face	223	228	230	235	235	229	240	229

there to learn from the effects of the air-gap formation in roll manufacture from a study of cooling curves?

Heat Conductivity Rates

Many years ago, the writer carried out some tests on relative conductivity values as measured by the effects of varied cooling rates, induced by varying cooling media, on the hardness value of a common cast iron. Tables X, Y and Z indicate the result of the experiments. The metal used for the tests 1 to 28 had the following composition:—C 3.22, Si 1.45, Mn 0.57, S 0.11, and P 0.79 per cent.

All of the test castings were poured with metal of the same class and temperature and at the same time in one mould from one ladle. The rate of pouring was standardised for each of the test blocks. The faces 4 by 3 in. and 4 in. square received treatment with various materials and conditions. Except for the green-sand moulds and denseners uncoated with refractory, all test moulds were thoroughly dried and allowed to cool to ambient temperature before receiving the molten metal. Test blocks 1 to 28 were poured with the test faces vertical. The treated face of the test blocks with four exceptions were machined to a standard depth of $\frac{1}{8}$ in. to eliminate the skin of the casting. On the uniform face thus formed, Brinell values were ascertained at standard points towards the centre of the specimen. Two impressions were made and the average reading recorded for the comparisons.

The materials tested covered green-sand, dry-sand, loam, graphite, steel shot and sand mix, silicon carbide, cast-iron denseners with various coating depths of loam or graphite and bare cast-iron densers of varied section. Test samples 26 to 28 exhibited white-iron chill to a depth of 0.12, 0.14, 0.15 in. respectively. The chilled surfaces were ground from the face of the samples, followed by $\frac{1}{8}$ machining.

AUTHOR'S REPLIES

Dr. Paschkis replied in writing that he was grateful for the many and important comments made to his Paper. The intensity of discussion showed how desirable it would be to have personal contacts and he hoped that ways would be found in future years to have authors of exchange papers to present these papers personally. Several problems had been brought up in the discussion by more than one person and in order to conserve space, he would try to answer these items only once.

Several questions were raised regarding limitations of the Analogue Computer technique. Dr. W. T. Pell-Walpole as well as Mr. T. Land wrote on this point. Dr. Walpole mentioned particularly two limitations:—(1) That it could be used only to check investigations made by direct experiments; and (2) the curves obtained could be interpreted only in the light of metallurgical knowledge. Taking the second limitation first, he agreed with Dr. Pell-Walpole; he believed he gave expression to this limitation in the last paragraph of the "Introduction," where it said "results can be obtained only by teamwork and co-operation between many specialists, *one* of whom, in foundrywork, should be a heat-transfer expert."

The first limitation could not be accepted. If and in so far as the validity of the technique was proven, the technique could be used to explore conditions which could not be achieved by direct experiment. For example, one might explore the solidification pattern, when using sand having properties not achievable in nature. It might be more exact to say: one might explore the time/temperature space history when pouring into a sand mould . . . because the solidification, under given thermal conditions might still depend on items other than heat, and thus not accessible to the computer.

Admitted Limitations

Dr. Paschkis considered the two main limitations of the technique to be:—

(*a*) Results were no better than the thermal properties used in the computation experiments. This limitation might be overcome, at least in part, by:—

i. Carrying out the electric computing experiments for the limits for each property: *e.g.*, for the highest and lowest conceivable value of thermal conductivity. The true result would lie between the results obtained for the two limits.

ii. Determining the relative influence of all properties (see right-hand column of page 8 of the preprint); the most important properties could then be determined more accurately.

(*b*) The shape factor was important. If the shape to be investigated became complex, the computing circuits became rather unmanageable. This limitation might be overcome, at least in part, by a new development which was mentioned in a recent Paper in *Scientific Monthly*.[1]

In reply to some of the comments by Mr. Land in this connection, the Author stated that he was right to consider insulation as one of the very important problems in design and operation of the equipment. Another problem was that of improper contacts either at one of the many plug-in points, or in the relays, used to effect the change of electric characteristics, which, in turn represented the thermal properties of the system. Fortunately, any irregularity in performance was easily detected; for example by comparing curves for consecutive points, by observing a single recording for irregularities, etc. Understanding of the processes, together with the old maxim *natura non salit* (no discontinuities in nature) helped the rapid detection of equipment failures, and thus such failures never proved to be of serious consequence. Difficulties in lumping existed. They comprised, in part, the limited size of equipment. Large numbers of lumps or sections required much material, sometimes more than was available. But even worse, large numbers of sections made the operation quite cumbersome, particularly where change of properties, introduction of heat, fusion, etc., were involved. As redeeming features one might mention:

(*a*) It was possible to operate first with very few sections, and then with slightly more, and thus extrapolate to many more sections which would be very accurate.

(*b*) It was possible to concentrate on points of specific interest. For example, if phenomena at or near the surface were to be investigated one

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would run a test with almost all the equipment concentrated at or near the surface.

Mr. Land also asked if the Author thought that the Analogue Computer or other computing devices were preferable. Dr. Paschkis replied that he had not, as yet, seen Mr. M. B. Coyle's Paper, and could not, therefore, comment on the aerodynamic analyser. He had seen the two hydraulic analysers described in this country: the "Hydrocal" developed by A. D. Moore[2] and the analyser developed by C. S. Leopold[3].

Having *worked* only with the electric analyser, he thought his remarks might be biased; but he set out the advantages and disadvantages between electric and hydraulic analysers as follow:—

Hydraulic analyser: probably less expensive to build; possibility of stopping experiments in the midst of the run, by stopping a number of stopcocks and then resuming tests by opening the stopcocks.

Electric analyser: easier and more precise reading; greater flexibility in making cross connections; in preparing for varying properties; in automatic operation of experiments.

Correlation

Several speakers commented either directly or by way of example on the fact recognised by many that studies on the Analogue Computer must be implemented by additional direct observations in the foundry. Mr. B. Gray described a special kind of bleeding test and concluded from the observations that during solidification the distribution of carbon and other elements might be different in different parts of the casting. This certainly would present some limitation on thermal studies, particularly if resulting changes in solidification ranges were significant and if the distribution of the composition in the casting were unpredictable. The differences in the plates cast horizontally or in a vertical position could conceivably be attributed to different feeding. His reference to convection currents was very important. The Analogue Computer did not permit representation of random convection. By comparing actual temperature measurements with predictions on the Analyser for castings made under various conditions it could be detected if and which conditions produce convection currents: when such currents occurred the prediction on the Analyser and actual temperature observations should not check.

Effect of Vapour in the Metal

Mr. F. Hudson reported a very interesting observation of steam bubbles rising through the metal. He agreed with Mr. Hudson that the Analyser could not predict such behaviour, although it was conceivable that the system of vapour rising through the metal could be studied by means of the Analogue Computer. He would think that it was mainly the question of finding where to direct one's attention and as so often, the imagination of the investigator was insufficient to visualise such conditions as escape of vapour through the metal. How much actual cooling would be accomplished by such escaping vapour was a different question. If the sand contained 4 per cent. moisture, then the heat of evaporation of a 1-in. layer of sand over an area of 1 sq. ft. was only roughly 300 B.T.U. Depending on how much the metal would be affected by the cooling, it was obvious that the degree of cooling obtainable in this way was quite limited. The studies mentioned in the Paper showed that also under the assumption of vapour escaping only through the sand, moisture did not contribute substantially to the rate of cooling of the metal.

Mr. R. Ruddle referred to the comments and comparisons with Chvorinov's actual experimental work. He commented on two facts: (*a*) that Chvorinov, in the opinion of Mr. Ruddle, based his statements on the time to reach the solidus; and (*b*) that the Author's findings regarding incorrectness of Chvorinov's claims were based on too small a size-range to be valid.

The first contention could not well be proved, or disproved. However, Chvorinov used a number of values published by other Authors, such as Briggs and Gezelius, who, in turn, based their solidification predictions on bleeding tests. In as much as for steel, bleeding tests appear to give solidification times corresponding to the liquidus, it would appear as if Chvorinov, perhaps unknowingly, used also the liquidus as criterion.

The second argument, it seemed to Dr. Paschkis, worked against Mr. Ruddle's reasoning, for if already within a small range of sizes Chvorinov's rule was not accurate, then for a larger range it must be questioned still more. At the last meeting of the American Foundrymen's Society, Chvorinov's Paper came in again for a good deal of discussion, particularly since a Paper by H. A. Schwartz and W. K. Bock was presented with further evidence against the validity of Chvorinov's claims. In the discussion, as the writer understood it, there seems to have been agreement that Chvorinov meant his laws to be an empirical generalisation, rather than precise mathematics. From this viewpoint, it is well to remember that he averaged castings poured with a great variety of different superheat values.

Temperature Measurements

Mr. Ruddle also writes "that the Author ignores edge-effects in his slabs." It should be noted here, that, on the Analyser, slabs were tested which had no edge-effect. But at the same time, the volume/area ratio was determined accordingly—*i.e.*, also with no edge-effects. Mr. Ruddle spoke about an apparent contradiction between the statements in the Paper regarding difficulties involving temperature measurements and the acceptability of temperature measurements as a check for the Analyser. The Author did not think that this was a true contradiction. Disregarding temperature measurements or discounting them because of lack of accuracy would be foolish indeed, operation of the Analyser depended on a knowledge of conductivity and specific heat. Both properties could be established only by temperature measurements.

If and insofar as temperature measurements in castings could be made with sufficient accuracy, they represented, as applied to thermal studies in foundrywork, final authority. But the reviewer knew, probably better than the Author, the difficulties and limitations of temperature measurements. Measurements in liquid metal had become possible, thanks to the extreme care of Mr. Ruddle; but the Author was not aware of a systematic study analysing the errors and limitations in such measurements. Observations near the surface, or of rapidly-changing temperatures were still practically impossible.

The larger part of the paragraph questioned by Mr. Ruddle dealt not so much with the temperature measurements themselves, but rather with the difficulties, economical and experimental, of providing samples with the desired variation of conditions. These remarks were also meant in reply to Dr. Pell-Walpole's understanding assuming that it appeared the Paper was meant to detract from the value of Mr. Ruddle's very excellent work, which the Author admired greatly.

Answering Mr. Ruddle's request for a better explanation of the time scale, the following comments might be helpful. A given thermal occurrence, such as the solidification of a casting, could be represented on the Analyser by a practically unlimited number of different electric computing circuits. Each circuit was related to the thermal occurrence by certain correlation factors, for example between thermal-conductivity (of the casting) and the electric-resistance; between specific-heat and capacity etc. One of these correlation factors related the time in thermal occurrences ("heat-time" in the language of the laboratory) to the time in the electric computing experiment ("electric-time" in American wording). All correlation factors were interrelated by certain mathematical relationships. Thus, by proper selection of certain correlation factors, it was possible to select the one relating heat-time and electric-time. The ratio "electric-time"/"heat-time" could thus be chosen. Consequently, a thermal occurrence of, say, 5 min. duration, could be represented by an electric computing experiment which lasted less than 5 min., exactly 5 min., or more than 5 min. The possibility of selecting the length of computing experiments to represent a given thermal occurrence was obviously of great importance. It made it possible to study very rapid thermal happenings, which occurred in fractions of a second, within reach of observation and measurement; and to reduce the time of observation of very slow occurrences which might take years for completion, to a practical duration.

Science versus Art

Dr. Pell-Walpole took exception to the statement in the Paper that science could eventually replace art in the foundry field. In the Author's opinion the ratio "science/art" in any field of industrial endeavour changes over the years, starting from zero, and approaching unity asymptotically; the ratio "one" therefore was achieved after infinitely long time—or, it could equally well be said—never, speaking in human terms. In the Paper he had indicated the theoretical limit of "one"; he had no objection to speaking in more immediate terms, by using the word "complement" instead of "replace."

Mr. T. Land distinguished three periods of developing and applying science, the first being the determination of physical properties. He felt that this period had been completed in the foundry field. It might be pointed out, however, that there was still great uncertainty regarding many of the physical properties which were important in foundrywork: thermal conductivities of metals at elevated temperatures, particularly in the liquid state, solidification range, and emissivities were just a few examples in point. The second period in his opinion comprised the application of the methods of measurements and so to say standardise procedures. Whereas there was no question, that over the last several years the foundry art had progressed considerably, it would appear to the Author that the existence of great variety of practices in foundries was a valid proof that we were still far distant from the point where empirical application of measurements resulted in reproducibility. For example, the contradictory views held by various foundrymen on such problems as gating and risering, could be quoted.

Boundary Conductance

Dr. Pell-Walpole found that the explanation of the boundary conductance in the Paper was not sufficiently clear and the following remarks were intended to answer this criticism. Experience showed that if a solid body was heating or cooling, the surface of the body was at a lower or higher temperature respectively than the ambient. This temperature drop was indicative of a thermal resistance between the surface and the surrounding; this resistance should not be confused with that inside the body; the latter was expressed by the ratio "thermal conductivity/thickness." The thermal resistance between surface and surrounding was expressed as the inverse of the boundary conductance.

Mr. Land was correct in stating that the text should read 3 to 9 times instead of 6 to 9 times in the section on "Practical Consequences of Heat Transfer Theory." Mr. Land was also correct in questioning the lack of end effects in a slab of 6 by 12 by 12 in., which served as comparison with a 6-in. slab on the Analyser. On the Analyser one could get rid completely of end effects, by treating a slab as "one-dimensional" or a cylinder as having purely radial heat-flow. In order to compare Analyser experiments with actual foundrywork, one could in actual casting only approach this "no-end effect" condition, but never reach it. In case of the 6- by 12- by 12-in slab, this was the largest slab of 6-in. thickness which could be cast in the experimental foundry in question.

Practical Applications

Mr. Ruddle asked for a list of possible applications of the Analogue Computer to practical foundry problems. It was not possible to give a complete list, but the following items might be of interest.

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(*a*) It was planned to study more the question of shape factor. Chvorinov's law drew so much comment (in Europe as well as in the U.S.A.) because of its tempting simplicity. Since it was accepted, at least in the U.S.A., that it was not correct, attempts would be made to supplant it by a better one, which should be more correct, without losing all of Chvorinov's advantage of simplicity.

(*b*) This, by necessity, would lead into two-, and possibly later. also, three-dimensional studies, at least of still rather simple shapes such as rectangular bars, finite cylinders, etc. A further step in this direction was the study of receding angles, of wholly-submerged cores, etc.

(*c*) Study of the influence of slow pouring; to date it was asumed that solidification started with the metal at pouring temperature meeting a mould at room temperature. Actually, the metal through its contact with runners and sprues etc., would have lost some of its heat content prior to reaching the mould cavity; and the mould wall, at least at the part near the gate, might have absorbed some heat from the metal flowing past it, before the time when some metal remained in contact with that part of the mould.

(*d*) All these studies would help to study the problem of gating and risering and of proper feeding.

(*e*) Finally, all studies to date were related to the solidification problem. Melting furnaces, ladles, core- and mould-drying and baking and annealing of castings were all subject to this kind of analysis.

Time Factor

Regarding Mr. Russell's remarks, he agreed that for the practical foundryman, the spread quoted by Mr. Russell of 6-18 hours, was very uncomfortable. He agreed also, that the man who has seen hundreds of cores dried, will improve on this overall rule. The purpose of introducing scientific approach, however, it seemed to the Author, was to get away from the reliance on experience. Now, the science of heat-transfer, of course, allowed one to narrow-down this wide spread, by introducing the ratio (thermal-conductivity/boundary conductance × thickness of core). This ratio was dimensionless and together with the geometry allowed an accurate prediction of the drying time. This prediction became rather involved, and therefore might be of still less use to the practical foundryman. The question, then, was: was it better to leave the foundryman entirely to his experience, or to give him simple and accurate although very wide limits?

Metal Density

Mr. Young brought up the quite-interesting statement that the temperature drop of the iron in running over a spout and in dropping through air was not sufficiently studied. This temperature drop could be quite readily studied by means of the Computer and it should be noted that the drop in the spout would depend in part on the tapping schedule of the cupola. Undoubtedly there were differences in density in molten metal but Dr. Paschkis was not aware of numerical values regarding the point of greatest density.

Two members had spoken about production of rolls. Mr. Longden began with the question of preheating moulds; the Author might re-word his question as follows. "Why does preheating of the moulds retard solidification, in view of the increasing conductivity of the sand within increasing temperature?"

Solidification occurred, of course, due to heat-extraction from the casting by the mould. For a given casting, the heat extraction was helped or increased by a large temperature difference between casting and mould and was hindered (decreased) by low conductivity of the mould. Incidentally, it would be more precise to speak of "low diffusivity," the thermal diffusivity being defined as the ratio, conductivity/(specific-heat × density). Increasing the mould temperature by preheating decreased the available temperature difference between casting and mould, therefore decreased the rate of heat-flow out of the casting and therefore slowed down the solidification. This effect was somewhat counteracted by the fact that with increasing mould temperature, the conductivity and also the diffusivity increased, making for a more rapid solidification. Although probably the question has never been analysed systematically, the Author suspected that the first influence overbalanced the second, and that there was a net decrease of solidification rate.

Refractory Values

Regarding the suggestion to use the Analyser to compute the best refractory and conductivity values, he interpreted the term "refractory values" to include specific-heat and density. Mr. Longden then proceeded to raise three specific questions which he would like to answer, respectively, as follows:—

1. The Analyser could undoubtedly help to predict cooling rates and solidification rates in the production of rolls, but it could not indicate what the most desirable cooling rates for a given composition of the moulds would be.

2. This question could be taken in two ways. (*a*) That the measurement of heat and the rate of heat-transfer were to be done on the Analyser. In this case the measurements would, it seemed, be incidental to the main problem of determining the temperature-drop in various spots in the casting; (*b*) the question could also mean measurements on actual castings. Such measurements would undoubtedly allow analysis of thermal behaviour to some extent. He was not sure if the information gained in this way would warrant the considerable effort in carrying out measurements on the large castings. If such measurements should be meaningful they would have to be carried out with considerable care and this in turn meant expense in time, money and disturbance of production. Moreover, he believed that, in order to be significant, measurements would have to be repeated in

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"The Institute and You"

Mr. L. G. Beresford's Presidential Address

At the inaugural meeting of the London branch of the Institute of British Foundrymen this session, following the approval of the minutes, the retiring president, Mr. F. E. Tibbenham, briefly introduced his successor, Mr. L. G. Beresford, and invited him to deliver his Address.

Mr. L. G. Beresford then delivered his inaugural address, in the course of which he said:—

Mr. Tibbenham and Gentlemen, in common with all presidents in the past, I am hoping that this will be a record year in the history of the London branch, and I shall do my utmost, with your help, to see that it is so. As a start, I propose to try and make this the shortest presidential Address on record, first, because I want us to have as much time as possible for Mr. Parkes' Paper, which is to follow, and second, because it seems to me that most of the subjects suitable for a presidential Address have been dealt with by my predecessors in a much more able way than I can possibly hope to attain. I would, therefore, rather regard this as a personal chat between you and me on a subject in which we all are interested—a chat which, for want of a better title—I propose to call "The Institute and You!"

Important Rules

Those who have read the rules of the Institute will have noticed that the objects of the Institute of British Foundrymen as set forth on page 11 of the booklet are:—

To promote the intellectual welfare of its members by periodical meetings for reading and discussing scientific Papers on subjects connected with the foundry and allied industries, and such other matters as may be considered within the scope of the Special Authority.

To initiate, conduct and supervise researches into the science and technology of the art of metal and alloy production, casting and working.

To organise and conduct or advise on means and systems of education for all or any grades of operatives or workers in the art and craft of metal casting and to collect and distribute information on the science and art of founding and allied subjects.

Generally to do all things necessary or expedient for the proper and effective carrying out of any of the objects aforesaid.

I take it that all of us are interested in furthering these objects—otherwise we should not be here tonight. Now let us examine our personal reasons for joining the Institute.

First and foremost I believe that for the majority of us it was the desire to further our knowledge of the foundry art and craft—tinged, maybe, with the mercenary thought that by so doing we might be able to improve our financial position. I hope, by the way, that in both cases you have been, or will be, satisfied. But, whatever the reason for joining the Institute, the main object, if we are honest with ourselves, is to get something *out* of it. Now that is satisfactory as long as it does not stop there. Most of us have lived long enough to know that we only get *out* of anything in proportion to what we are prepared to put *into* it; yet how many of us put anything, apart from our subscriptions, *into* the Institute. You may say that the London branch has the largest number of members, and the highest attendances at monthly meetings. But mere attendance is not enough. You cannot expect the other fellow to come here and give you the benefit of his experience, either by lecturing or by taking part in the discussions, unless you, yourself, are prepared to give him the benefit of yours; the acquisition of knowledge is a mutual affair.

Benefits of Authorship

One of the matters which have been worrying your Council this year is that too few of the papers are to be provided by members of our own branch. I know the answer in many cases will be that you do not feel capable of preparing a paper—my answer to that is, try it; and you will be surprised at your own capabilities. The presentation of a paper does not require outstanding literary ability. All that is required is a subject (and in your every-day work there should be no lack of these), a knowledge of that subject (which I am sure all of you possess) and, above all, a willingness to pass on that knowledge to others. In all the scientific societies with which I am connected there is always the complaint that we do not get enough *practical* papers—complaints usually from the practical men themselves, who, holding the remedy in their own hands, are reluctant to take it. Try it some time—jot down what you know and I guarantee that before long an interesting paper will take form before your very eyes.

Speaking to the younger members of the branch in particular, the presentation of papers can bring your name before the people who matter. I can think of several personal experiences, and I have no doubt that Mr. Faulkner can do so too, where the presentation of a paper has resulted in a young author getting a much better job. One instance, in particular, comes to my mind in connection with my own journal. Some years ago we published an anonymous article on the Future of the Aluminium Industry. The day after publication I received a telephone call from the managing director of a large company who said they were so impressed by the statements in the article that they would like to meet the author with a view to offering him a better job. Having obtained the author's permission, I telephoned the managing director and said that the author was quite willing, in fact, contact could be made in the office next but one to his

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own! I might add that there is no guarantee that this will happen to you.

To all those who can prepare a paper I say this: Do not wait to be asked to do so—offer it; yet if preparing a paper is too much for you, and in some cases I know pressure of work and the impossibility of revealing confidential information prevents you—what about taking a more active part in the discussions? We are all grateful to our stalwarts who can always be relied upon to contribute for the benefit of others, but I would like, in my year as president, to have more contributions from the body of the hall; the livelier and more controversial the better.

I have heard, from members of other branches who have joined this, that the mild nature of our discussions compares very unfavourably with that of other branches. One of the reasons for this is, of course, the innate shyness of the foundryman, and of the London foundrymen in particular, but I can assure any of you who may feel shy about taking part, that whatever you have to say will be listened to with respect even though others may not agree with your remarks—and, I hope, if they do not they will not hesitate to say so.

May I leave you with one final thought, borrowed from a game not unknown to some of us—*The more you put down—the more you pick up*! I can assure you that, in the case of acquiring knowledge, this saying is much more true than it is in the game with which it is generally associated.

Vote of Thanks

MR. F. E. TIBBENHAM, proposing the thanks of the branch to the President for his Address, which was much appreciated, said the statements made were very much to the point, and it was hoped the members would take the advice concerning suggestions they could make and Papers they might present. The fixing of the programme each year always presented problems to the Council, and anything the members could do to help would be very much appreciated.

(The vote of thanks was warmly accorded, and the president briefly made acknowledgment.)

The Branch President, before proceeding with the rest of the programme, announced that a Diploma of the Institute had been awarded to two members of the branch for Papers presented to the parent body and to the Slough section respectively during the previous session. The recipients were Mr. M. M. Hallett and Dr. Scheuer, and to them the president offered congratulations which were endorsed by general applause.

AT AN ORE-GRADING PLANT operated by Dorman, Long & Company, Limited, a 54-in. conveyor belt manufactured by the British Tyre & Rubber Company, Limited, has carried 2,575,000 tons of ore from primary to second crusher and is still running. A 48-in. belt delivered 2,467,000 tons from secondary crusher to screens before its recent replacement. At this plant three B.T.R. wharf sinter belts, 36-in. by 8-ply, have carried 567,670 tons of hot sinter at an average belt cost of 1.14d. per ton.

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several castings, possibly with variation of some factors involved, for example, mould material.

Air-gaps

3. Formation or non-formation of an air-gap would have significant influence on the cooling rates when the rolls were cast against a chill, but would have relatively small influence if the rolls were cast against sand. This ties in with Dr. A. B. Everest's remarks. The Author did not mean to indicate in the Paper that they did not know what influence an air-gap had on the cooling rate but only that the Analyser could predict at what time such an air-gap formed. The time of formation of the air-gap could be detected by combining temperature observations in actual solidification with analysis on the Analyser. The idea of passing molten lead between roll and chill seemed interesting. He wondered to what extent practical difficulties would be encountered due to an uneven air-gap thickness, which would result in different thickness of the lead layer.

Returning to the discussion, Mr. Longden referred to the practice of an American Company to use water-cooling outside the mould. From a purely thermal viewpoint, almost the same effect would be obtained by decreasing the mould thickness. He was aware that there were limitations there due to the strength of the mould and its ability to withstand the ferro-static pressure of the casting but was not sure if this minimum thickness had been reached.

In the whole matter of roll production, it would seem that the logical sequence of thought would be as follows. The hardness was influenced by the cooling rate; the cooling rate was influenced *inter alia* by the conductivity and density of the mould material; therefore, by metallurgical study the desired cooling rate should be found to obtain the desired grain structure and hardness of the casting; the thermal diffusivity of mould material necessary to get such cooling rate should be determined as well as the conductivity, density and specific heat of various mould materials so as to find out how to obtain the desired diffusivity.

REFERENCES.

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Factory Inspectorate for Wales

The Ministry of Labour and National Service announces that it has been decided to set up a separate division for Wales in the organisation of the Factory Inspectorate. The Inspectorate is organised on a basis of districts grouped in divisions but there has never previously been a separate division for Wales. South Wales districts have been grouped with districts in the south west of England and North Wales districts with districts in the West Midlands. The new Division will be under a separate Superintending Inspector.

Production and Properties of Aluminium Casting Alloys*

By F. H. Smith A.I.M.

(*Continued from page* 485)

The concluding section of this Paper deals mainly with the development of aluminium casting alloys in groups according to properties and the formulation of standard specifications. Relevant appendices are also included. The discussion of the Paper at the Newcastle-upon-Tyne conference, which is printed contiguously, principally concerned identification of scrap; cutting down the number of specifications; relations between secondary and virgin alloys; special-purpose compositions; the removal of magnesium; and the influence of ingot casting temperatures.

Classification of Alloys

Compared with his predecessor at the beginning of the century, the aluminium founder to-day has at his command a wealth of alloys. Their range of properties and characteristics is so wide that aluminium alloy castings are to be found fulfilling a variety of functions in almost every branch of industry. Fifty years ago the founder was concerned almost entirely with the production of sand castings in one or two alloys. To-day his successor is expected to know not only whether an alloy is suitable for production in the kind of mould and shape of casting requested but also whether it is suitable for use under any specified set of conditions. For the engineer or designer who has not the founder's advantage of a knowledge of the castability of many of the alloys, the choice of material is even more difficult.

B.S. 1490 contains specifications for twenty alloys ranging in strength (minimum) from 7.5 tons per sq. in. for the weakest sand cast alloy to 21 tons per sq. in. for the strongest chill cast alloy in the fully heat-treated condition. Some of the alloys, such as the high silicon compositions, can be cast into the most intricate of moulds without fear of cracking; others, particularly those of higher strength, are limited in their application by their foundry characteristics. Some alloys, such as LM-12, 13, 14 and 15, largely retain their strength with rising temperature and are used for combustion engine pistons, others, *e.g.*, LM-5, 6, 8 and 9, are less affected than most by chemical substances and find applications in food and chemical plant and marine craft. The most widely used of all the casting alloys (LM-4) has no single outstanding applicational advantage, but the ease with which it can be cast in the foundry, and its proved suitability under commonly encountered conditions, make it a good general purpose alloy.

A discussion of the factors affecting the choice of alloy even on the basis of casting characteristics alone would be a lengthy business, but they have been considered elsewhere.[11] Appendix III provides a convenient summary of the casting characteristics, general properties and type of application for each of the B.S. 1490 alloys which should assist both the founder and engineer to select the most suitable alloy for any set of conditions. Appendices IV and V show the mechanical properties and compositions of the alloys.

In conclusion it is interesting to see how British casting alloys compare with those of other countries, *e.g.*, U.S.A., Germany and France.

It is clear from what has been said about the alloys contained in B.S. 1490 that in Great Britain the expression " secondary casting alloy " should not be used in connection with a specification alloy since it implies a distinction for which in most cases there is no evidence. As has been explained, an alloy is defined solely by the composition and mechanical requirements of the specification and it may be made, according to the practice of the producer and the available raw materials, wholly from primary aluminium, wholly from reclaimed metal or from any proportions of each. Similarly, in the United States, specifications define casting alloys only by compositions and mechanical property limits, and no reference of any kind is made to the raw materials which may be used. Although in Great Britain this principle has only been admitted during recent years, in America it seems never to have been seriously questioned by those responsible for specifications. One result of this is that in technical discussions and Papers on the properties and applications of casting alloys, the expression " secondary alloy " never appears On the whole it can be claimed that British specifications demand lower limits for most of the elements which are not deliberately added for alloying purposes, *e.g.*, iron and zinc, but it would be difficult to produce evidence to show that American alloys are inferior to the corresponding British alloys.

In France there are two specifications for many alloys. The composition requirements for the one series of specifications are little different from those of the corresponding B.S. 1490 specifications, but for the other series, very much higher impurity contents are permitted. The designations of the latter alloys are prefixed by the figure "2" denoting " alliage de 2 ème fusion " or " secondary alloys."

The latest German DIN standards (1945) seen by the Author contain, in addition to the alloys used before the war, four specifications for " remelt " alloys, prefixed with the letter "U" (Umschmelzlegierung). These are in some ways similar to LM-3 and 4, but compared with British standards, they allow very high limits for impurity elements. In

* Paper presented to the Newcastle-upon-Tyne Conference of the Institute of British Foundrymen, with Mr. J. J. Sheehan in the chair. The Author is Development Officer, ALAR Limited (Association of Light Alloy Refiners).

Production and Properties of Aluminium Alloys

the normal alloys, in almost every case, the permitted impurity contents are higher than those in the equivalent British specifications. This is particularly apparent, as in the American specifications, for the element zinc.

One of the main objects of this paper has been to show the care and skill employed in the production of aluminium casting alloys in this country, and it is gratifying to find that our alloys compare so favourably with those of other countries. The recovery and re-employment of aluminium is of the utmost importance to British economy, and this Paper can be concluded with the satisfying thought that visits to other countries have shown that nowhere is the recovery of aluminium more comprehensively and efficiently carried out, or are the products of a higher standard, than in Great Britain.

Acknowledgments

The Author is grateful to the directors of ALAR Limited for permission to publish this Paper and acknowledges his thanks to the technical staffs of the member companies for their advice and the provision of many of the illustrations.

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[Five appendices included with the Paper are included in the following pages.—EDITOR.]

DISCUSSION

MR. D. C. G. LEES, M.A., A.I.M. asked whether, in the sorting of the scrap before the refining processes began, there was any means used to identify the different alloys, short of a complete chemical analysis. In a number of places he had seen spot tests described, in which one took various chemicals and put a drop or two on the surface of the aluminium alloy and various colour changes were then supposed to take place which enabled the experienced man to determine what was present, and equally what was not present. He was not aware of any great use being made of that type of test and would like to know whether such methods had been found useful in practice.

Secondly, one often heard it said, and indeed it had been said in a discussion earlier that morning, that there were such a large number of aluminium alloys—the implication being that it was bewildering to users—and also that there were more divergent aluminium alloys than there were with other metals, but he was not at all certain that it was so. It was true that there were some twenty alloys mentioned in B.S. 1490 for aluminium ingots and castings but he imagined that two, three or four of those accounted for well over 90 per cent. of the tonnage, and that amongst the wrought products the same sort of situation occurred, probably four alloys making up well over 90 per cent. That meant that the total tonnage would seem to be accounted for by less than ten alloys, both cast and wrought, and he wondered if that was very different from other metals.

He had noticed an article in the technical Press describing the extrusion of copper alloys which mentioned nineteen or twenty different alloys. He had also noticed, a little while previously, a leaflet produced by a well-known steel foundry stating that they were prepared to make castings in something of the order of fifteen different steels.

Rapid Testing Methods

MR. F. H. SMITH, replying to the question on the sorting of scrap, said it was quite true that there were chemical spot tests for identifying alloys and that they were quite widely used. Spot tests depended on the development of a colour, in a drop of solution placed on the cleaned surface of the sample, for the detection of single elements present in the alloy. Most of the common elements could be identified in this way but this type of spot test demanded quite a high order of skill and a great deal of experience in interpretation. The operator must have some knowledge of the sensitivity of the test and so be able to decide whether the element found was present as a main alloying element or not. He must also know the nominal compositions of wrought and cast alloys in order to be able to deduce the alloy or type from the elements found in the sample. For these reasons spot tests were usually made by members of the laboratory staff. Chemical check tests were also made on fragments cut or broken from samples and dissolved in small volumes of appropriate solutions in test-tubes. Although this method was a little longer and had to be done in the laboratory rather than wherever the scrap lay, it was, generally speaking, easier to control.

He should perhaps emphasise that a very large proportion of scrap was identified by the sorter by simple manual tests backed by years of experience and a knowledge of the kind of alloy used in any application. The skill of the sorter was one of the arts of the secondary-aluminium industry and in practice chemical tests were used mainly to establish the identity of alloys in unfamiliar types of uses or to distinguish between two similar alloys in the same composition group.

There were other tests for identification which were less widely used; there was the electrolytic test in which the potential was measured between the piece of scrap and an electrode of aluminium using a chloride solution as an electrolyte, and the thermo-electric method in which a thermocouple was formed between a piece of scrap and pure aluminium and the junction heated by an aluminium-tipped electric soldering iron. The galvanometer (and the millivoltmeter in the previous method) was calibrated to show the alloy instead of the e.m.f.

APPENDIX I.—*Aluminium Statistics.*

U.S.A. Production (Long Tons).*

Year.	Primary.	Secondary.	Ratio. Sec./Prim., per cent.
1913	21,100	4,150	19
1914	25,870	4,040	15.6
1915	40,040	7,580	18.7
1916	51,380	17,210	33
1917	57,980	14,370	24
1918	55,620	13,420	22
1919	57,360	16,670	29
1920	61,550	13,820	22
1921	24,330	7,950	29
1922	32,870	14,540	44
1923	57,480	19,000	33
1924	67,200	24,080	36
1925	62,520	39,270	62
1926	65,750	39,430	61
1927	73,030	41,230	56
1928	93,590	42,660	45
1929	101,700	43,180	42
1930	102,200	34,440	33
1931	79,200	27,020	34
1932	46,820	21,400	45
1933	37,970	29,860	79
1934	33,100	41,390	126
1935	53,260	45,880	86
1936	100,450	45,980	45
1937	130,550	55,820	42
1938	128,100	34,620	27
1939	146,050	48,130	32
1940	184,350	71,540	38
1941	275,900	95,350	34
1942	465,200	177,000	38
1943	824,000	183,000	22
1944	693,300	203,400	29
1945	441,900	175,600	40
1946	365,800	189,600	51
1947	510,300	171,700	33
1948	556,300	180,800	32
1949	537,800	124,000	23
1950	641,600	199,900	31
Total ..	7,303,520	2,518,130	34.5

* Most of the above figures were provided by C. H. Burton, Aluminium Research Institute, Chicago. They are mainly from his Paper "Secondary Aluminium in 1949." The figures for primary production for 1948 to 1950 are from "Primary Aluminium Monthly Reports," Bureau of Mines.

United Kingdom Production (Long Tons).

Year.	Primary.	Secondary.	Per cent. Ratio, Sec./Prim.
1940	18,900	39,100*	207
1941	22,600	50,300	222
1942	46,800	75,300	161
1943	55,700	87,700	158
1944	35,500	95,900	270
1945	31,900	61,900	194
1946	31,500	48,600	154
1947	28,900	63,700	220
1948	30,000	63,300	211
1949	30,300	68,600	227
1950	29,500	86,400	293
Total ..	361,600	740,800	Av. 205

Germany.

Year.	Primary.	Secondary.	Ratio. Sec./Prim.	Total consumption.
1933	18,600	5,400	29	27,900
1934	36,600	5,400	15	51,700
1935	69,700	5,400	8	85,500
1936	95,700	7,100	7.5	102,600
1937	125,200	13,200	10.5	123,000
1938	158,600	31,000	20	173,700
1939	206,700	43,200	21	206,500
1940	201,300	57,100	28	247,800
1941	208,800	84,200	40	269,200
1942	223,400	92,000	41	268,600
1943	199,900	112,100	56	281,200
1944	187,800	160,500	86	262,600
Total ..	1,732,300	616,000	Av. 35.6	2,100,300

Italy.

Year.	Primary.	Secondary.	Ratio, Sec./Prim.	Total consumption.
1935	13,550	1,190	10	14,700
1936	15,600	1,780	13	16,700

* Based on second half of year.
The U.K. figures are from Ministry of Supply Statistics; the German and Italian figures are from W. Lewis, "Light Metals Industry," Temple Press, London, 1949.

U.K. Consumption (Despatches) in Long Tons.

Year.	Primary.	Secondary.	Ratio, Sec./Prim.	Ratio, Sec./Sec. + Prim.	Secondary* per cent. In total uses.	Secondary* per cent. In castings.	Secondary* per cent. In wrought products.
1935	33,600	8,000	24	—	—	—	—
1936	38,400	8,000	21	—	—	—	—
1937	39,600	10,000	25	—	—	—	—
1938	44,400	16,000	36	—	—	—	—
1939	78,000	20,000	26	—	—	—	—
1940	102,200	37,500	36	27	32	55	21
1941	116,600	50,000	43	30	36	65	22
1942	195,400	74,600	38	28	31	60	18
1943	208,100	90,900	44	30	34	56	23
1944	150,100	66,800	45	31	38	58	29
1945	94,900	47,600	50	33	40	72	29
1946	114,600	82,600	72	42	44	82	33
1947	158,600	107,500	68	40	40	81	28
1948	173,400	69,400	40	29	26	80	9
1949	178,600	68,800	39	28	28	84	10
1950	181,400	93,800	52	34	31	87	11
Total ..	1,907,900	851,400	—	—	—	—	—

Most of the above figures are from Ministry of Supply Statistics, but some figures for 1935-41 are taken from the *Financial Times* September 26, 1949. (The secondary consumption figures for 1935-41 are estimated.)

The average ratio of secondary to primary over the period 1935-50 is 44.7.

*These figures are calculated by the Ministry of Supply on the basis of returns from founders, fabricators, etc.

APPENDIX II.—*Related Specifications and Trade Names.*

B.S. 1490.	B.S.S. (Engg.) (obsolete).	B.S.S. (aircraft).	L.A.C.	D.T.D.	B.S./STA.7 (Services).	Trade names.	A.S.T.M. B179-49T.	Alcoa.	Alcan.
LM 0	300	L.49	—	478*		—	—	—	—
LM 1-M	—	—	—	428*	AC 1	Z.3	CS 72A	113	—
LM 2-M	—	—	112A*	—	AC 2	—	—		—
LM 3-M	—	—	113B*	—	AC 3	—		645	—
LM 4-M	—	—	—	424	AC 4	—	SC 54B	319	117
LM 5-M	—	—	—	165	AC 5	Birmabright	G 4A	214	A 320
LM 6-M	702	3L.33	—	—	AC 6	Alpax	S 12A	13	160
LM 7-M	—	—	—	—	—	Hiduminium 51	—	—	—
LM 7-P	—	L.51	—	133C/287*	AC.7	RR.50, Ceralumin B	—	—	—
LM 8-W	—	—	—	—	AC 8	Hiduminium 40A	SG 70A	356	135
LM 8-WP	—	—	—	—	AC 8	Hiduminium 40B	SG 70A	356	135
LM 9-P	—	—	—	240*	AC 9A	Alpax β	—	—	—
LM 9-WP	—	—	—	245	AC 9B	Alpax γ	—	—	—
LM 10-W	—	L.53	—	300A*	AC 10	Noral 350W	G 10A	220	350
LM 11-W	—	—	—	298	AC 11A	Noral 226W	—	195	225
LM 11-WP	—	—	—	304	AC 11B	Noral 226T	—	195	225
LM 12-WP	—	—	10*	—	AC 12	—	CG 100A	122	—
LM 13-WP	—	—	—	—	AC 13A	Lo-Ex	SN 122A	A 132	162
LM 13-WP(S)	—	—	—	—	AC 13B	Lo-Ex	SN 122A	A 132	162
LM 14-M	703	2L.24*	—	—	—	"Y" Alloy	CN 42A	142	—
LM 14-WP	704	2L.35	—	—	AC 14A	"Y" Alloy	CN 42A	142	—
LM 14-WP(S)	—	—	—	—	AC 14B	"Y" Alloy	CN 42A	142	—
LM 15-WP	—	L.52	—	131B/255*	AC 15	RR.53, Ceralumin C	—	—	—
LM 16-W	—	—	—	272	—	Noral 125W	SC 51A	355	125
LM 16-WP	—	—	—	276	—	Noral 125T	SC 51A	355	125
LM 17-M	—	—	—	204	—	Birmasil Special	—	—	—
LM 18-M	—	—	—	—	—	Alar 00.5	S 5A	43	123
LM 19-W	—	—	—	294	—	Aeral A	—	—	—
LM 20-M	—	—	—	—	—	Alar 00.12	S 12A	13	—

NOTE.—The suffix letters in the first column denote the following conditions of the alloys:—M—as cast; W—solution heat-treated; P—precipitation heat-treated; (S)—special stabilising treatment. * Obsolete.

APPENDIX III.—*Casting Characteristics and General Properties.*

Specification B.S. 1490.	Casting characteristics.					General properties.		Uses and general remarks.
	Fluidity.	Resistance to hot-tearing.	Sand casting.	Gravity die-casting.	Pressure die-casting.	Corrosion resistance.	Machinability.	
LM 1	F	F	F	G	F	P	G	General purpose gravity die-castings.
LM 2	G	G	G	G	G	G	F	General purpose alloy especially suitable for pressure die-castings.
LM 3	F	P	G	U	U	P	G	General purpose sand casting alloy.
LM 4	G	G	G	G	G	G	G	General purpose alloy with good foundry and mechanical properties.
LM 5	F	F	F	F	F	E	G	For use where corrosion resistance is of first importance, *e.g.*, marine applications.
LM 6	E	E	E	E	G	E	F	Suitable for large, intricate and thin castings, and where ductility and corrosion resistance required.
LM 7	F	G	G	G	F	G	G	General purpose sand and gravity die-castings.
LM 8	G	G	G	G	G*	E	F	Suitable where resistance to corrosion is important, *e.g.*, marine applications.
LM 9	E	E	E	E	G*	E	F	Uses as for LM 6, but has greater strength and lower ductility.
LM 10	F	G	F	F	F*	E	G	For castings requiring high strength and shock resistance. Requires special foundry technique.
LM 11	F	P	F	P	U	F	G	For castings requiring high strength or high ductility (according to heat-treatment). Requires special foundry technique.
LM 12	G	G	F	G	U	P	E	For use at elevated temperatures, *e.g.*, for medium duty pistons.
LM 13	E	E	G	G	F*	G	F	For use at elevated temperatures. Suitable for most types of pistons and cylinder heads.
LM 14	G	G	F	G	U	F	G	For use at elevated temperatures. Suitable for high-duty pistons and cylinder heads.
LM 15	G	G	F	G	U	G	G	Similar in applications to LM 14.
LM 16	G	G	G	G	G*	G	G	Suitable for fairly intricate castings where mechanical properties of heat-treated alloy required.
LM 17	G	G	G	G	G*	G	F	Similar to LM 6 in some respects, but better mechanical properties at elevated temperatures.
LM 18	G	G	G	G	G	E	F	Combines good foundry characteristics with high resistance to corrosion.
LM 19	F	F	F	F	U	F	E	Free machining alloy.
LM 20	E	E	E	E	G	G	F	Similar to LM 6 but lower ductility and better machinability.

Symbols:—E = Excellent; G = Good; F = Fair; P = Poor. U = Unsuitable. * Not pressure die-cast in this country.

APPENDIX IV.—*Mechanical Properties Specified*

Specification B.S. 1490.	Minimum mechanical properties.*						
	Sand cast.			Chill cast.			Brinell hardness number.
	0.1 per cent. proof stress,† tons per sq. in.	Ultimate tensile stress, tons per sq. in.	Elongation, per cent. on 2 in.	0.1 per cent. proof stress,† tons per sq. in.	Ultimate tensile stress, tons per sq. in.	Elongation, per cent. on 2 in.	
LM 1-M	5.5	8.0	—	7.0	10.0	—	—
LM 2-M	4.5	8.0	—	—	9.5	—	-
LM 3-M	6.0	9.0	—	—	—	—	—
LM 4-M	4.0	9.0	2	4.5	10.0	2	—
LM 5-M	5.0	9.0	3	5.0	11.0	5	—
LM 6-M	3.5	10.5	5	4.5	12.0	7	—
LM 7-M	4.0	9.0	2	4.5	10.0	2	—
LM 7-P	7.0	10.0	2	8.0	12.5	3	—
LM 8-W	7.0	11.0	2.5	7.0	15.0	5	—
LM 8-WP	13.0	15.0	—	13.0	17.0	2.5	—
LM 9-P	6.0	11.0	1.5	8.5	15.0	2	—
LM 9-WP	13.0	15.5	—	16.0	19.0	—	—
LM 10-W	10.0	18.0	8	11.0	20.0	12	—
LM 11-W	8.0	14.0	7	8.5	17.0	13	—
LM 11-WP	12.0	18.0	4	12.0	20.0	9	—
LM 12-WP	—	—	—	—	—	—	100-150
LM 13-WP	—	11.0	—	—	16.0	—	100-150
LM 13-WP(S)	—	9.0	—	—	13.0	—	65-85
LM 14-M	8.5	10.0	—	10.0	12.0	—	—
LM 14-WP	13.0	14.0	—	14.0	18.0	—	100-130
LM 14-WP(S)	—	12.0	—	—	15.0	—	75-85
LM 15-WP	17.0	18.0	—	17.0	21.0	—	100-150
LM 16-W	8.0	11.0	2	9.0	13.0	3	—
LM 16-WP	11.0	15.0	—	12.0	17.0	—	—
LM 17-M	4.5	12.0	2	6.0	16.0	3	—
LM 18-M*	3.5	7.5	3	4.0	9.0	4	—
LM 19-W	11.0	14.0	3	12.0	17.0	5	—
LM 20-M	3.5	10.5	3.5	4.0	12.0	5	—

* Standard test-bars cast to dimensions specified in B.S. 1490. † Values for information only.
M = As cast. W = Solution heat-treated. P = Precipitation heat-treated. (S) = Special stabilising treatment.

APPENDIX V:—*Compositions Specified*

Specification B.S. 1490.	Chemical composition (per cent.).									
	Cu.	Mg.	Si.	Fe.	Mn.	Ni.	Zn.	Pb.	Sn.	Ti.	Others.
LM 0 ..	0.2	0.05	0.5	0.6	0.2	0.1	0.1	0.05	0.05	—	Al 99.0 min.
LM 1 ..	6-8	0.15	2-4	1.0	0.6	0.5	2-4	0.3	0.2	—	Mn+Ni+Pb+ Sn 1.0 max.
LM 2 ..	0.7-2.5	0.30	9.0-11.5	1.0	0.5	1.0	1.2	0.3	0.2	0.2	—
LM 3 ..	2.5-4.5	0.10	1.3	1.0	0.5	0.5	9-13	0.3	0.2	—	—
LM 4 ..	2.0-4.0	0.15	4.0-6.0	0.8	0.3-0.7	0.35	0.3*	0.1	0.05	0.2	Mn+Fe 1.3 max.
LM 5 ..	0.1	3.0-6.0	0.3	0.6	0.3-0.7	0.1	0.1	0.05	0.05	—	—
LM 6 ..	0.1	0.10	10.0-13.0	0.6	0.5	0.1	0.1	0.1	0.05	—	-
LM 7 ..	1.0-2.5	0.05-0.20	1.5-3.5	0.3-1.4	0.1	0.5-1.7	0.1	0.05	0.05	Ti+Nb 0.05-0.30	
LM 8 ..	0.1	0.2-0.6	4.5-6.0	0.6	0.3-0.7	0.1	0.1	0.1	0.05	—	-
LM 9 ..	0.1	0.2-0.6	10.0-13.0	0.6	0.3-0.7	0.1	0.1	0.1	0.05	—	—
LM 10 ..	0.1	9.5-11.0	0.35	0.35	—	—	—	—	—	0.2	—
LM 11 ..	4.0-5.0	—	0.25	0.25	—		—		—	Ti+Nb 0.05-0.30	—
LM 12 ..	9.0-10.5	0.15-0.35	2.0	0.5-1.5	0.6	0.5	0.1	0.1	0.1	—	Mn+Fe 1.5 max.
LM 13 ..	0.5-1.3	0.8-1.5	11.0-13.0	0.8	0.5	2.0-3.0	0.1	0.1	0.1	—	—
LM 14 ..	3.5-4.5	1.2-1.7	0.6	0.6	0.6	1.8-2.3	0.1	0.05	0.05	0.2	—
LM 15 ..	1.3-3.0	0.5-1.7	0.6-2.0	0.8-1.4	0.1	0.5-2.0	0.1	0.05	0.05	Ti+Nb 0.05-0.30	—
LM 16 ..	1.0-1.5	0.4-0.6	4.5-5.5	0.6	0.5	0.25	0.1	0.05	0.05	—	—
LM 17 ..	0.1	0.10	10.0-13.0	0.6	0.5	2.5-3.5	0.1	0.1	0.05	—	—
LM 18 ..	0.1	0.10	4.5-6.0	0.6	0.5	0.1	0.1	0.1	0.05	—	—
LM 19 ..	2.0-4.5	0.2-1.5	0.7	0.8	0.1-0.5	—	0.1†	0.05	0.05	0.05-0.2	Cd 0.5-2.5
LM 20 ..	0.4	0.15	10.0-13.0	0.7	0.5	0.1	0.2	0.1	0.05	0.2	—

N.B.—Single figures are maxima.
* For castings the zinc content may be 0.5 per cent. max. † For castings the zinc content may be 0.2 per cent. max.

Too Many Alloys?

He agreed that there were too many alloys but in practice the ingot producers had no alternative but to make the alloys the foundries asked for. He had been a member of the B.S.I. committee which had produced B.S. 1490 and had felt that although the founders had presented a "short list" of alloys as a basis for the standard some of the alloys were not sufficiently widely used to justify their inclusion in the standard. Mr. Logan who was also a member of the committee had expressed the same view. It was necessary that all casting alloys should be subject to specifications and although each of the twenty alloys had its own particular characteristics and field of application it might have been better to have left the less-commonly-used alloys in the D.T.D. series and so limit the B.S.I. series to say half the number.

On the other hand as Mr. Lees hinted, the number of specifications for aluminium casting alloys was of the same order as for other common casting alloys. B.S. 1400 for copper alloys, the equivalent to B.S. 1490, contained specifications for twenty-three alloys and there were British Standard Specifications for thirteen cast irons and twenty-six cast steels.

Aluminium Alloys—Discussion

He was glad that the subject of the relative consumption of the alloys had been raised. He had been inclined to illustrate the versatility of D.T.D. 424 in the discussion on Mr. Fenn's Paper of the "versatile alloy" by pointing out that this alloy, together with the very similar composition 305, accounted for about one half of the production of castings in the United Kingdom. LM 6 would account for quite a fair proportion of the remainder and this fact would serve to illustrate that some of the B.S. 1490 alloys were used only to a very small extent. Probably half a dozen alloys would cover 90 to 95 per cent. of the total consumption.

MR. LOGAN expressed his pleasure at hearing the question of the number of alloys raised, as on the B.S. Committee he had made what he thought was a strong plea that they should cut down the number of alloys in common use to what he considered would be the requirements of the industry; and that number he had assessed as being around six or seven. They had just received confirmation from the previous speaker that six or seven would cover about 90 to 95 per cent. of the requirements of the aluminium foundry, but the fact remained that there were 20 alloys specified and available for those who wanted to take their choice.

The Author of the Paper had done well to remind members how young aluminium really was in the service of man. In fact, it was less than 100 years of age, but the great development of aluminium and aluminium alloys had occurred mostly within their own experience and lifetime during the last 30 or 40 years, so, although they frequently heard it said the world had entered upon the Aluminium Age, it was really only on the threshold. That seemed a particularly interesting thing to think about, because it conjured up to his mind the fact that, even though they had made rapid progress in alloys, and in developing alloys with the right properties, they could really only be on the brink of what might be very marvellous developments in the future with regard to aluminium. They did not know what sort of alloys the future might hold, and to speculate would mean entering the realms of prophecy, which was always a dangerous thing to do.

Quality Alloys

The Author had given a very clear and excellent description of the methods and care taken in the production of secondary alloys, and there was no doubt that the secondary casting alloys, produced correctly and with such knowledge, care and scientific control as the refiners were using nowadays, could be nothing but satisfactory for their purpose. There was, however, a sensitivity on the part of the refiners to the use of the word "secondary." He felt that they would like the word to be dropped altogether, and they inferred that a secondary alloy was identical with one made from virgin material with alloy additions, but his experience did not quite support that. Fifteen years previously, as a matter of interest, it had been possible to obtain the piston alloy which was then known as 122 alloy, which later became L.A.C.10, and which was now, in the latest British Specification, known as L.M.12; and it had been possible to obtain that alloy made up from virgin aluminium. That virgin material had die-cast with an ease and soundness which had never been approached by any of the secondary alloys used since, and die-casting the same type of component, such as a piston, year after year, gave a very good criterion of the "castability."

Apart from the obvious physical effect of impurities, which might not always be actually detrimental, he believed that aluminium alloys were influenced by a number of factors which in the aggregate amounted to something which might be termed "quality" for want of a better description. Some of the factors which influenced that quality were mentioned by the Author in the paragraph on metal treatment at the top of page 11 of the preprint, where he mentioned the purposes of flux as used by the refiners: "its main purposes are to protect the metal from oxidation, and to refine the melt by removing all traces of oxides, nitrides, carbides and other non-metallic impurities." Those, of course, were the main quality-influencing factors, but not necessarily all; indeed, probably noone was yet aware of all the factors which went to produce that rather nebulous thing which he called "quality." Incidentally, he did not think Mr. Smith would wish the statement just quoted to be taken too literally, as if all traces of carbides for instance were removed, the resultant alloy would be quite uncastable because of excessive grain size. That was an example of a small trace of something having a beneficial effect on quality.

The Paper concluded with an appendix which gave the new British Standard number for alloys in common use, with cross-references, which should prove very useful to aluminium founders and was in a very handy form for those who might not have access to other references, and he supported the Author's appeal for all aluminium founders to use the British Standard Specification—L.M. numbers—for the alloys. The sooner all became familiar with and used them the better.

Secondary and Virgin Alloys

MR. F. H. SMITH said that while many of Mr. Logan's comments did not call for an answer, he would like to thank him for the things he had said about the Paper. He did not know whether it was true of the industry as a whole, but he personally would like to see the word "secondary" discarded, not because the refiners were not proud to say that they reclaimed their alloys from previously-used metal, but because there had been a time when the methods by which alloys were made from scrap had raised a good deal of doubt in the minds of engineers on the wisdom of using any aluminium alloys. Modern practice had made inferior secondary alloys a memory of the distant past, but it took a long time for some engineers to lose their suspicions. Furthermore, he would not claim, and he did not think anyone would, that alloys made from secondary materials and those made from virgin materials were identical; obviously they were not, although he was not at all sure that if they were made to identical composition, a foundryman would be able to distinguish one from the other.

Mr. Fenn had referred in his Paper* to the properties of a D.T.D. 424 alloy made from virgin aluminium and had said that the elongation was much superior. This one would expect as the virgin alloy contained no magnesium and many of the elements present "naturally" in D.T.D. 424 were absent, or present in much smaller amounts, in the virgin version. The two compositions were in fact two different alloys and little useful purpose was served in comparing their properties unless they were related to the chemical compositions and also ultimately to the cost of the alloy. Each had its field of application and for the secondary alloy the field was very large.

Piston Alloys

He had no personal experience of the behaviour of the 10 per cent. copper alloy when made solely from virgin material, but he did know that for very many years a large annual tonnage of pistons had been produced in L.A.C.10 and that these had proved quite satisfactory in service. He could not see why the casting characteristics of the alloy made on a pure aluminium basis should be different from those of the alloy made from secondary raw materials since, neglecting the effect of grain size and gas content which could be easily controlled in either alloy, casting characteristics were largely determined by the amounts of main alloying elements which were present and the American 122 alloy had been the basis of the L.A.C.10 specification. He wondered whether Mr. Logan had had the opportunity of comparing the casting behaviour of the two types of alloy on the same piston under identical conditions. He thought the pistons of 15 years ago might have been a little simpler than some which were being produced today, and this view was supported by the fact that the L.M.12 specification allowed an addition of up to 2 per cent. of silicon to overcome the casting troubles with the more intricate type of piston.

He could not accept, on the basis of his own experience—and he was sure that most of the members present would support him—that metal made from secondary sources had not the hall-mark of quality which alloys made from virgin aluminium possessed. As he had said before, comparison of virgin and secondary alloys was usually meaningless, because the alloys were of different compositions and each had merits in their own particular field. The 12 per cent. silicon alloy L.M.6, however, was a composition which was produced from both virgin and secondary aluminium and the alloys from these two sources competed on an equal footing on the foundry floor. Many founders preferred the L.M.6 made by the refiners, claiming that they were able to obtain better mechanical properties. The main difference between the alloys, however, was not one of composition, but of method of production.

Most primary and secondary alloys did not overlap in such a manner that they could be compared in this way, but founders using specification alloys purchased from reputable refiners knew that they would be assured of consistency in composition, mechanical properties and casting characteristics which he thought constituted the "hall-mark" demanded by Mr. Logan.

Nitrides

Mr. Logan had made a reference to nitrides. One was used to hearing of the oxidation of aluminium, but some members of the audience might be surprised to learn that aluminium reacted very readily with nitrogen, too, under suitable conditions. An investigation carried out during the war by the U.S. Bureau of Mines showed that, after removing the larger metal particles, the dross from the production and remelting of unalloyed aluminium by two American producers of *primary* metal contained a little over 45 per cent. of aluminium nitride (or nitrogen compounds) against nearly 39 per cent. of aluminium oxide. The presence of nitrides in the drosses from secondary aluminium production was plainly evident to those associated with the refineries from the familiar smell of ammonia which arose from drosses and residues exposed to moist atmospheres. Mr. Logan could rest assured that the nitrogen compounds were wholly in the flux residues and had yet to be found in the refined metal.

Mr. T. H. Weaver, referring to Mr. Lees' question as to the sorting of the scrap, asked, after deciding upon the melt, what steps were taken during that melt to determine that one had got a satisfactory specification, and whether elevated temperatures were used to eliminate any mistake which could possibly be made in the sorting out.

Mr. F. H. Smith said he had tried to explain in the Paper that the principle of working was first to produce, after pre-treatment, batches of material which could be segregated as being of known composition. After melting in the furnace, depending upon local practice and the size of the furnace, but probably during the last melting stage, samples of the melt were taken for rapid analysis to confirm the composition before casting. That was extremely important in very large batches, because one could not afford to cast 10 or 20 tons of metal into ingots and then, having found that it was not quite the composition required, put it all back and melt it again. Analysing the liquid melt enabled adjustments to be made if necessary, and if in the worst cases it was found that one element content was a little too high, it would still be possible to dilute the alloy with aluminium or other material to bring the figure down to the specification limit. If one was melting in small batches where the melting time did not permit a complete analysis to be made, then, of course, the check on material was the ultimate analysis of the ingots which were cast. In small units, one had to be even more certain about the composition of the materials used, in order to avoid re-melting, which would make economical production difficult. Mr. Weaver could be sure that the metal was of the composition required, whether it was analysed when it was still molten or after it was cast into ingots.

* "D.T.D. 424—The Versatile Light Alloy," Foundry Trade Journal, July 26, 1951.

Aluminium Alloys—Discussion

Removal of Magnesium

One of the reasons for making a check during the liquid stage and before casting was to control the magnesium content, as magnesium was one of the elements which was quantitatively reduced, and its removal was quite an expensive process. It had been said earlier that it was not possible to reduce magnesium completely from the metal, but theoretically that was not so. One could take it down to, say, 0.02 to 0.03 per cent. without much trouble, but the point to be remembered was that it cost money and time and the foundry would probably not be prepared to pay, as it was doubtful whether the advantage gained by reducing magnesium to the utmost limit was really justified. Such reduction would increase the cost of the alloy appreciably. This was the only treatment applied at the final stage to the molten metal to effect chemically an alteration in the composition.

MR. WEAVER asked whether, during the melting period, one had a determined temperature, and upon the Author replying in the affirmative, he asked what that temperature was.

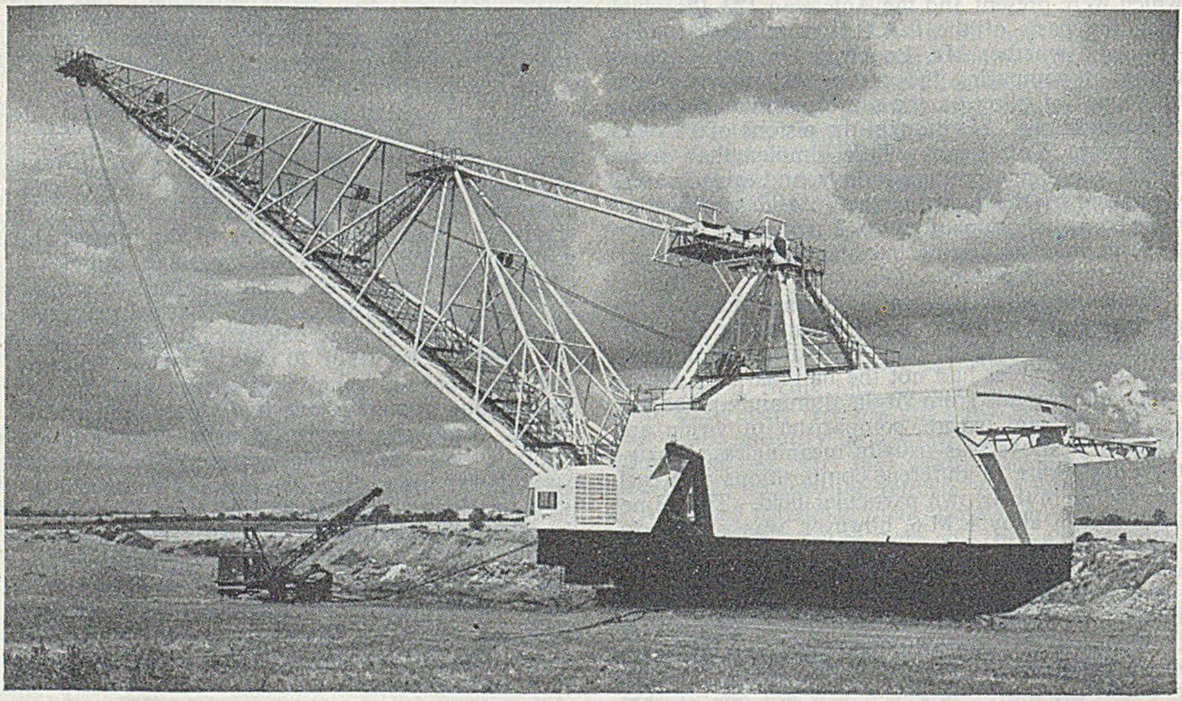
MR. F. H. SMITH replied that it was not an easy question to answer because it depended upon the type of furnace and practice one was using, but probably in general work a temperature of 800 deg. C. was seldom exceeded. That might seem a little high, but some of the fluxing treatments did require the temperature to be rather higher than normal melting temperatures. During that time the melt was completely covered with flux, so that there was no chance of oxidation.

Ingot-casting Temperature

MR. WEAVER asked if there was a fixed temperature at which the ingots were cast, and whether it was in an air-conditioned foundry or room, or did humidity not have a marked effect.

MR. F. H. SMITH replied that the casting temperature would be as low as possible, and something of the order of slightly less than 700 deg. C. would be reasonable for most alloys. There was no question of casting in temperature-controlled or humidity-controlled atmospheres, and he did not think with the general type of casting alloys that the humidity at the pouring station was likely to make any difference during the casting time. Even under the worst conditions, which might possibly produce unsoundness in a sand casting, the low pouring temperature, rapid chilling and directional solidification of aluminium alloys in the metal moulds would ensure that the ingots were not adversely affected.

The CHAIRMAN (Mr. J. J. Sheehan) thanked the Author for the presentation of his Paper and the members for taking part in the discussion, which had been of a very high standard.



Our Illustration shows the World's Largest Walking Dragline Excavator. It has been installed by Stewarts and Lloyds, Limited, of Corby, in the Northamptonshire Iron-ore Fields. The Dragline was built by Ransomes & Rapier, Limited, of Ipswich. A Souvenir Brochure has been published by Stewarts and Lloyds, Limited, but it is a Matter for Regret that no Pictures were included of the Castings incorporated.

Pig-iron and Steel Production

Statistical Summary of August Returns

The following particulars of pig-iron and steel produced in Great Britain have been extracted from the Statistical Bulletin for September, issued by the British Iron and Steel Federation. Table I summarises activities during the previous six months; Table II gives the production of steel ingots and castings in August, Table III gives deliveries of finished steel, and Table IV the production of pig-iron and ferro-alloys in August. (References applicable are given at the foot of column 2.)

TABLE I.—*General Summary of Pig-iron and Steel Production. (Weekly Average in Thousands of Tons.)*

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy). Imports.[2]	Output of ingots and castings.	Deliveries of finished steel.	Stocks.[3]
1949	258	169	199	183	188	17	299	233	1,071
1950	249	174	197	185	197	9	313	239	997
1951—March ..	267	167	204	184	187	6	318	253	848
April	279	149	201	179	195	6	323	261	800
May[1]	287	159	204	182	180	7	305	242	762
June	315	159	204	183	182	7	308	262	737
July	299	162	202	182	153	9	256	226	706
August[1]	280	176	203	181	147	8	266	190	712

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in August, 1951. (Thousands of Tons.)*

District.	Open-hearth. Acid.	Open-hearth. Basic.	Bessemer.	Electric.	All other.	Total. Ingots.	Total. Castings.	Total ingots and castings.
Derby, Leics., Notts., Northants and Essex ..	—	2.8	10.3(basic)	1.4	0.1	14.1	0.5	14.6
Lancs. (excl. N.W. Coast), Denbigh, Flints., and Cheshire .. Yorkshire (excl. N.E. Coast and Sheffield) ..	1.1	16.2	—	1.4	0.4	18.1	1.0	19.1
Lincolnshire ..	—	27·3	—	—	0.1	27.3	0.1	27.4
North-East Coast ..	0.7	54.1	—	0.9	0.4	54.6	1.5	56.1
Scotland ..	4.0	34·9	—	1.3	0.6	39.1	1.7	40.8
Staffs., Shrops., Worcs. and Warwick ..	—	11.8	—	0.5	0.5	11.9	0.9	12.8
S. Wales and Monmouthshire ..	5.7	44.5	5.6(basic)	0.7	0.1	56.2	0.4	56.6
Sheffield (including small quantity in Manchester)	7.2	19.8	—	6.0	0.4	31.9	1.5	33.4
North-West Coast ..	—	1.7	3.5 (acid)	0.3	0.1	5.5	0.1	5.6
Total ..	18.7	213.1	19.4	12.5	2.7	258.7	7.7	266.4
July, 1951 ..	21.7	195.7	20.1	15.3	3.3	247.5	8.6	256.1
August, 1950[1] ..	22.2	224.8	17.5	12.2	2.7	272.4	7.0	279.4

TABLE III.—*Weekly Average Deliveries of Non-alloy and Alloy Finished Steel. (Thousands of Tons.)*

Product.	1949.	1950.	1950. August[1]	1951. July.	1951. August[1]
Non-alloy steel:					
Ingots, blooms, billets and slabs[4]	4.5	3.6	2.8	3.2	3.1
Heavy rails, sleepers, etc.	9.8	11.3	9.8	10.7	7.1
Plates ⅛ in. thick and over ..	39.2	40.0	32.8	31.2	33.8
Other heavy prod.	37.5	40.2	34.8	35.2	34.2
Light rolled prod.	46.4	47.6	41.5	42.5	37.0
Hot-rolled strip ..	17.1	19.4	15.7	20.1	15.6
Wire rods	15.4	16.3	14.5	12.6	13.3
Cold-rolled strip ..	4.9	5.5	4.2	6.3	4.7
Bright steel bars ..	5.6	6.2	5.4	6.7	5.3
Sheets, coated and uncoated ..	27.6	30.5	23.5	35.1	29.6
Tin, terne and blackplate ..	13.7	14.3	11.1	13.3	10.3
Tubes, pipes and fittings	18.5	20.0	15.0	22.9	16.3
Mild wire	12.0	12.6	11.2	10.9	9.2
Hard wire ..	3.2	3.5	2.9	3.2	3.1
Tyres, wheels and axles	4.1	3.5	3.4	4.3	2.5
Steel forgings (excl. drop forgings) ..	2.4	2.2	1.5	2.2	1.9
Steel castings ..	3.6	3.5	3.3	3.9	3.9
Total	265.5	280.2	233.4	264.3	230.9
Alloy steel	10.4	10.6	8.6	12.1	9.8
Total deliveries from U.K. prod.[5] ..	275.9	290.8	242.0	276.4	240.7
Add imported finished Steel	9.5	3.8	2.7	4.2	3.8
	285.4	294.6	244.7	280.6	244.5
Deduct intra-industry conversion[6] ..	52.8	55.6	46.1	54.8	54.5
Total net deliveries ..	232.6	239.0	198.6	225.8	190.0

TABLE IV.—*Weekly Average Production of Pig-iron and Ferro-alloys during August, 1951. (Thousands of Tons.)*

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants and Essex ..	25	—	15.6	23.3	1.4	—	40.3
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire .. Yorkshire (incl. Sheffield, excl. N.E. Coast) ..	6	—	7.5	—	—	0.7	8.2
Lincolnshire ..	13	—	23.0	—	—	—	23.0
North-East Coast	23	7.6	35.5	0.1	—	1.4	44.6
Scotland	9	0.8	11.9	2.6	—	—	15.3
Staffs., Shrops., Worcs., and Warwick ..	9	—	9.1	1.2	—	—	10.3
S. Wales and Monmouthshire	8	2.9	22.8	—	—	—	25.7
North-West Coast	7	11.9	—	—	—	1.6	13.5
Total ..	100	23.2	125.4	27.2	1.4	3.7	180.9[7]
July, 1951 ..	99	25.4	122.7	30.1	0.9	3.3	182.4
August, 1950[1] ..	98	24.4	120.3	27.6	1.1	3.5	177.0

[1] Five weeks.

[2] Weekly average of calendar month.

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

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

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

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

[7] Including 100 tons of direct castings.

News in Brief

FROM NOVEMBER 4 to December 1, coconut and palm kernel acid oil will be reduced from £109 10s. to £105 per ton, naked, ex works.

EMERGENCY SUPPLIES of hematite pig-iron delivered to Ley's Malleable Castings Company, Limited, Derby, enabled full production to restart last Monday.

IT HAS BEEN DECIDED to continue the extended hours of opening of the Patent Office Library at 25, Southampton Buildings, Chancery Lane, W.C.2, until December 28, 1951. The hours are 10 a.m. to 9 p.m. Monday to Friday, and 10 a.m. to 5 p.m. Saturday.

ABOUT 160 MEMBERS of the East Midlands branch of the Institute of British Foundrymen accepted the invitation of Mr. Tom Brown, deputy managing director, to inspect the newly-constructed foundry of Sheepbridge Engineering, Limited. They were conducted on a tour by Mr. H. Morton, sand foundry manager.

THE 19,000-TON Argentine battleship, Sao Paulo, now being towed across the South Atlantic, is almost certain to go to the Clyde for breaking-up. No definite allocation has yet been made by the British Iron & Steel Corporation, but it is probable that one of the Clyde shipbreaking firms will be given the contract.

ONE OF THE world's largest "clubs" will be inaugurated on January 1, 1952, when the British Railways Staff Association is founded. The new association will be open to all the 600,000 railway staff, their wives and dependent children, retired staff, and widows of railway men, so that well over a million people are eligible to join.

THE SYMPOSIUM on the Corrosion of Buried Metals, organised by the Iron and Steel Institute for December 12, will now be held in the lecture theatre of the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2. Other details remain unchanged. The programme was detailed in the JOURNAL of October 18.

EMPLOYEES OF W. & T. Avery, Limited, from Belfast, Aberdeen, Liverpool, Dublin, and Sheffield journeyed to the Soho Foundry, Birmingham, on November 6 to attend the ceremony at which the company's chairman, Mr. H. Walford Turner, presented awards to this year's group of long-service veterans. This year's presentations bring the total number of years for which the firm has made awards to 12,000. The firm believes that it was certainly among the first and possibly the first among foundry firms to make such recognition of long service. It was in 1918 that Avery's made the first presentation, to 61 men who had been with the company for over 30 years.

THE BIRMINGHAM CHAMBER OF COMMERCE, in cooperation with Birmingham University and the Federation of British Industries, is planning a convention to be held next spring, to analyse fully the position of the graduate in industry, and to establish for future development a closer liaison between industry and the University.

With other industries, which have seen great technical advances in the past years, the foundry, and particularly the large unit, is finding old-fashioned the belief (long held in many craft trades) that a man must work his way through the shops to reach effective managerial status. Neither time nor the wide field to be covered nowadays permits of such a lengthy training. The proposed convention aims to solve the problem of the preparation of graduates for industrial administration, and the methods and means of entry by which it can be attained. Birmingham University is well equipped and experienced to undertake any work of this kind, serving as it does the great industries of the Midlands with which it has already established close relationship.

Obituary

THE DEATH occurred on November 1 of MR. F. M. PARKER, aged 70, chairman of Frederick Parker, Limited, engineers and ironfounders, Leicester, which he founded.

THE SUDDEN death on October 20, at Penarth, of MR. H. COOPE, M.I.E.E., manager of the Cardiff office of Metropolitan-Vickers Electrical Company, Limited, is announced.

A DIRECTOR of Herbert Terry & Son's, Limited, spring manufacturers, of Redditch (Worcs), MR. CYRIL DOUGLAS TERRY was killed when he fell in front of a tube train at Charing Cross, London, recently. Aged 52, he was representing the company at the Motor Show.

MR. THOMAS R. GOLDSBROUGH, who relinquished his appointment as secretary of Gjers Mills & Company, Limited, pig-iron manufacturers, of Middlesbrough, at the end of last year, has died at the age of 69. He had been with the company for 56 years, and was appointed secretary in 1944.

MR. L. SEAMAN, who has died at the age of 66, was managing director of the Bryan Donkin Company Limited, Chesterfield, and had been associated with the firm since 1909. He was also a member of the directorates of George Walker, Limited, Stroud, Glos, and B.H.D. Engineers, Limited, London.

MR. W. F. DRYNAN, who died suddenly on October 21, had been associated with Cockburns, Limited, ironfounders and valve makers, Cardonald, Glasgow, since before the first world war. He joined the firm in 1913 as an engineering draughtsman and rose progressively to his appointment as engineering manager in 1936.

MAJOR HAROLD ERNEST TRUBSHAW, who was a director of the Llanelly Steel Company (1907), Limited, and the Llanelly Foundry & Engineering Company, Limited, died in hospital at Carmarthen on October 25. In recent years he had been group welfare officer of the Steel Company of Wales, Limited.

SON OF THE FOUNDER of Edwin Danks & Company (Oldbury), Limited, boiler makers, etc., MR. FREDERICK THOMAS DANKS has died at the age of 84. He entered the business after completing his education and in due course became head of the company, continuing to direct its operations until it was acquired by Babcock & Wilcox, Limited, a few years ago.

FORMERLY deputy director of works at the Admiralty, MR. WILLIAM JOHN CLARKE has died at the age of 94. He entered the service of the Admiralty in 1882, being appointed superintending civil engineer of the naval establishments at Malta in 1894. In 1912 he was appointed assistant director of works. He retired in 1919, having served for some time previously as deputy director.

I.A.E.S.T.E.

Each time we review the annual reports of this body, we explain that the initials stand for the International Association for the Exchange of Students for Technical Experience. This is the fourth annual report and it discloses an ever-expanding activity. Last summer (1951) 2,433 students were sent abroad to gain added experience, an increase of 761. It takes 3¼ pages to list the names of British firms co-operating in the scheme and amongst these there are dozens of foundry owners. The scheme is confined to university and technical-college students and where these conditions obtain, employers would be well advised to use the organisation now so successfully operating. The secretary is Mr. J. Newby, Imperial College, South Kensington, London, S.W.7.

Raw Material Markets

Iron and Steel

With the foundries clamouring for all the pig-iron they can get and steelmakers seeking full deliveries, producing furnaces are quite unable to satisfy all requests. The recent improvement in deliveries of iron ore has enabled most producers to maintain and, in some instances, to increase outputs, but the preference given to steelmaking grades has not eased the situation of the foundries. Some hematite makers are still short of iron ore, while many producers need increased supplies and better quality coke. More furnaces in blast is the only solution to the present scarcity of pig-iron supplies, but supplies of raw materials must be expanded appreciably before this can be accomplished.

The grades of iron normally taken by the general engineering and speciality foundries are very stringent and the varying analyses of supplies only serves to aggravate the situation. Some of these establishments would be prepared to take up supplies of suitable imported irons if they could be obtained. The users of high-phosphorus pig-iron are equally perturbed by the supply position, which tends to deteriorate. The jobbing, light, and textile foundries are also finding increased difficulty in securing adequate supplies of iron, owing to a reduction in the number of furnaces producing high-phosphorus iron. These foundries are, in fact, so short of supplies that a few of them have purchased parcels of Continental iron at a cost greatly in excess of home prices.

Supplies of foundry coke, while generally adequate for current use, are not sufficient to permit stocks to be augmented. The allocation for the winter period will shortly be advised; as intimation has been given of reduced deliveries, the future cannot be viewed with any degree of confidence.

Scrap supplies remain very difficult. There is urgent need for heavy cast iron and steel scrap, both foundries and steelworks being very short of supplies, thus necessitating the use of larger tonnages of pig-iron. Ganister, limestone, and firebricks are available to requirements, while ferro-alloys can usually be secured for current needs.

The re-rollers continue to rely almost entirely on deliveries of steel semis from home steelworks. These, however, are quite inadequate, and most mills are working short time. Only small parcels of Continental steel are being received, and there appears to be no prospect of these being increased appreciably in the early future. Consumers of sections, bars, and strip are urgently in need of supplies against orders placed some time ago and new business is extremely difficult to negotiate. The re-rollers of sheets are also badly in arrears with deliveries owing to supplies of sheet bars being inadequate. Supplies of crops or defective billets and sheet bars are readily accepted, together with any other form of raw material suitable for conversion, but quantities arising are small.

Non-ferrous Metals

Fluctuating prices were seen on the London tin market last week but on balance there was not much alteration. The backwardation stood at £30 on October 26, but by last Friday this had narrowed to £17 10s. Should this trend continue, and there seems to be some hope that it may, we may expect that by the end of the year a modest contango will be in existence. This would obviously make for a healthier state of affairs and encourage hedging sales thus bringing more business to Whittington Avenue. However, yesterday (Wednesday) the backwardation increased to £25.

Development of the commodity markets will, it is hoped, form part of the programme instituted by the new Government, and although there are manifest difficulties in the way of extending activities on the Metal Exchange, the non-ferrous industry is not without hope that something may be done to release the trade from some of the controls which at present weigh upon it.

It has been objected that both copper and zinc are at present subject to international allocation, but it must not be forgotten that the tonnage allocated is merely on a permissive basis without any guarantee that the metal will be forthcoming. It is, in fact, incumbent upon the country concerned to obtain the supplies to which it is entitled under the allocation scheme.

While there has not been any breach between the Bolivian producers and the Reconstruction Finance Corporation in the discussions to arrive at an agreement for a further contract for the sale of tin concentrates to the United States, the fact remains that progress is lacking. The short-term agreement at the $1.12 price has now expired and the Bolivian representatives do not seem to be prepared to renew at this figure. The producers want to finalise at $1.50 but this the Americans will not pay, and so matters have reached something of a deadlock which probably it will not be easy to resolve. But the R.F.C. can probably afford to wait longer than the Bolivians who cannot easily find an alternative market for their low grade ore.

In the United States tin has been included in a new "most critical" classification established by the Defence Production Administration. Aluminium, copper, lead, and zinc are also in this category.

London Metal Exchange official tin quotations were as follow:—

Cash—Thursday, £1,000 to £1,005; Friday, £987 10s. to £992 10s.; Monday, £975 to £980; Tuesday, £995 to £1,000; Wednesday, £1,000 to £1,005.

Three Months—Thursday, £982 10s. to £985; Friday, £972 10s. to £975; Monday, £962 10s. to £965; Tuesday, £975 to £980; Wednesday, £975 to £980.

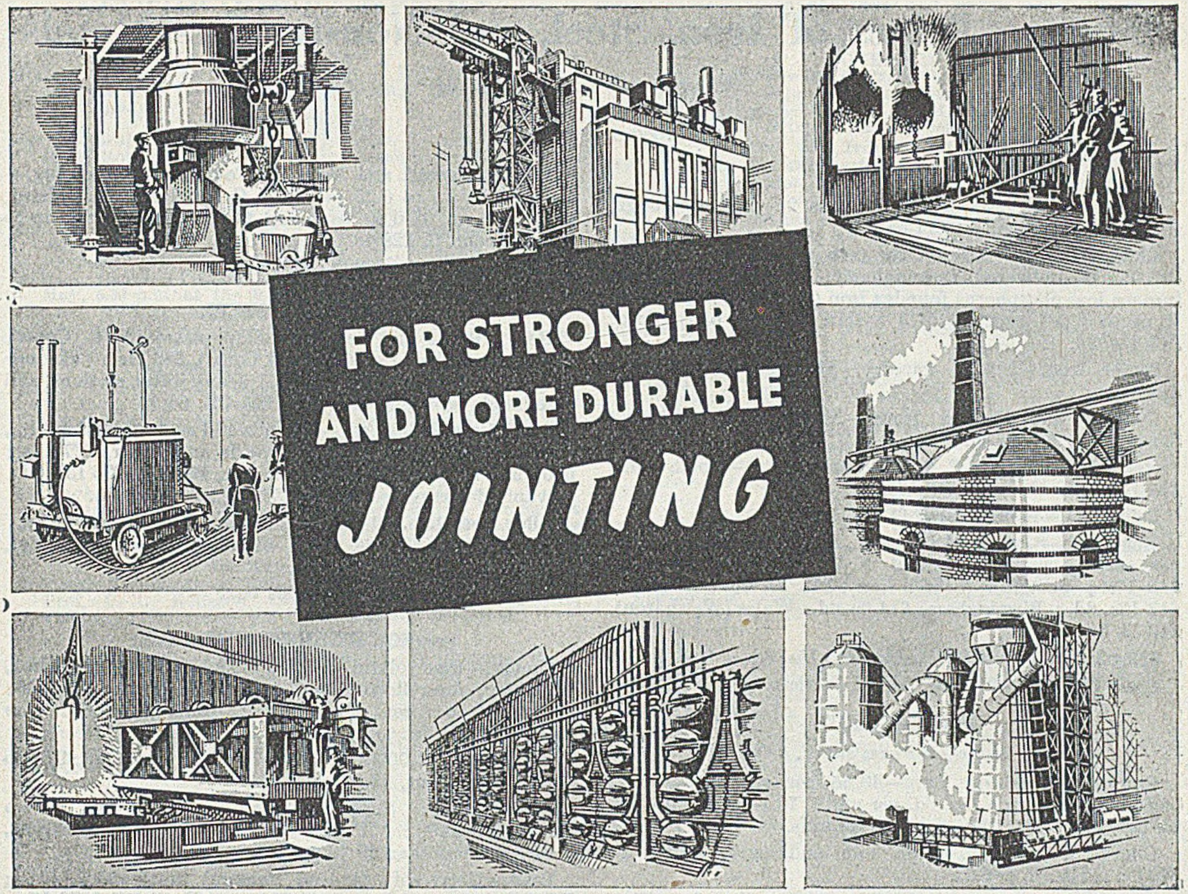
Exports of Copper Goods

From to-day (Thursday) the export of some copper goods to any destination other than China or Hong Kong under open general licence will be permitted only if the value of the goods exceeds the value of the copper or copper-alloy content, calculated at the rate of £700 per ton for copper and £600 per ton for alloys mainly of copper. Under a similar previous licence, which is revoked, the values were £500 and £400 per ton respectively.

The rate has been stepped up owing to the continuing shortage and increasing price of copper and the consequent need to ensure that our exports are of corresponding high value. The general export position is that all strategic goods made of or containing copper are already controlled in that an export licence has to be obtained before they can be sent to any country except the Commonwealth and U.S.A.

Enquiries regarding the open general licence should be made to Export Licensing Branch, Board of Trade, Atlantic House, Holborn Viaduct, London, E.C.1.

MR. NOEL P. NEWMAN, J.P., as chairman of the Council of Ironfoundry Associations, has sent a letter to the managing directors of participating firms explaining the actions to be taken in connection with current shortages and emphasising the need to complete the forms C.90 and CX.25 in order to assist the authorities in their allocations.


FOR STRONGER
AND MORE DURABLE
JOINTING

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

(Delivered, unless otherwise stated)

November 7, 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, £15 17s.; South Zone, £15 19s. 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., £40 8s. 9d.

Manganese Briquettes (5-ton lots and over).—2lb. Mn, £50 6s. 6d.

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 11s. 6d.; tested, 0.08 to 0.25 per cent. C (100-ton lots), £22 1s. 6d.; hard (0.42 to 0.60 per cent. C), £23 19s.; silico-manganese, £29 15s.; free-cutting, £24 15s. 6d. Siemens Martin Acid: Up to 0.25 per cent. C, £27 16s.; case-hardening, £28 4s.; silico-manganese, £30 16s. 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.—52s. 1½d. per basis box.

NON-FERROUS METALS

Copper.—Electrolytic, £227; high-grade fire-refined, £226 10s.; fire-refined of not less than 99.7 per cent., £226; ditto, 99.2 per cent., £225 10s.; black hot-rolled wire rods, £236 12s. 6d.

Tin.—Cash, £1,000 to £1,005; three months, £975 to £980; settlement, £1,005.

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), £175; ditto (Empire and domestic), £175; "English," £176 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 10s. to £73 15s.; nickel, £454.

Brass.—Solid-drawn tubes, 25d. per lb.; rods, drawn, 32⅞d.; sheets to 10 w.g., 29⅝d.; wire, 31¼d., rolled metal, 28⅜d.

Copper Tubes, etc.—Solid-drawn tubes, 26d. per lb.; wire, 254s. 9d. per cwt. basis; 20 s.w.g., 281s. 9d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £255 to £280; BS. 1400—LG3—1 (86/7/5/2), £265 to £300: BS. 1400—G1—1 (88/10/2), £330 to £360; Admiralty GM (88/10/2), virgin quality, £330 to £360 per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £340 to £370; L.P.Bl, £295 to £315 per ton.

Phosphor Bronze.—Strip, 38¼d. per lb.; sheets to 10 w.g., 40¾d.; wire, 42¾d.; rods, 38d.; tubes, 36¼d.; chill cast bars: solids 4s., cored 4s. 1d. (C. Clifford & Son, Limited.)

Nickel Silver, etc.—Ingots for raising, 2s. 7d. per lb. (7%) to 3s. 6¾d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 3s. 1d. (7%) to 4s. 0¾d. (30%); to 12 in. wide × .056, 3s. 1¼d. to 4s. 1d.; to 25 in. wide × .056, 3s. 3¼d. to 4s. 3d. Spoon and fork metal, unsheared, 2s. 10d. to 3s. 9¾d. Wire, 10g., in coils, 3s. 6¾d. (10%) to 4s. 6½d. (30%). Special quality turning rod, 10%, 3s. 5¾d.; 15%, 3s. 10½d.; 18%, 4s. 2¾d. All prices are net.

Forthcoming Events

NOVEMBER 12

Institute of Fuel

Midland students' section.—"Fuel Oil in Industry," by T. O. Ambrose, 7.30 p.m. at the University, Edmund Street, Birmingham.

Institute of Metals

Scottish local section:—"Metals for Gas Turbines," by Dr. J. M. Robertson, 6.30 p.m. at the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow, C.2.

Institution of Production Engineers

Manchester graduate section:—"Heating Methods in Engineering," by M. O'C. Horgan, 7.15 p.m. in room C3, Reynolds Hall, The College of Technology, Manchester, 1.

Sheffield section:—"Induction Heating in Industry," by E. May, 6.30 p.m. at the Royal Victoria Hotel, Sheffield.

Incorporated Plant Engineers

Dundee branch:—"Factory Instrumentation," 7.30 p.m. at Mathers Hotel, Dundee.

Purchasing Officers' Association

London branch:—"Production and Uses of Copper," by Dr. E. Voce; film: "Copper Belt of Northern Rhodesia," 7.30 p.m. at the Royal Society of Arts, John Adam Street, London, W.C.2.

NOVEMBER 13

Institution of Works Managers

Birmingham branch:—"Some Impressions relative to Works Management obtained as Leader of the British Non-ferrous Metals Anglo-American Productivity Council Team," by W. F. Brazener, 7 p.m. at the Grand Hotel, Birmingham.

Institute of Metals

Liverpool Metallurgical Society:—"Welding Metallurgy," by Prof. E. C. Rollason, 7 p.m. in the Lecture Theatre, Electricity Service Centre, Whitechapel, Liverpool.

Institution of Production Engineers

Birmingham graduate section:—"Design and Manufacture of a Tractor," by H. E. Ashfield, 7 p.m. at the James Watt Memorial Institute, Great Charles Street, Birmingham, 3.

Purchasing Officers' Association

Wolverhampton branch:—Afternoon visit to the works of John Harper & Company, Limited. (Further details from the Secretary.)

Beeston Boiler Foremen's Association

"Mechanical Handling," film and lecture by J. R. Sharp, 7.30 p.m. in the Canteen, the Beeston Boiler Company, Limited, Mona Street, Beeston, Notts.

NOVEMBER 14

Institution of Production Engineers

Stoke-on-Trent section:—"The Metallurgist's Place in Production Engineering," by E. R. Gadd, 7.30 p.m. in the Drill Room, Prince Albert Street, Crewe.

British Cast Iron Research Association

31st Ordinary general meeting, 3 p.m. at the Waldorf Hotel, Aldwych, London, W.C.2.

NOVEMBER 14 to 24

Institute of Vitreous Enamellers

Exhibition of Enamels at the Wolverhampton Art Galleries.

NOVEMBER 14 to 28

Building Exhibition at Olympia, London.

NOVEMBER 15

Institution of Production Engineers

Cornwall section:—"To What Extent is Production Planning and Control really Necessary?" discussion at 7.15 p.m. at the Cornwall Technical College, Trevenson Park, Pool.

South Essex:—"Standardisation in Engineering," by E. L. Diamond, 7.30 p.m. at the Mid-Essex Technical College, Chelmsford.

Incorporated Plant Engineers

Liverpool and North Wales branch:—"Industrial Ventilation," by L. Gordon Davies, 7.15 p.m. at Radiant House, Bold Street, Liverpool.

NOVEMBER 16

Institution of Mechanical Engineers

Thomas Hawksley Lecture: "Some Fuel and Power Projects," by Dr. H. Roxbee Cox. (Further details from the Secretary.)

Manchester Association of Engineers

"Engineering Inspection and Metrology," by W. E. Landon, 6.45 p.m. in the Engineers' Club, 17, Albert Square, Manchester.

NOVEMBER 17

Institute of British Foundrymen

East Midlands branch:—"Patternmaking as an Aid to Production Moulding and Coremaking," by S. A. Horton, 6 p.m. at Derby.

Bristol and West of England:—"Production of Heavy Castings for Electrical Equipment," by N. Charlton, 3 p.m. at the Grand Hotel, Broad Street, Bristol.

CLASSIFIED ADVERTISEMENTS

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

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

SITUATIONS WANTED

EXPERIENCE: Design, Planning, Production Aluminium Magnesium Gravity Die Casting, Pressure, Precision Casting. Accustomed full control and acting on own initiative.—Box 1364, FOUNDRY TRADE JOURNAL.

N. E. MOULDER.—Managerial experience, Ferrous and Non-ferrous production. Requires position in the Southern area preferably. Light Castings or small foundry who can use an experienced man.—Box 1372, FOUNDRY TRADE JOURNAL.

AVAILABLE.—Foundryman M.I.B.F. age 35 yrs. Managing 200 tons p.m. British owned foundry in India, 20 years' exp. jobbing, plate, and machine work in C.I. and Bronze, exp. machine shop, etc. Consider any offer management or representation. Now in U.K.; own car.—Box 1343, FOUNDRY TRADE JOURNAL.

ASSISTANT FOUNDRY MANAGER (aged 30) requires position with firm holding modern views on management. Experience mechanised, jobbing work; costing, pattern layout, etc., thorough technical and practical training.—Box 1360, FOUNDRY TRADE JOURNAL.

FOUNDRY EXECUTIVE, engineer trained, M.I.B.F., A.M.I.P.E., over 20 years' technical and administrative experience founding Light Alloys, specialising in Gravity Die-Casting, widely travelled, well connected, and lecturer in Foundry Practice desires change of appointment. Willing to accept full responsibility of medium-sized foundry which requires revivifying. Midland area preferred.—Box 1374, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

LONDON Iron and Non-ferrous Foundry requires REPRESENTATIVE for medium and heavy weight castings.—Apply Box 1330, FOUNDRY TRADE JOURNAL.

TECHNICAL ASSISTANT required for Metallurgical Research Dept., experience in Metallurgy of light alloys essential and possession of Higher National of equivalent certificate desirable. Age about 21-23. Apply in writing with full particulars to: SECRETARY, Magnesium Elektron, Ltd., Lumm's Lane, Clifton Junction, Nr. Manchester.

K & L STEELFOUNDERS & ENGINEERS, LTD., have vacancies for two TECHNICAL ASSISTANTS in their Steel Foundry. Candidates should be aged 23/35, with H.N.C. or equivalent standard of education, have either metallurgical or foundry experience and be prepared to undertake either development or supervisory work as required. Duties will be of such a nature that they will be developing the individual for further advancement. Help can be given with housing accommodation. Full details to DEVELOPMENT DIRECTOR, K & L Steelfounders & Engineers, Ltd., Letchworth, Herts.

SITUATIONS VACANT—*Contd.*

LARGE Iron Foundry, West B'ham, requires an ASSISTANT CHEMIST. Knowledge of sand control and cast-iron analysis preferred but not essential. Please state experience and salary expected to Box 1368, FOUNDRY TRADE JOURNAL.

ASSISTANT FOUNDRY MANAGER required for Jobbing Steel Foundry (Medium and Heavy) in Glasgow district. Must have good experience and practical training.—Apply Box 1363, FOUNDRY TRADE JOURNAL.

PATTERNMAKING FIRST - CLASS ESTIMATOR required. Apply in writing, stating age, wage, and full experience; references essential.—State when available, to WRIGHT & PLATT, LTD., the World's Largest Engineering Master Patternmakers, Irving Street, Birmingham, 15.

RATEFIXER required by Non-ferrous Mechanised Foundry in south-west Glasgow. Knowledge of time and motion study in high-speed machine moulding and core blowing essential, also ability to negotiate and operate suitable time standards with all production personnel. It is desired that the successful applicant be capable of collaborating with the timekeeper in the preparation of wages details.—Box 1362, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER required for mechanised and jobbing Malleable and Grey Iron Foundry in East Coast. Experience of mass production and ability to maintain high production of good quality castings. Good disciplinarian. Knowledge of pattern layout an advantage. Give details of previous experience and salary expected to Box 1346, FOUNDRY TRADE JOURNAL.

SMALL Engineering Grey Iron Foundry requires capable FOREMAN, 7.30 a.m. man, adaptable, take full charge, including melting. Must be able to produce good class work, train unskilled labour, get results from moulding machines and floor. Position offers scope for rapid improvement of developing foundry engaged on general work, excellent opportunity for energetic fairly young but experienced man to prove his worth. South Yorkshire area. Salary commensurate with results would be paid. Please give full particulars of apprenticeship and since, in confidence, including any technical knowledge.—Box 1371, FOUNDRY TRADE JOURNAL.

FOREMAN METAL PATTERNMAKER required. Good disciplinarian, accustomed to handling large numbers of first-class patternmakers producing highest class Metal Pattern Equipment to dead-on limits, with mirror finish. Used to modern methods, backed by the largest and most modern Plant and Equipment in the trade. Applicant must be good Estimator, with inspection experience and Foundry knowledge.—Write, stating full experience, age and wages now received, and expected, and when available, to WRIGHT & PLATT, LTD., the World's Largest Engineering Master Patternmakers, 45/58, Irving Street, Birmingham, 15.

SITUATIONS VACANT—*Contd.*

SHIFT CHEMIST required for Steel Foundry operating two basic electric furnaces, on plain carbon and low alloy steel. State age, experience, and wages expected to Box 1327, FOUNDRY TRADE JOURNAL.

SKILLED MOULDERS, PLATERS, TURNERS, BORERS, etc., required by Distington Engineering Co., Ltd., Workington, Cumberland.—For further details apply to the LABOUR MANAGER.

METALLURGICAL CHEMIST required for Malleable Foundry with experience of melting and annealing. Apply stating age, past experience and salary required to BAGSHAWE & Co., LTD., Dunstable Works, Dunstable.

PROGRESSIVE engineering works in North Midlands requires a first class FOREMAN for their Iron Foundry, which is making high-grade castings in green and dry sand up to 5 tons per piece. The conditions are ideal, and the position is permanent. Write giving full details, experience and past employers to Box 1348, FOUNDRY TRADE JOURNAL.

PLANT DRAUGHTSMAN REQUIRED.—Excellent opening exists for keen man to start a Section in conjunction with Engineer responsible for Foundry Plant Development Schemes. Applicants with Structural and/or Mechanical experience only would be considered. Duties involve site visits to various companies controlled.—Box 1342, FOUNDRY TRADE JOURNAL.

ASSISTANT CHIEF METALLURGIST whose duties will include supervision of both routine control and development work. Metallurgical degree and foundry experience desirable. Help can be given with housing accommodation. Full details to DEVELOPMENT DIRECTOR, K & L Steelfounders & Engineers, Ltd., Letchworth, Herts.

FOUNDRY MANAGER required for Jobbing Foundry. (Iron castings up to 15 tons, Non-ferrous up to 30 cwt., and Pattern Shop.) Duties to include estimating and full control metallurgically. Salary in region of four figures according to experience and results. Pension scheme.—Box 1345, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER required immediately in the North Midland area. Medium sized Jobbing Foundry producing Grey Iron Castings for own machines and sub-contract work; in process of reconstruction to bring into line with modern practice. Applicant must have full knowledge of present-day methods, be keen, good disciplinarian, age between 30-45. Good salary and Bonus. Pension scheme.—Box 1320, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

ASSISTANT METALLURGICAL CHEMIST (Graduate preferred) required for Marine Engineering Works in Belfast. Apply stating age, experience and salary required to Box 1351, FOUNDRY TRADE JOURNAL.

FACTORY PREMISES WANTED

GREY Iron Foundry Premises required in Midlands. Approximately 10,000 sq. ft.—Full details and price to Box 1322, FOUNDRY TRADE JOURNAL.

DISUSED FOUNDRY or Premises suitable for smelting required within 25 miles London, either Surrey or Sussex. Approx. 5-8,000 sq. ft.—Full details and price to Box 1106, FOUNDRY TRADE JOURNAL.

BUSINESSES FOR SALE

BROMSGROVE FOUNDRY Moulding Sand Supplies business for sale owing to ill-health. Lorries. Pulveriser. Loader. Spare parts and tools. Large deposits sand.—Box 1365, FOUNDRY TRADE JOURNAL.

FOR SALE.—South London. Small Non-ferrous Foundry. Suit two working partners. Reason, ill-health.—Box 1375, FOUNDRY TRADE JOURNAL.

AGENTS WANTED

AGENTS or MERCHANTS required in London, Midlands and North, able to obtain orders for Non-ferrous Castings and Engineering Products.—Box 1366, FOUNDRY TRADE JOURNAL.

REFRACTORY COATINGS.—AGENTS required in London, Midlands, Yorkshire and South Wales, to handle remarkable new range of refractory coatings. Must have first-class direct connections with the furnace-using industries. Generous commission.—Details to Box 1361, FOUNDRY TRADE JOURNAL.

FINANCIAL

ENGINEERING OR ALLIED INDUSTRY.—Advertiser, with substantial financial resources, desires to acquire an interest in (or would purchase outright) an Established Concern with good profit-earning record. Continuity of management and personnel essential.—Address Box 1268, FOUNDRY TRADE JOURNAL.

PLANT WANTED

REQUIRED.—Secondhand Mill to take 1 cwt. or, preferably, 2 cwts. of moulding sand.—Box 1359, FOUNDRY TRADE JOURNAL.

MACHINERY WANTED

PORTABLE MOULD DRIER required complete with motor suitable for 400 volts A.C.—Box 1369, FOUNDRY TRADE JOURNAL.

WANTED.—Shake Out (self emptying for preference), powered by electric motor, to suit 16 in. by 14 in. to 24 in. by 18 in. boxes.—Box 1358, FOUNDRY TRADE JOURNAL.

WANTED

SANDSLINGER by Foundry Plant & Machinery, urgently required.

FRANK SALT & CO., LTD.,
Station Road, Blackheath, Birmingham.
BLA. 1635.

MACHINERY WANTED—*Contd.*

4-5 ton ROTARY MELTING FURNACE required. Brackelsburg, Sesci or Stein & Atkinson. Give full details to Box 1373, FOUNDRY TRADE JOURNAL.

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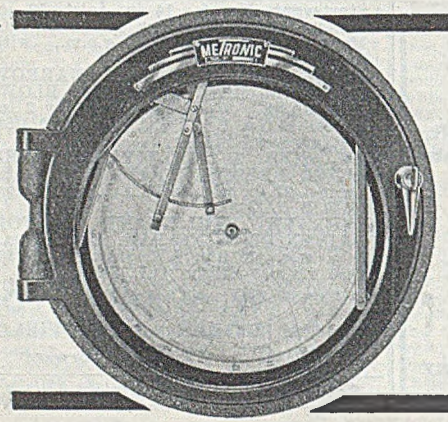

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