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MARCH 5, 1953
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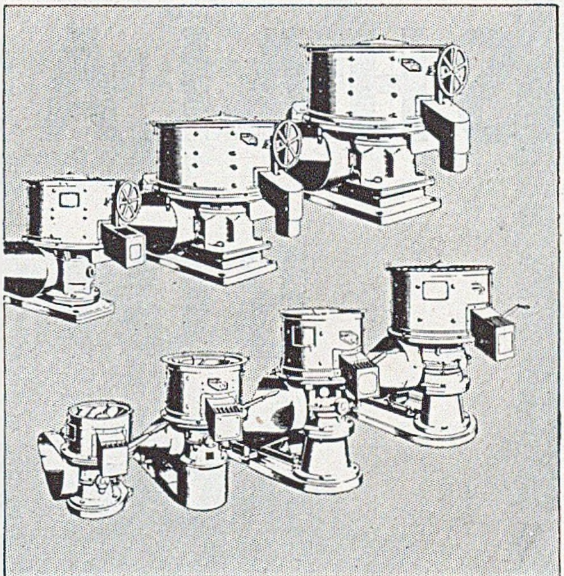

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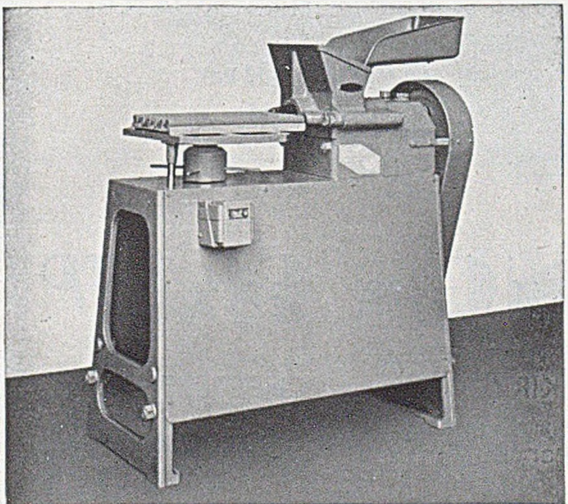

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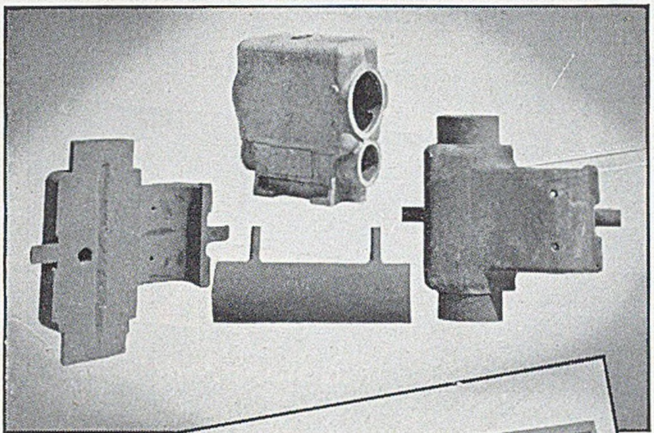

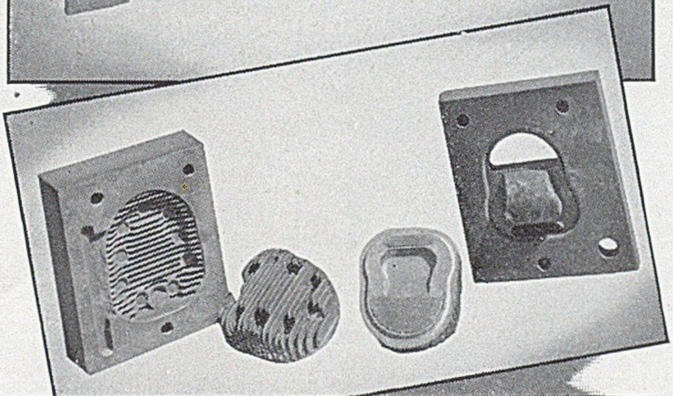

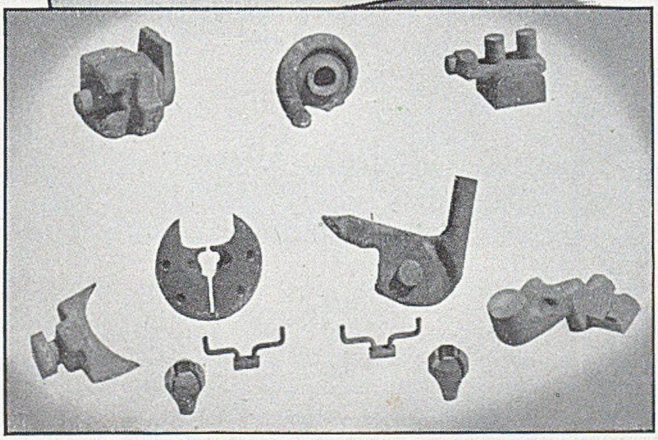

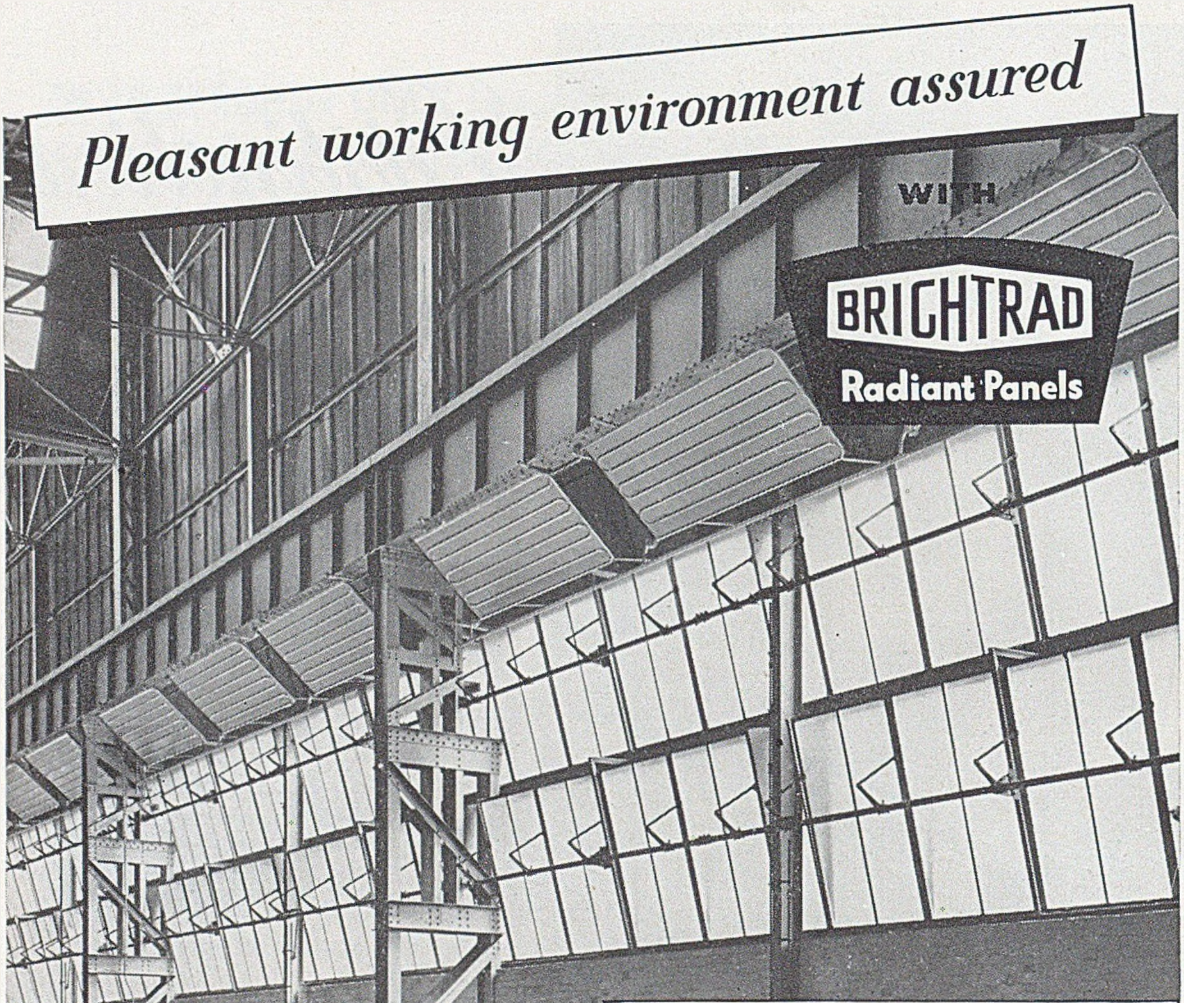

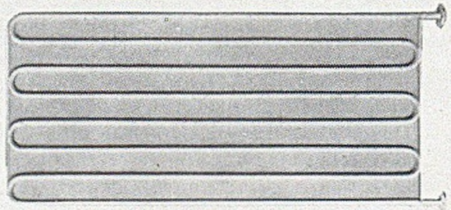

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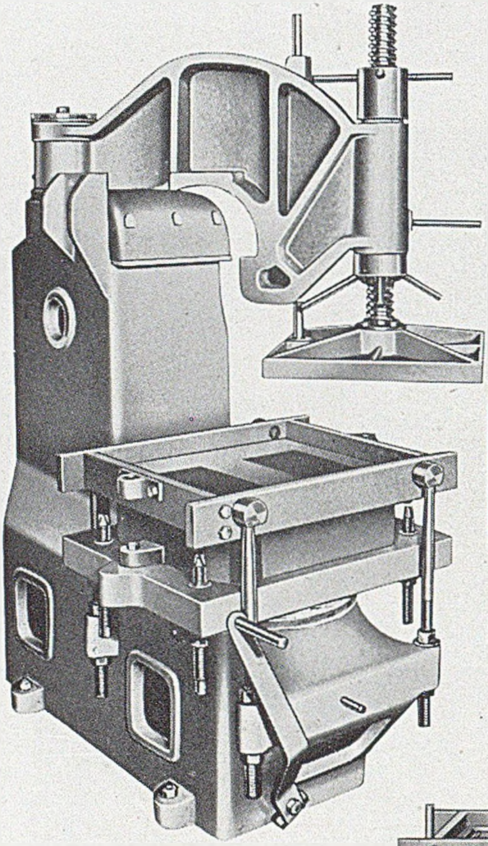

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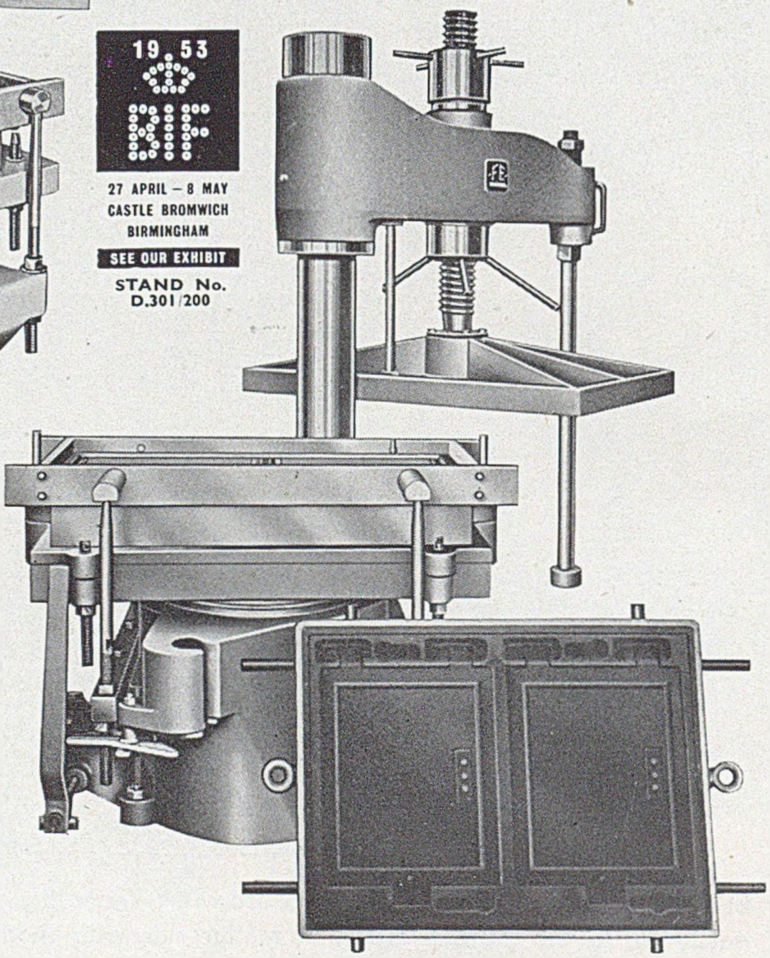

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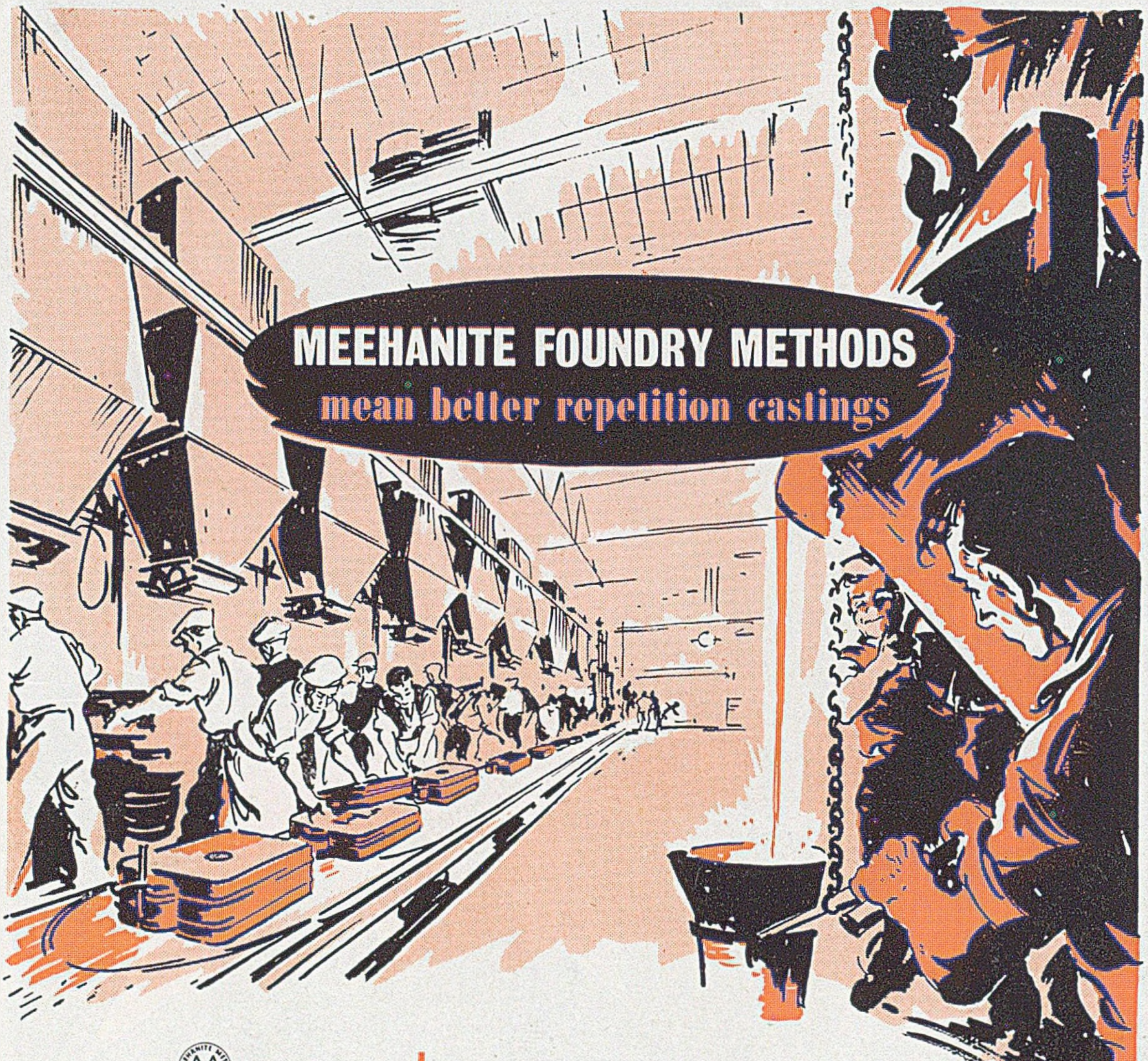

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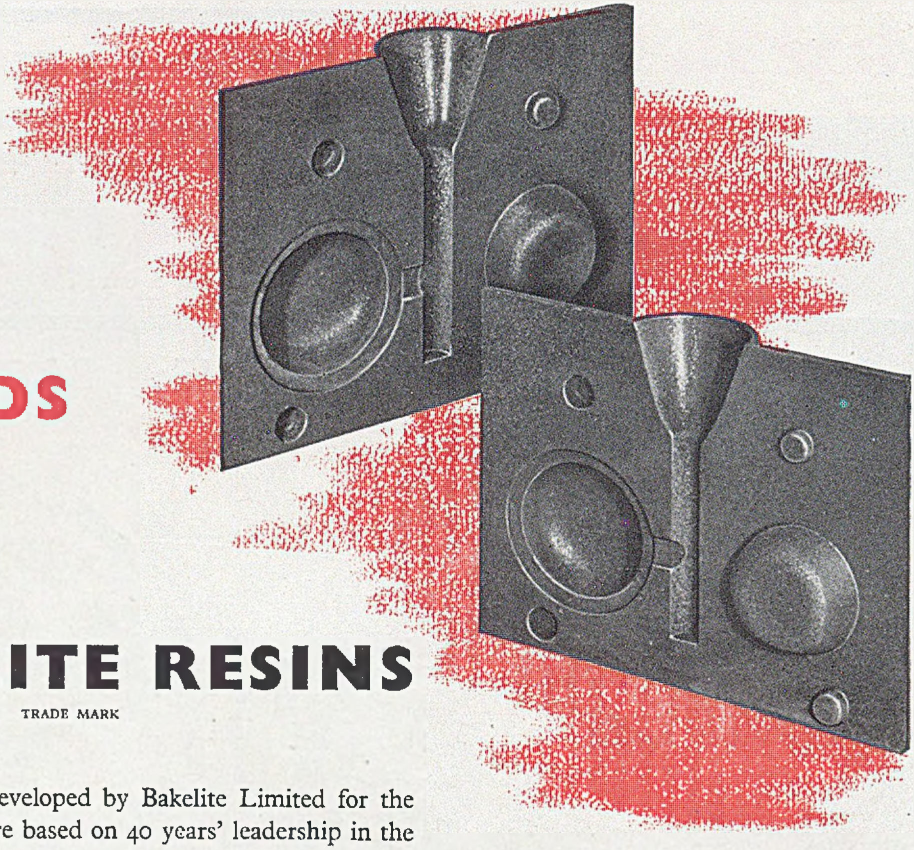

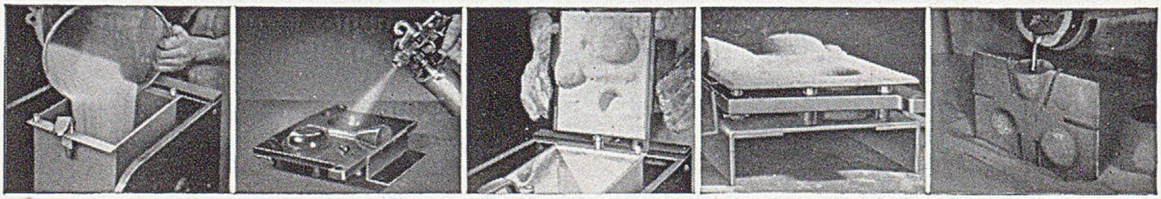

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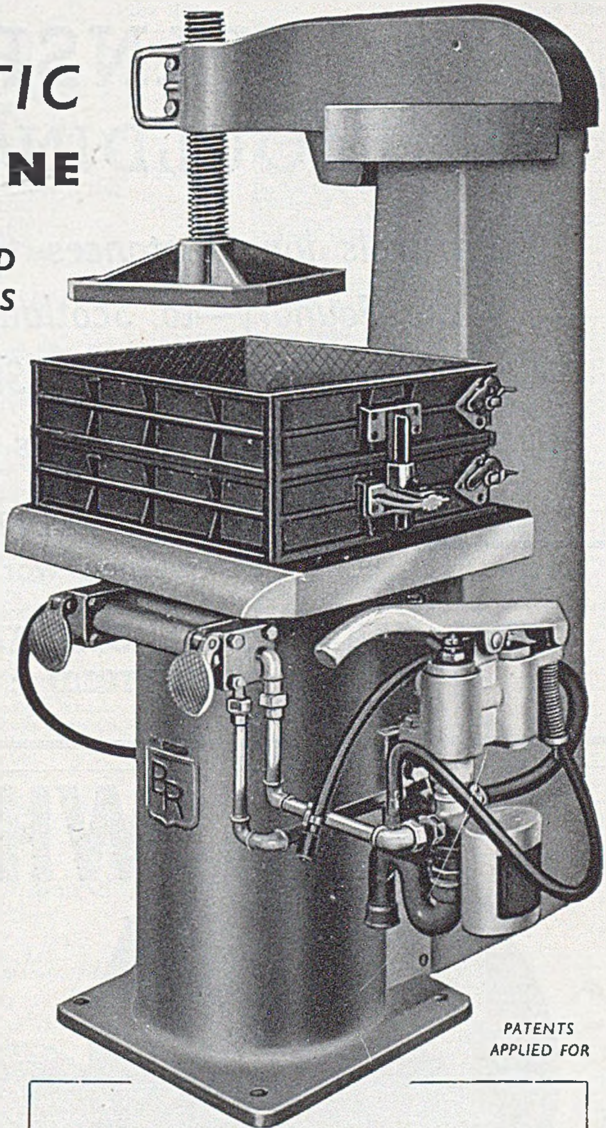

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FOUNDRY TRADE JOURNAL

Established 1902

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PRINCIPAL CONTENTS

PUBLISHED WEEKLY: Single Copy, 9d. By Post 11d. Annual Subscription, Home 40s., Abroad 45s. (Prepaid).

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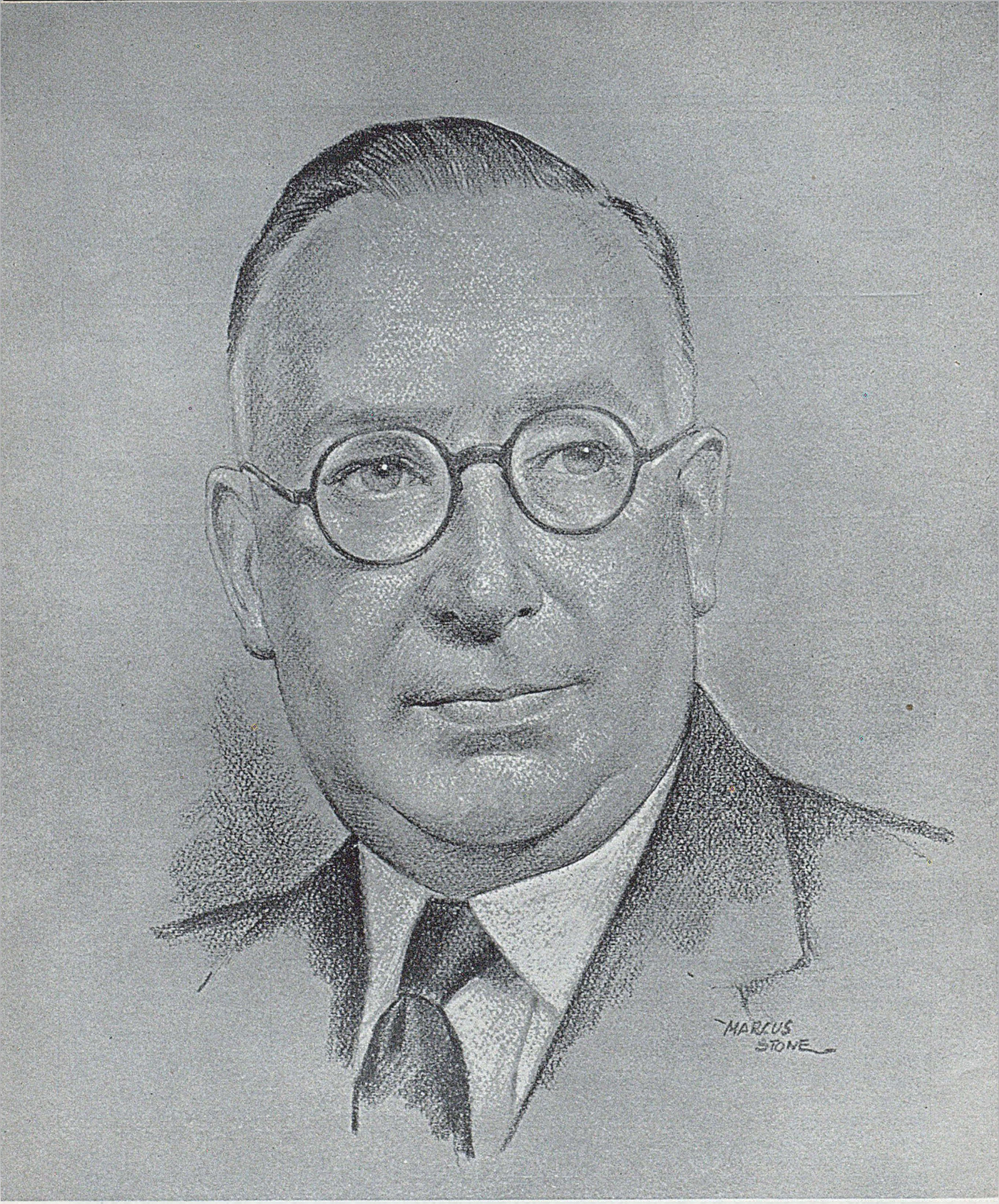
Joint Consultation

Some of the papers on joint consultation given at a course for "Directors and Senior Management" recently organized by the department of industrial administration of the Birmingham College of Technology were rather platitudinous, but there was one exception. That was a contribution by Miss Winifred Raphael, of the National Institute of Industrial Psychology, as her conclusions were based on an extensive survey of four independent factories employing over 250 people. She summarized the survey, which extended over a year, in a Table carrying three headings:—"Support," "Accept" and "Resent." Against these were given the opinions of the chief executive; senior management; middle management; foremen; worker-representatives; shop stewards, and the workmen.

From this Table we learn that the managing directors were in general very enthusiastic, for 81 per cent. supported the idea and only 3 per cent. resented it; as the line of management descended, support decreased until the nadir was reached with the foremen, only 39 per cent. of whom supported it, and 14 per cent. resented it. From the operative side, the representatives of the men were highly enthusiastic, no fewer than 82 per cent. supporting and none opposing; but not so the workmen, who registered but 40 per cent. supporting it, whilst the shop stewards came intermediately with four per cent. resenting. These figures were not, by the way, based on four factories but 545. A note by the author is very significant. "Foremen comparatively seldom gave support to joint consultation; often they were not integrated into the system."

Here and there, joint consultation has been an outstanding success but, where it has not, we suggest that a restart be made with as much foremen representation as possible, plus some of the sales staff, as the latter, if they are to be successful, must be good mixers and natural psychologists. Moreover, they possess knowledge of real interest to the workmen. If they be overseas' salesmen, so much the better, as their stories are often much more colourful. Obviously, the lead must be given by the managing director, for it is on his outlook that the whole success of the scheme depends. It so happens, however, that some of the very best executives are not convincing speakers; their *forte* is the assessing of a set of conditions and giving decisions. In such cases, it is best to forget joint consultation and, from experience, conduct the works in line with the best modern conditions. The survey quoted from does not seem to offer any bright future for such activities, and the general happiness of the shop will continue to be in the hands of the foreman. The present ones may not be such skilled craftsmen as their fathers, but we believe they are better and more intelligent leaders. They require every support that can be accorded to them in their difficult task.



MR. G. F. MUNDELL

Director of the Knowsley Cast Metal Company Limited, and Past-president of the Association of Bronze and Brass Founders.

Leaders of the Industry

MR. G. F. MUNDELL

MR. GEORGE FERGUSON MUNDELL is in the second generation of a family of non-ferrous founders. The firm he directs is the Knowsley Cast Metal Company, of Trafford Park, Manchester. As was the recognized system in the days before the 1914-18 war, Mr. Mundell served an apprenticeship in foundry practice, pattern making and in the machine-shop, but wisely spent his evenings at the Manchester College of Technology studying such subjects as accountancy, economics, and commercial law. Then came the war and with it a period of service with the Manchester Regiment. Returning to the works, he continued to gain experience, until, in 1928, he was promoted foundry manager with a seat on the Board.

His early training aroused his interests in technical matters, which he has always maintained. He is thus a member of the two technical institutes catering for his industry—the Institute of British Foundrymen, and the Institute of Metals. When the Association of Bronze and Brass Founders was begun his firm was amongst the first to join. In 1950, he presided with distinction over the Association. He became a Liveryman of the Worshipful Company of Founders in 1951.

Like so many other members of family businesses, Mr. Mundell is worried as to the future. His father, who is over eighty, is still at the helm, and death duties may be so high as to jeopardize the firm and its 300 employees. Though the firm produces between 30 and 40 tons of gun-metal castings a week, it has also turned its attention to the production of aluminium die-castings to compensate for the reduction in the demand for bronze. Mr. Mundell deplores the lack of help given to research activities by the smaller concerns in the industry, and believes that work done in the heavy non-ferrous metals is neither as great in volume nor as useful as that made available to the light-alloy sections of the industry. Whilst Mr. Mundell makes a hobby of his business, and is also a director of Sydney Moorhouse & Company (1935), Limited, he is very interested in masonic work.

Notes from the Branches

London—Slough Section

At the first formal meeting in 1953 of the Slough section of the London branch of the Institute of British Foundrymen, held on February 17 in the Lecture Theatre, High Duty Alloys, Limited, the chairman, Dr. E. Scheuer, paid tribute to the late Mr. Ian Ross, and on behalf of the section expressed sympathy to Mrs. Ross and his family.

Mr. F. R. Pell then read his paper "Surface Finish and Facing Sands" to the assembly of about 35 members and guests. The underlying theme of this paper, now familiar to members through its presentation in London and printing in the FOUNDRY TRADE JOURNAL, was that experimenting and observation by technicians not necessarily experienced in the field, could readily produce good results as regards formulation of moulding materials to meet a particular set of conditions. Having established the necessary requirements, with critical limits in some constituents, reproducible results and satisfactory working conditions were obtained so long as rigid laboratory control was maintained on the raw materials used for the moulding sand under discussion. This involved comparatively simple tests, and Mr. Pell pointed out the usefulness of the shatter test to indicate the requisite amount of wood-flour, for instance, which would otherwise introduce complicated and lengthy control analysis. That such control was justified, was shown by the greater productivity achieved in the iron foundry of Hayward-Tyler, Limited, Luton (to which Mr. Pell was attached at the time), on a variety of intricate castings, solely by the introduction of a single synthetic "green" moulding sand. The technique had latterly been applied to core work as well. An interesting development with regard to cores, on which work was now being carried out, was the provision of a core coat for producing a viscous layer in contact with the molten metal, thus minimizing metal penetration, resulting in an improved surface finish.

The discussion showed a general agreement that synthetic moulding mixtures gave all-round improvements, which outweighed any slight disadvantages. Mr. Williams pointed out that owing to the quick air-drying tendencies of synthetic materials, mould patching was not possible. Mr. Pell agreed that good pattern equipment was necessary to overcome this. Mr. Blandy stated that using a Leighton Buzzard 26A sand he found it possible to do patching, due to a small percentage of natural bond in this sand. In any case, he was prepared to put up with some extra fettling, such were the advantages he obtained with synthetic mixtures. Replying to a question on the re-use of such sands, Mr. Pell pointed out that this was straightforward, since only one base sand was used, and all that was required was a small addition of binder. Finally, a vote of thanks was proposed by Mr. Williams.

Film Review

"Date of Birth." Sponsored by the Ministry of Labour and National Service, this Canadian film is frankly propaganda for the employment of the middle-aged to elderly. It shows how this class of workers are better time-keepers, more conscientious, less liable to accident and equally productive. The only people who can do anything about sponsoring this employment are industries' higher executives, and this type of individual neither needs nor welcomes visual material to suggest taking the necessary steps. Surely a well-written letter would have been cheaper and more effective.

V. C. F.

National College Tour

Each year, in addition to visits to local works in the Midlands, the National Foundry College students have included in their curriculum a week's conducted tour of foundries in some other industrial centre. Last year, establishments on the north-east coast were visited and this year, the London area has been selected. Beginning at High Duty Alloys (aluminium foundry) on Monday morning, May 11, the afternoon of the same day will be spent at Langley Alloys (heavy non-ferrous) and the following day at John Dale (die-castings) and K & L (Steelfounders and Engineers) respectively. Wednesday morning the party will spend at J. Stone & Company's Charlton Works and cross the Thames to Ford's Dagenham works in the afternoon. For Thursday and Friday, the party will travel a little way from foundries of the truly metropolitan area, first for a whole day at Lake & Elliot's Braintree steelfoundry and then, on the final day, they go to Crane's malleable foundry at Ipswich.

Presumably, attachments to the party are not permitted, otherwise there would doubtless be many foundrymen wishing to avail themselves of the facilities for such a "Cook's tour."

Forty Years Ago

In the issue of the FOUNDRY TRADE JOURNAL for March, 1913, a prominent foundryman (Mr. W. B. Parker) attacked the appelation "refined" irons; he insisted that such material should be made in the now defunct Lancashire hearths. If he were living to-day he would no doubt have other views. It was extraordinary to learn from his paper (Specifications for Foundry Pig-irons) and discussion, hints of the future development, which have since been accepted and utilized. Amongst new companies listed appears the entry "Hadfields Limited (to carry on the business of manufacture of steel castings)." Advance notice was given in this issue of the first Foundry Trades Exhibition to be held in the U.K. the following June. This was to coincide with the Annual Convention of the British Foundrymen's Association in London. Other articles in the issue were on industrial education, and castings for motor cars.

Change of Address.—The registered office of Lancashire Dynamo Holdings, Limited, has now been moved to St. Stephen's House, Victoria Embankment, London, S.W.1. Tel.: WHItehall 7211.

Works Visit Correction.—The visit of the London local section of the Institute of Metals to Murex Limited, Rainham, Essex, will take place on the afternoon of *Thursday*, March 19, and not Wednesday as given in a circular letter announcing the excursion. Members who wish to participate are asked to inform the section hon. secretary, c/o Mond Nickel Company, Limited, Bashley Road, London, N.W.10.

Joint Meeting. The southern section of the Institute of Vitreous Enamellers has invited the London branch of the Institute of British Foundrymen to a joint meeting to be held in the Howard Hotel, Norfolk Street, London, W.C.2, on Wednesday, March 18, at 7.30 p.m. The subject will be "Requirements for the Production of a First-class Vitreous Enamelled Casting" and discussion will be initiated by two enamellers and two foundrymen representatives.

Large South African Electric Furnace

A Paper which Mr. H. J. G. Goyns of D. Drury and Company presented to the South African branch of the Institute of Production Engineers and which is printed in the (South African) "Engineer and Foundryman" gave a short historical note on the early development of electric melting furnaces and concluded with a full-length illustrated description of the manufacture of a modern 10-ton arc furnace in South Africa and its installation at the Usco Works. Printed here is an abridgement of this account.

In the attempt to utilize the electric arc for melting, the nineteenth century gave birth to many ingenious mechanisms, few of which have survived the test of time. In 1878, a notable step in the right direction was made by Siemens with an arc furnace which featured both overhung and bottom electrodes, but a further 20 years were to elapse before Héroult completed in 1899, at La Praz in France, the first installation of what was, in effect, the direct series-arc furnace, shown in Fig. 1. This furnace was a single-phase unit of 3,000 kg. capacity, taking 3,000 amps at 110 volts. The body was oblong, and massive 14 in. square electrodes were used. Power consumption varied between 1,100 and 1,200 kwh. per ton.

Furnaces in South Africa

South Africa did not take long to follow the overseas lead, the country's first arc furnace, a 2½-ton, 600 kva unit being installed at Vereeniging in 1918. The first furnaces on the Reef date from 1921, and while in the next 10 years very little development took place, from 1931 to 1937 the number of units increased slowly. Thereafter the advent of the war years brought about rapid expansion. While, in the main, this expansion has been accomplished through the importing of equipment from overseas, locally-built furnaces have made a very useful contribution to the tonnage produced. It is also worthy of note that in South Africa old and obsolete furnaces, like the old soldier, never die, decent and timely burial in many cases being deferred owing to the high prices and extended deliveries for new plant.

To-day there are over 40 direct-arc furnaces in operation with a rated capacity of 60,000 kva. They vary in type from the very ancient to the ultra-modern, with the accent perhaps on the first category. Many are of the simplest design, with manual control of the electrodes, and transformer capacities which are inadequate by modern standards. Nevertheless, because of the ease with which they can be overloaded, comparatively high outputs are obtained, but the danger of overloading and consequent major electrical breakdown is considerable and ever-present. Capacities vary from a few cwts. to 10 tons, but the majority are in the 2 to 4-ton range. It is exceptional to find any water-cooling except on the electrode holders. The only water-cooling generally found is when the holders or connections spring a leak and the furnaces and operators are subject to purely adventitious cooling.

10-ton Furnace

It is proposed to describe the most recent addition to the direct-arc furnaces in this country. This is a 3,000 kva 10-ton furnace, which went into operation some six months ago. The arc is automatically controlled by a rotary-type regulator. Electrical equipment is protected from excessive overloading through a comprehensive series of interlocks and relays. The tilting and roof slewing operations are hydraulic; renewal and slipping of the electrodes are pneumatic and water-cooling is used throughout the furnace and for the transformer heat dissipation.

Furnaces of this type (Figs 2 to 4) have been made in comparatively large numbers over the last 40 years in Britain and the U.S.A., and the initial problems have been overcome in large measure through familiarity with the production requirements. Due to the delivery position from overseas and the recently developed facilities in the heavy section of the local engineering industry, it was decided to manufacture the mechanical parts of the furnace in South Africa and assemble on site with the imported electrical gear. The transformer was made by a firm which has specialized in furnace-transformer design, the cooling system being manufactured locally.

The rotary regulator, the various control panels, and the special hydraulic pump, which are built as standard equipment in Britain, were imported. The transformer indicating and recording instruments were of American manufacture.

In its operating condition the furnace weighs some 80 tons, and of this, mechanical and structural components account for about 40 tons. Modern furnace equipment calls for closer limits in manufacture than were necessary with the older types. To ensure satisfactory operation, mechanical and electrical interlocks require accurate setting; roof movement must be controlled within close limits, and care in manufacture can reduce appreciably the considerable heat losses which were often accepted as inevitable. The delicate control possible with a modern regulator can be offset by faulty mechanical action of the carriages, or dimensional inaccuracy at the holder end of the electrode arms.

It is necessary to check that the setting of the holders, the masts, and the carriage travel are all truly vertical, as a relatively small error is magnified considerably at the electrodes, some 8 to 10 ft. away. Electrode sections are 5 ft. long and allowance was made at the layout stage for 15 ft. maximum or three lengths. During erection, these components were adjusted to give the maximum clearance at

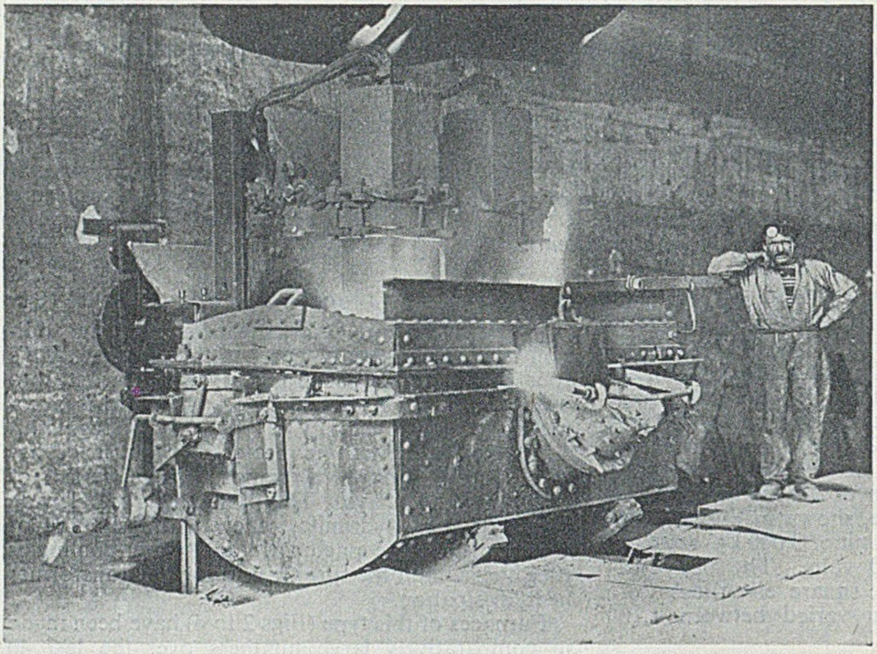


FIG. 1.—*Héroult Electric-arc Steel Melting Furnace, erected in 1899 at La Praz in France. It was probably the First Plant to operate successfully and was the Prototype of all such Furnaces. It had a capacity of about 30 cwt. The Square Electrodes (all that were then available) were adjusted by hand, and individually set in position, hence their Stub Ends were wasted. Nevertheless, the Furnace gave Good Service for a Number of Years.*

both top and bottom of their travel to avoid interference in the roof openings.

The overall height of the furnace body and roof in relation to the cam slot bracket is of importance, as under operating conditions, when fitting a new roof, the slewing assembly is swung clear, leaving the roof in position on the body for its subsequent removal by crane. A new roof is fitted and the main structure, complete with roof arms, is swung back into position. With the normal rise in the roof bricks, should the furnace shell be too high in relation to the slewing mechanism, the roof arms will foul on the brick work. Any variation in the roof ring shape will influence its position on the bricking template, and thereby the position of the electrode holes. It is of advantage therefore to maintain accuracy and interchangeability in the fabrication and bricking, otherwise busbar tails, water connections, holders and bus tubes may require adjusting each time the roof is changed.

Furnace Transformer

The voltage ratio of the 3,000 kva transformer at " no load " is 6,600/200, and the l.v. windings are arranged for delta connections, with tappings on the h.v. windings to give additional secondary voltages of 178, 160 and 147 (with the windings delta-connected). or 116, 103. 92 and 85 (with the h.v. windings " star "-connected). An auxiliary reactor is mounted inside the tank to give total reactance of approximately 25 per cent. with tappings at ⅓ and ⅔ choke. While natural cooling is adequate for small units, on a transformer of this capacity forced cooling is employed, and special pumps are mounted on the tank for circulating the oil under pressure through a water-type heat exchanger.

Additionally, as part of the installation which caters for the complete melting plant, the transformer is externally cooled, the required volume of air being evenly distributed around the walls by suitably designed ducting. Oil and water circulation is controlled by flow-meters within fairly close limits. Should any drop in volume occur, or if the transformer oil temperature exceeds the specified 50 deg. C. rise, a persistent alarm bell comes into action in the control room, where the temperature is shown on a large clearly-marked indicator. Apart from four pressure gauges and two flow-meters, there are actually five temperature indicators in the transformer system.

In operation, while admittedly not, so far, under full load conditions, the oil has shown a commendably small temperature rise. A typical record of the oil temperature over 24 hrs. showed that the temperature had not exceeded 30 deg. C.

Installation

The furnace was delivered on site suitably dismantled, and the shell was first placed in position on the already prepared foundation and levelled off to bring the masts vertical. Thereafter, carriages and arms were lined up to electrode mean P.C. diameter, and for vertical and horizontal alignment. The tubular masts are fitted with machined " feathers " fore and aft, on which the carriage rollers travel. These were adjusted to give optimum friction-free running and minimize, as far as possible, any tendency to hinder mechanically the action of the regulator.

Each carriage is raised or lowered by roller chains, and at the top of travel engages a limit switch which shuts off the power to the driving motor. At the bottom of travel, or when an electrode encounters any non-conducting obstruction in the charge, a ratchet gear comes into operation to prevent electrode breakage, or undue overloading. The roof position was checked in relation to interlocks, raising arms, seating on the shell and electrode clearances. The roof bricking template was marked off to correspond with the actual seating of the roof on the furnace, the fixed dimension being from the centre line of the back electrode to the centre line of inner lifting lugs. This ensured that each roof, irrespective of variations in individual shape, would be bricked to bring the holes in line with the electrodes without altering the holders or arms.

Adequate precautions at the start can alleviate many of the troubles, and the water-cooling system throughout was subject to stringent tests at double working pressure. Even with this precaution, under the high-temperature operating conditions, leakages may develop through shrinkage defects in the castings or imperfect joints in the pipeline. This applies particularly to such castings as holders and coolers which require to be adequately fed to ensure pressure tightness.

The electrodes are spring-loaded and pneumatically released, being adjusted to operate at a minimum pressure of 40 lb. per sq. in., thus making ample allowance for any drop in line pressure which may occur. The flexible cables which carry the heavy current from the " bus " tower consist of multiple leads of 19/18/0.044 bare copper wire, 16 leads to each phase, a total of 48 leads. To avoid unnecessary friction or chafing, the loops fit snugly into each other.

With the varying position of the furnace terminals in relation to the fixed terminals in the " bus " tower, provision was made to avoid, at one extreme, undue strain on the connections and, at the other, undue mechanical or electrical interference between phases. The slewing position presented the greatest deviation from normal, and after checking by the use of rope templates, the final dimensions were calculated to suit these conditions, 12 different lengths of cable being used.

Testing

Following complete assembly, the installation was subjected to detailed tests, and important spares such as holders and roof rings were fitted and adjusted at this stage to ensure the necessary interchangeability when the occasion should arise for rapid replacements during production.

Electrical testing involved the tracing and checking of well over 3,000 connections, which constituted a long and painstaking task for those concerned. Insulation tests were carried out to prove that the holders and current-carrying media were isolated from the furnace and mast structure.

Before testing the furnace movements, the shell was loaded with 18 tons of ballast, and the bricked roof was placed in position. When pump pressure is applied, the furnace tilts 45 deg. forward or 15 deg. backwards, provided the interlock gear is properly adjusted. The time and pressure required indicates any misalignment or binding in the moving parts. Re-setting of the interlocks enables the roof slewing mechanism to be used. Again, excessive time or pressure is an indication of faults such as high spots on the cam slot, or inadequate lubrication of the bearings or shuttles. The slewing mechanism is also tested by removing the arm pins and slewing the arms and gear, but leaving the roof in position, any interference being rectified by modifying the clearances and adjustments. These tests being satisfactorily completed, mechanical stops and limit switches were permanently fixed in position, and Fig. 2 shows the final stage of installation of the mast section and Fig. 3 the general arrangement respectively.

Charging

The furnace is charged (Fig. 4) by the " tulip " method which employs a cylindrical charging basket with the lower portion consisting of segments fastened at the bottom by rope. The basket is placed in the specially constructed stand (which is normally in position on the truck) and charged by magnet crane. The truck is then shunted into the charging bay and, when the roof is slewed, the basket is lowered by crane into the furnace. The heat of the bottom burns through the rope in a matter of seconds, and the basket is removed, leaving the furnace fully charged. The scrap is levelled off to prevent any obstruction, and the roof is then swung

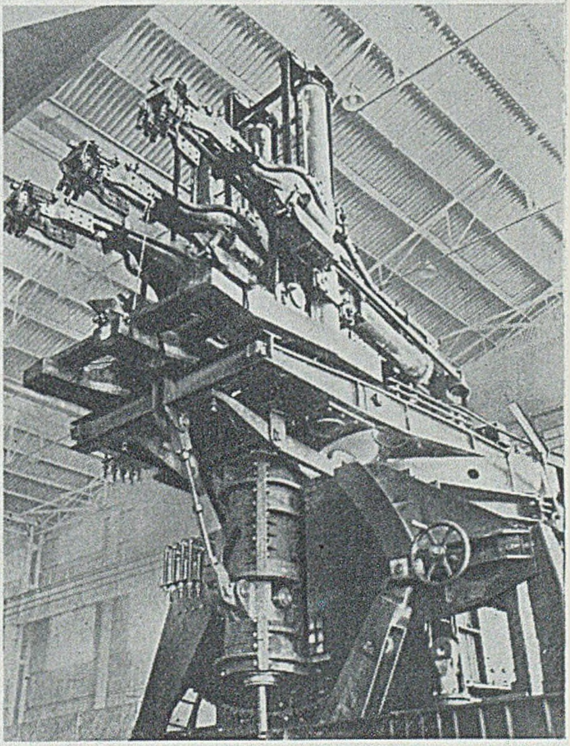


FIG. 2.—*Mast Side of the New 10-ton capacity Electric Melting Furnace installed at the Union Steel Corporation's Works in South Africa.*

Large South African Electric Furnace

back into position. With this method " power-off " to " power-on " usually takes 5 to 10 min.

Various claims are made by the advocates of mechanical charging for the savings effected when compared with hand charging. In this instance, there is no comparable plant working under the same conditions, but using the older method of hand charging. However, it is obvious that good economy is secured through increased production and refractory life, with reduced power consumption and electrode cost per ton.

The saving in power is, of course, largely dependent upon the melting technique, and especially on the length of the refining period. The fact that the estimated saving in charging time is roughly equivalent to an extra four heats per working week is sufficient to justify the incorporation of this method from the production viewpoint alone (without taking into account the improvement in plant utilization and other factors), especially where the equipment is working at or near capacity.

Control " Pulpit "

The whole furnace tilts forward for teeming, and backwards for slagging. For charging, the roof assembly rises and swings through 80 deg. in the horizontal plane. Both operations are carried out by one prime mover, and are mechanically and electrically interlocked.

Control gear for tilting and slewing is mounted on the " pulpit." A foot, or " dead man's switch," is used to start the pump motor, the original idea being that this would act as a safeguard in any emergency. If the operator was splashed with molten metal and jumped backwards, his foot would leave the switch and tilting would cease. However, in this instance the pulpit is more elaborate than usual, the operator having a full view of spout and ladle pit from behind the protection of an armoured plate-glass window.

Mounted on the " dash " is a three-way valve which, if moved right, tilts the furnace forward or slews the roof through 80 deg.; if moved left, tilts the furnace backward, or returns the roof to the normal position. " Power-on " or " power-off " for

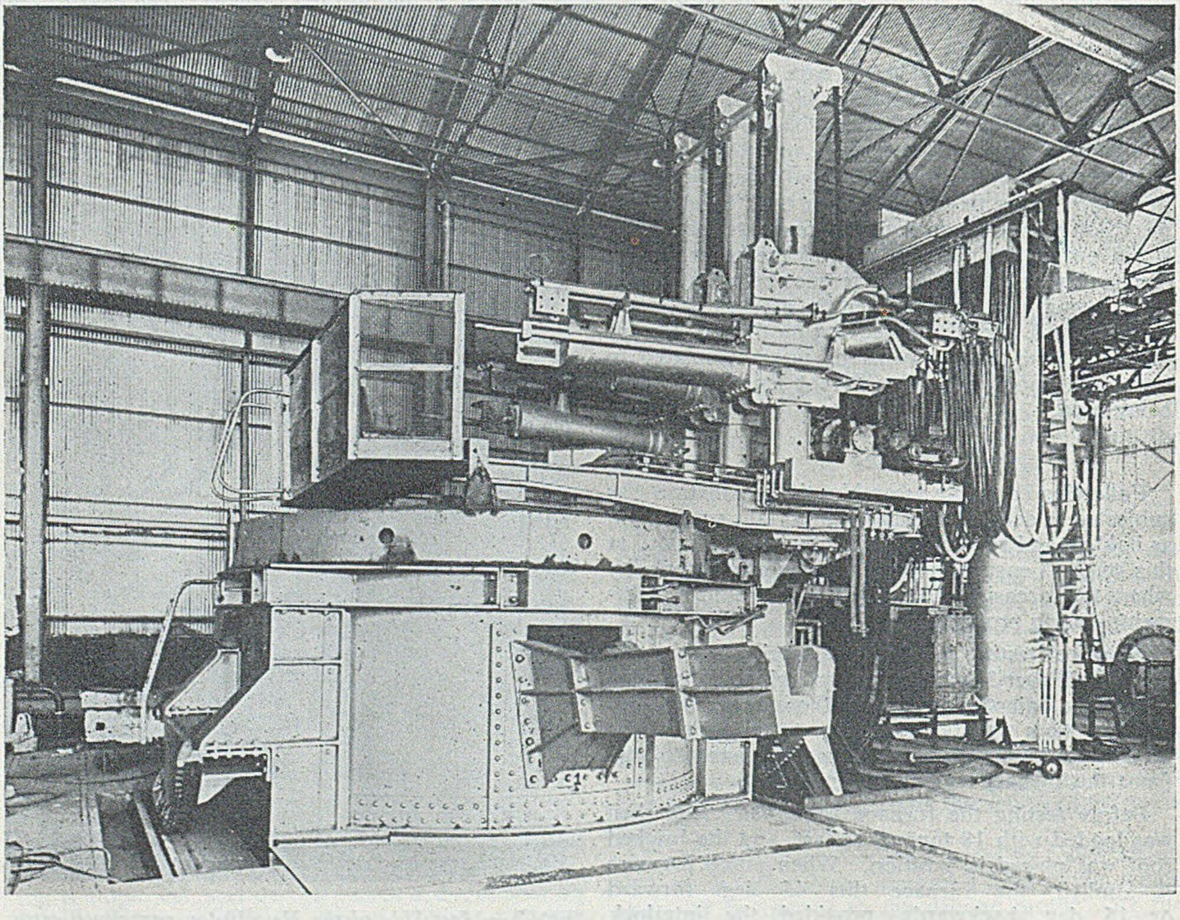


FIG. 3.—*General View of the 10-ton Furnace from the Pouring Side. Note the independent mounting of the Electrodes and Control Gear which permit their withdrawal when removing the Roof.*

the pump circuit, and the tilting approach limit, are indicated by red and green signals. A pressure-gauge is provided for the hydraulic system and push-buttons for the motor-operated ladle pit cover.

Electrodes

Graphitic electrodes, 12-in. dia., are used and renewal or slipping of these is controlled from the operator's cabin. The holders are of cast steel, machined and tinned on all contact faces. A coarse machined thread in the bore gives the necessary grip and contact. Only the main casting is water-cooled. To minimize heat losses from the openings of the furnace roof and through the electrodes themselves, copper coolers with self-adjusting economizers are provided, where the electrodes pass through the roof.

Rotodyne Regulator

The control of the furnace power is effected by variation in the arc length. Many types of regulator are available, and regulators employing contactor gear have, in many cases, given good service, but the maintenance cost in replacing the moving and wearing parts can be considerable. Hydraulic regulators, are also in fairly common use, and with regular maintenance have proved a very satisfactory method of control. The rotary regulator, however, is a fairly recent development and comparatively few are in operation locally. With continuous production, ease of maintenance is a major factor. The demands on local power supplies dictate the necessity for minimizing the surges which are inevitable during the melting-down period. Where steels of close analysis, and especially low-carbon steels are specified, dipping of the electrodes in the molten bath, with the attendant carbon pick-up, must be avoided. These requirements have been adequately met by the rotary regulator, which is automatic in operation, the operator only having to switch on or off.

The electrodes are moved by means of d.c. motors and gear-boxes mounted on the swing platform. An a.c. motor, driven from the works l.v. supply is coupled to three d.c. generators, one for each electrode motor. Each generator has two opposing shunt field windings. One is fed from the busbar current transformer through a step-up transformer and rectifier; the other from the main transformer through an auxiliary tapped transformer and rectifier. The former is controlled by the load regulator, the latter by the voltage selector switch.

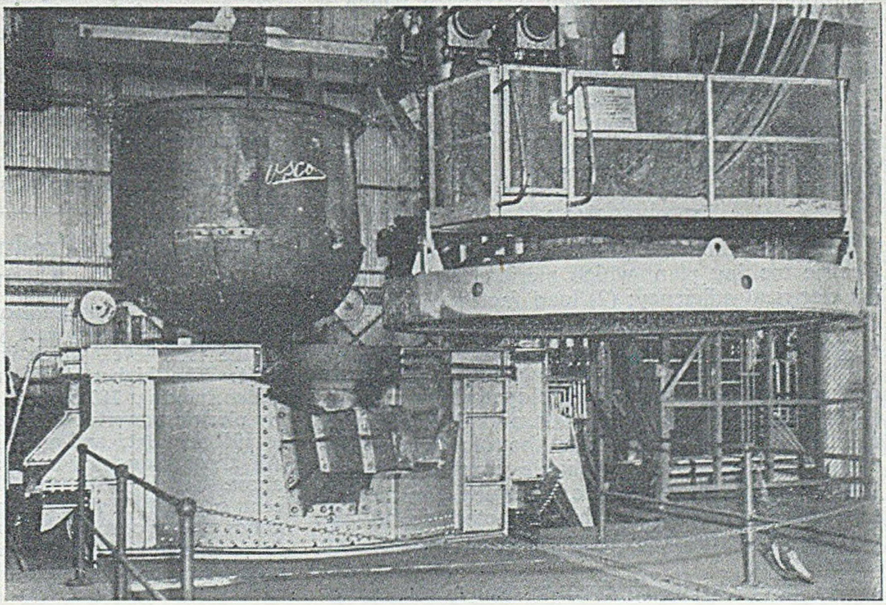


FIG. 4.—*"Tulip" Basket, holding the Charge of Steel Scrap ready for discharge into the Furnace Body, the Furnace Roof having been Slewed Sideways for this purpose.*

The electrode movement in both speed and direction is controlled by the reaction of the specially-designed generator windings to variations in the electrode currents and voltages, "high current" conditions exciting the current-control winding, and thereby raising the electrode until balanced conditions are restored. Similarly, with high voltages, the voltage-winding is excited and drives the electrode downwards. The motors are energized in proportion to the magnitude of the variation, and each electrode rapidly becomes adjusted to give the exact loading required to maintain the desired setting.

While under normal conditions control of the three electrodes is automatic, when necessary the furnace can be switched to manual control and the electrodes operated independently. Various refinements are incorporated, including the automatic raising of the electrodes on the opening of the h.v. switch, and a "raise and stop" position for slagging. As the generator and the electrode motor fields are constantly excited, the time and energy consumed in overcoming the factors of inertia and acceleration when reacting to out-of-balance conditions are considerably reduced, and the speed of response is thereby increased.

Other Controls

The hydraulic system is controlled from the "pulpit" as already described, and the remainder of the equipment from the operator's cabin. On the auxiliary panel are the transformer temperature and kw. l.v. recorders. On the h.v. panel are the h.v. instruments, the kwh meter, the tap-change indicator and control, and the remote-control operating lever for the main switch. On the Rotodyne panel

Large South African Electric Furnace

are the l.v. instruments, the regulator controls and the 1st stage of the 2-stage protection system. The necessary indicating lamps, fuses, etc., are mounted on each panel. At the rear of the panels is the motor generator set for the regulator, and on the back wall are the l.t. distribution board and switches for the various auxiliaries.

On the furnace and l.v. leads from the transformer, the usual bus "bars" are replaced by water-cooled bus "tubes." Water cooling is used on the transformer, electrode holders and coolers, doors, jambs, arches and the roof. The pneumatic system operates the door mechanism and electrode release gear.

Preventive Maintenance

During assembly, provision was made for lubrication, a schedule being prepared which covered the complete equipment. In addition, the question of spares was given attention, and those which under normal operating conditions might be required at short notice, were tested and tried in place at this stage. Even among people who should know better, preventive maintenance is more honoured in the breach than in the observance, but this case was the exception inasmuch as the question of maintenance was fully discussed before the furnace was erected. Herein the value of previous experience with similar equipment cannot be over-estimated, as obviously provision cannot be made to overcome troubles unless it is known what troubles are likely to occur.

Preventive maintenance starts with attention to detail in assembly and erection, and many breakdowns would be avoided if the "good enough" attitude was replaced by intelligent inspection and testing to ensure that the job will be just a little better than may be necessary. Under the arduous conditions of operation, even a furnace which is accurately constructed at the outset will eventually, due to wear and tear from various causes, give some trouble. With a furnace constructed on the "hit and miss" principle, breakdowns are always imminent, and any saving in initial cost can be readily dissipated in the cost of interrupted production and high maintenance.

Furnace Efficiency

There are three factors in the operation of any electric melting plant which merit close attention: (1) electrical efficiency; (2) load factor; (3) furnace efficiency. Brief reference to the third factor only is made here.

Furnace efficiency is measured by taking the sum of the heat energy usefully employed (1) in melting; (2) by the slag-making materials, and (3) in chemical reactions, and dividing this by the total heat energy supplied. To arrive at reliable comparisons, the type of scrap, the method of charging, the melting and refining technique, the refractories and the size of the furnace must all be taken into consideration.

The extent to which furnace design and operation influences heat losses is perhaps sufficiently realized insofar as the sealing of doors and electrode entries are concerned. The importance of this latter aspect is shown in the following table, the furnace concerned being an older type Héroult.

	Energy Consumed (per cent.)
Heat absorbed by steel	45.80
Heat absorbed by slag	08.50
Heat loss through electrodes and electrode openings	15.40
Heat taken out by gases	03.20
Open door losses	03.70
Roof surface losses	14.20
Side surface losses	05.20
Bottom surface losses	04.00

While these figures may not apply to an efficient modern installation, they are indicative of what can happen with many of the older furnaces in use where badly-fitting doors, and the ever-open doors are accepted without question, and where economizers and coolers, when used, are considered of insufficient importance to merit regular and adequate maintenance.

Conclusion and Acknowledgment

Many details have, of necessity been omitted from this account in order to cover the complete installation in the space available. In conclusion, acknowledgment is made to the directors of the Electric Furnace Company, the Union Steel Corporation, and D. Drury & Company for permission to publish the data on this installation.

Higher French Steel Output

Total production of iron and steel in France in 1952 showed a marked advance over the 1951 levels. Pig-iron output totalled 9,772,000 metric tons, against 8,750.000 tons in 1951; crude steel production was 10,868,000 metric tons against 9,835,000 tons.

Saar production of iron and steel was also above the 1951 levels. Pig-iron production was 2,552,000 metric tons, against 2,369,000 tons in 1951; crude steel output amounted to 2,823,000 metric tons, against 2,603,000 tons.

Despite the good results for 1952 as a whole, the low rate of inflow of new orders was causing concern in the later months of the year, and it is not expected that any marked improvement in the situation will occur until the organization of the common market for steel under the Schuman plan is known.

Industrial Production in Western Germany

Preliminary estimates show that industrial production in Western Germany last year rose to 142.5 per cent. of the 1936 level, which is 7 per cent. higher than in 1951. The highest level is in the electrical industry, which stands at 287 per cent. of the 1936 figure, followed by electric power at 220 per cent., vehicle construction at 196 per cent., and machine building at 193 per cent. All those industries have also increased their output above that of 1951. Steel construction is only 90 per cent. of the 1936 figure, non-ferrous semi-manufactured goods 91 per cent., and shipbuilding 92 per cent. With the exception of non-ferrous products, however, those industries have also shown great progress as compared with 1951.

Flow of Metal into Moulds

Discussion of T.S.35 Sub-committee Report and Film by I.B.F. Branches

One of the most valuable manifestations of the work of the technical sub-committees of the Institute of British Foundrymen is the way in which their reports are disseminated for critical discussion throughout the general body of members. The "Flow of Metal" report and film were introduced into the proceedings of last year's Buxton and Sheffield conference and have now been considered at a number of branch meetings. What follows is a record of discussions at three such meetings; in each case the report and film were first introduced by a member of the sub-committee.

EAST MIDLANDS

At the meeting of the East Midlands branch of the Institute of British Foundrymen, held in Leicester, over which Mr. J. Hill presided, Mr. John Hird presented the film on "Flow of Metal into Moulds." Afterwards, the following discussion took place:—

Mr. P. A. Russell said he had seen the film before at the annual conference, and he had made a comment that he thought the flow pattern was affected by running the jobs on the mould-joint level. He had, however, found he was wrong, as after he got back to the works he carried out experiments and found he got exactly the same results when using a head of metal. Mr. Russell said the film had brought home to all that once the metal started to flow in one direction it tried to continue in that direction.

Mr. Hird said he had taken the liberty of quoting Mr. Russell's experiment to make the point that the extra head did not seem to have any effect on the flow pattern; however, the size of the downgate appeared to control the velocity of the metal.

Mr. Hayden was particularly interested in the first illustration of the whirl-gate, which appeared to do its job very effectively by preventing slag entry into the mould and asked for some sizes of the spin bob used and the cross-sectional areas of the inlet and outlet. Also, the illustration showed the inlet and outlet of the spinner in the bottom of the mould which was done probably for illustration purposes; he asked if Mr. Hird had any information as to what happened when the outlet was in the top-half of the mould.

Mr. Hird said the spinner was the reverse of that used in normal practice. Usually, a saucer-shaped piece was moulded in the bottom and both the ingate and the outgate of the spinner were in the top-part, with the ingate having a cross-section slightly in excess of the outgate. He could not give the exact sizes.

Reproducibility

Mr. Millar said that in one or two of the illustrations he noticed the inside gate running last. On the illustration with the runner-bush in the centre, and the two outside ingates, Mr. Hird had said both delivered about the same amount of metal, but this did not appear to be the case. The impression gained from these illustrations was that there might be a certain amount of luck as to which started to run first. Could Mr. Hird say to what extent this "luck" entered into the formation of the flow-pattern, or give any indication of the difference of the metal delivery in lb. per sec. per sq. in. of ingate on the various types used.

Mr. Hird replying on the question of reproducibility of the flow-pattern, agreed that the impression was given that one ingate was passing a little more metal than the other, but that could be deceptive, as it would depend on the shape of the metal flow as presented to the camera. If one disregarded the actual ingate and looked at the bottom of the mould one would find the mould flow-patterns were being reproduced very satisfactorily, and could be repeated a second time. He could not give any information about the actual rate of flow of metal passing through the ingates; it would depend on the diameter of the downgate as it was through this that the volume was controlled.

Mr. Saunders said he was very interested to hear that the moulds were level and asked if it were possible to alter that pattern by tilting the mould slightly.

Mr. Hird said they could have tilted one mould to shew that difference. He thought the report presented a good case for not casting moulds for flattish jobs on the flat.

Velocity or Pressure Head

Mr. Lamb asked for an opinion on what governed the actual traverse of the metal over the mould; was it static or velocity-head which was the more operative in this case?

Mr. Hird replied that from Mr. Russell's experiment of increasing the head and getting the same results, it would appear that it was the velocity of the metal rather than the head which was the controlling factor. There was effect from the weight of metal following behind, which seemed to want to flow in a straight line much more than one was in the habit of thinking it did.

Mr. Lamb said that in an instance where there were three directions in which the metal could run from a single runner-bar it seemed to take the two long channels instead of the one short channel.

Mr. Hird replied that it was surprising that the metal did not enter the mould through the ingate under the pouring basin, but when one came to think about it there was an explanation, *i.e.*, immediately at the bottom of the downgate there was no full depth opening into the mould as the ingates were not cut to the bottom of the runner-bar. The metal went down the downgate and along the runner-bar and into the mould at the end of the bar through the ingate there.

There was still much the sub-committee had not

Flow of Metal into Moulds—Discussion

done, and it was hoped there would be work to follow-up on the lines brought out by the discussions at the various branch meetings. Until the film was taken and examined, members did not really know what was going to be seen. All members of the sub-committee would be reporting back to their chairman and any other suggestions would be welcomed.

Mr. B. Millington, on the question of ingate velocity, said unless his memory failed him there was one mould which did fill uniformly, and that was one with the greatest area towards the mould. It would appear that this shape of ingate gave reduced velocity of metal across the mould and was therefore desirable. Perhaps further work might be done to enlarge on those aspects.

Studying the Connor Runner

Mr. Hill said he was very interested in the way the metal ran into the flat plates. He had found that it was very difficult when running from one ingate on one side, to control the depth of large open-sand plates when dealing with thickness up to 1 in., and that the most important flow-offs, to control the thickness, were best located adjacent to the runner, as this was the last point to fill.

He was interested to note the flow of metal from the ingate, and to see that very frequently it was not until all the bottom was covered that the portion under the fall from the ingate filled up. There had often been debates upon the actual function of the Connor runner, and he wondered whether the elimination of this dead spot played some part in its effectiveness.

Mr. Russell asked whether Mr. Hird could give any technical details regarding photography, as he would like to have a look at the Connor runner pouring into an opened-up mould.

Mr. Hird could not give any technical details, but said one advantage of this photography was that one could see what was happening. When casting a milling-machine table with a spinner in the runner-bar and two ingates, his men found they were getting bits of slag on one side only. It turned out that the ingate from the spinner to the runner-bar was just slightly on the slope, and they were getting 75 per cent. of the metal through one ingate. This discovery was made by reflecting on the behaviour of the metal as seen in the film. They then put two downgates and two spinners, giving two separate runner systems, and equalizing the flow of metal. The only snag had been that he was afraid of getting slag in from both sides, but the modification had in fact cured the trouble.

Mr. Millar said as a matter of interest about two years ago his firm started to manufacture a different size of product. Up to then they had been making jobs up to 6 in. dia., and they went on to sizes up to 9 in. An attempt to run them in the same way as for the smaller sizes gave all sorts of trouble, such as badly scabbed cores and the like. They had tried various running systems without success and then the shop foreman suggested they should use horn runners. Mr. Millar said he himself was very sceptical, but the fact remained it had proved the only runner which produced good castings.

Influence of Viscosity

Mr. Payne said although members were concerned with the flow of metals he wondered whether other factors were more important in this case. Had the possibility of defects arising from uneven temperature been considered. Also, how much of the flow-pattern actually affected the temperature and final cooling of the casting. It was four minutes, if not more, after casting before the casting began to solidify, and in four minutes there was much equalization of temperature.

Another point was that members were warned that the question of viscosity did not come into the picture, but he still thought it did. When pouring molten metal into a mould, towards its solidification temperature there was a tendency to get a surface film, and to break that film, fairly high velocity was required. He then asked if anything had been considered with respect to using extended designs of filter cores, where the metal came through the bottom holes first and a small amount of metal later trickled through the top holes, with the filter core used as part of the actual casting. What was the effect of the speed of the metal on the particular flow-pattern?

Mr. Hird replied that the reason the sub-committee had not set out to discuss surface-tension was that they were rather afraid of mathematicians "blinding them with figures." Mr. Payne was perfectly right in that the flow-pattern was controlled by velocity rather than the surface tension of the metal. Regarding surface tension, there was not such a large meniscus with cast iron or steel as with aluminium, yet the flow-patterns were almost identical. They hoped that the film had whetted the foundryman's appetite to consider the observations in relation to his running methods. On castings of the one-off type it was not, of course, practical, but on small repetition lines it was well worthwhile cutting out the top to see where the metal was going. It might be found that just by altering the angle of an ingate trouble could be avoided.

Mr. Payne said that he had seen a similar film, which he believed was American, which advocated not open moulds, but cutting windows in the moulds.

Mr. Hird remarked with regard to the earlier "shots" showing the metal agitated when lying on the sand face of the mould, until this part was shown in slow motion observers thought it was quiescent.

Mr. Saunders said that a previous speaker seemed to think that the metal in the path illustrated in the film was not taking the line of least resistance but he thought it was—for a mould which was level.

Mr. Hird said it had been pointed out that if one overloaded the top of the mould with coal-dust and lifted it off carefully after casting one could see the flow of the metal drawn on the surface of the mould by the track it had made in burning coal-dust. However, he had not tried this himself.

Mr. Payne said with one specialized application that method might be feasible as an assessment of the flowability of the metal. He asked whether the sub-committee had studied what happened in a fluidity test-mould.

Work on "Fluidity"

MR. HIRD replied that the sub-committee had not considered the fluidity test, but he knew of a Chinese student from Birmingham University who was doing a thesis on fluidity of cast iron, and when using a variation of the standard fluidity test (arranging vents all the way along the spiral) he found he got a surge in the metal flow along the spiral channel. These vents were spaced $\frac{3}{4}$ in., 1 in., $1\frac{1}{4}$ in., $1\frac{1}{2}$ in., and then the next one would be about $\frac{3}{4}$ in. again and so on. The investigator put two ingates, one in the centre and one on the outside, and whichever way they were arranged the result on pouring was a series of surges. The bigger the diameter of the downgate the bigger the surge. This probably explained some of the unexpected results obtained with the standard fluidity test.

MR. HILL remarked that some time ago his firm made a very thin plate approximately 9 in. by 4 in. and ran it with the conventional flat-type ingate. The resultant casting was unsound, and had scabbed. To promote soundness a Connor runner was used, and was effective not only in producing a sound casting, but it also removed the scab, probably by promoting a more even flow of metal over the mould surface.

MR. HIRD remarked that a plain flat plate was one of the most difficult castings to make in a foundry.

MR. LAMB quoted an experiment which had been carried out. He had cut out the top-part of a mould immediately over a standard strainer core. It was observed that the metal did not appear to run through the strainer core, but over the top of the core, *via* the cut-away. The holes in the strainer core had been opened out in such a way that their total area was greater than the area of down-runner, but the metal still went straight over the core, and not through it.

Following up the remarks as to excess coal-dust leaving a "foot-path" of the metal flow-pattern on the cope of a mould, an American society had done much research work on flow phenomena in closed moulds and included in its findings a series of photographs depicting running "foot-paths."

MR. HIRD asked how long were the holes in the strainer cores described by the last speaker.

MR. LAMB gave the dimension as from $\frac{1}{2}$ to $\frac{3}{16}$ in.

MR. HIRD stated that did not happen with the strainer core shewn on the film, but he did not know how thick the core was. It would seem that a vertical downgate would pass more metal than a gate of the same cross-sectional area in a horizontal position, probably due to the weight and velocity of the metal.

At the conclusion of the meeting, Mr. Hird was cordially thanked for showing the film and answering questions.

BIRMINGHAM

MR. H. MORROGH, opening the Birmingham branch discussion of the sub-committee's work by proposing a vote of thanks, said that films of this type had been shown before in this country, and a characteristic reaction was—what new information had been gained from it. Much of the technique for filling moulds was based on a process of guesswork, elaborated by trial and error and it was of considerable value to have some of the guesses proved or disproved by photography. Mr. Hird had said that the sub-committee had only been formed in 1950, and he thought that they should be congratulated on the energy with which the project had been pushed forward. Referring to the casting of the spoked wheel, Mr. Hird had mentioned a method which gave less residual stress. He would like to assure Mr. Hird that all foundry methods caused considerable nervous stress as to whether the mould would actually fill or not! It was, he said, rather amazing that an industry which concerned itself daily with the filling of moulds with liquids, should show such profound interest in these simple cases.

MR. HARRISON, in seconding, said this was the second time he had seen the film and he thought that Mr. Hird was quite right, that much more was gained from a second viewing. He wondered what the effect would be of pouring the mould when closed, and where the runners would be another 3 to 4 in. higher, and asked whether the flow-pattern would be similar, as the mould conditions would be somewhat different. Having witnessed the flow-patterns on simple castings, there was much food for thought about what happened in a more complicated mould.

MR. HIRD expressed his thanks for the warm reception which the meeting had given the film and said he would certainly convey members' appreciation to the sub-committee. Regarding the point raised by Mr. Harrison, he said Mr. Phillip Russell had criticized the same point when he had seen the film when it had been presented at the Buxton conference, and went back to his own foundry with the intention of proving that those same factors did make a considerable difference, and to produce some photographs to illustrate his point. However, Mr. Russell, using a 6-in. top-part and with a cut-out window to see what was happening, had found that the flow pattern was identical with that shown in the film. Apparently, therefore, the factors mentioned made very little difference.

THE PRESIDENT interposed here to extend a welcome to Dr. A. B. Everest of the Institute's technical council, and also to new members of the Institute who were present.

MR. BERNSTEIN asked whether a check was made that the moulds were perfectly flat before pouring took place, as his impression had been that in one or two cases the moulds were not.

MR. HIRD assured the speaker that a spirit-level had been put on the bottom surface of the mould.

MR. HALL, in view of the indication that the flow-patterns seemed very similar for all metals, asked whether any other liquid had been tried. For instance, would melted wax have given the same result with the same ingates, etc.?

MR. HIRD said that with all the metals the sub-committee had tried, the same flow-patterns were apparent, even with aluminium which had a high surface tension. Steel and cast iron followed much

Flow of Metal into Moulds—Discussion

the same pattern, but whether other materials would do so, he would not like to say.

Mr. Weaver asked whether a record of temperature had been taken and if so where had it been measured.

Mr. Hird said he had mentioned that temperatures were as follow: "Hot," 1,420 deg. C. and "cold" 1,310 deg. C. The castings were all poured at a uniform temperature and readings were taken from metal in the ladle.

Analogy Between Cast Metals and Other Liquids

Mr. Wright, who had seen the film twice, said he felt tempted still to say "what do we gain by seeing this film, what do we learn and how does it help?" The main object of a foundryman was to fill a mould as quickly and quietly as possible. The film did prove the value of correct venting and of dry-sand, but apart from that of what other value was it? Regarding Mr. Hall's suggestion of using wax, Mr. Wright said he believed most of the effects could be shown very clearly by using a simple wax. Not only would it show flow patterns, but it also possessed liquid shrinkage and hence revealed draws and cavities caused by thick and thin sections and hot and cold spots. Mr. Wright considered that wax in a Perspex mould would show more clearly and precisely what happened than any open mould would.

Mr. Hird said he hoped that at least the film would cause people to consider more logically what happened when a mould was cast. Different effects of rubbish getting into the mould could be seen, and much could be learnt from watching the film through several times. He agreed that the vertical plane had not been taken into account, but under the terms of reference, the sub-committee had been rather limited in their work.

Mr. Pearce said that there might be something in the idea that the sub-committee had re-discovered something that was already known, and suggested it would perhaps be more to the point if founders tried to confirm the data with simple fluids, as, for instance, by proving that cast iron relative to water acted in such and such a way. This might call for much research to prove or disprove certain points, but that if some relationship could be proved, it might be of very great importance.

Mr. Hird agreed that it would be very useful, but suggested that to study the hydraulics of pouring and running was a little beyond the scope of the sub-committee at present, and rather an ambitious undertaking.

Mr. Hird Snr. was very impressed with what he had seen on the screen, to him it seemed a fine advance from the old days. He asked whether the percentage of coal-dust in the sand had any effect upon the pattern that the metal took in the mould. Flames could be seen in the film coming off from the bottom of the mould which he thought he was correct in assuming, were mostly from the coal-dust, and possibly from the moisture, and in one or two cases, they did seem to oppose the flow of metal. In one case, in the dry-sand mould, it seemed fairly obvious that there was a turbulence in the flames and gas bubbles. This was a case where wax, or anything other than metal, would not show the foundryman what he really wanted to know.

Mr. Hird said they had no idea of the effect of coal-dust until the film was taken because what was shown on the film was not visible to the naked eye. When the film was slowed down, then the turbulence could be seen, but to the naked eye the metal seemed to be cast quietly. The discussion on the film, so far, had certainly indicated that there was a demand for further work on these lines.

Application of Hydraulics

Mr. Shotton, referring to the point made by Mr. Pearce in talking about the relation of hydraulics, said that this idea was not so very far away from what was indeed being carried out. A sub-committee had been studying the effect of design of runners and risers, although a report had not yet been published. Regarding closed gating, as opposed to open gating, the speaker was still convinced that the effect was not the same; it might be similar, but that there must certainly be some difference in the flow-pattern where there was a constriction half way.

Mr. Shore said that he had been present when Mr. Hird, Snr., had given his famous Paper on coal-dust in moulds, and he was rather surprised that his son should not have followed the same practice! He asked what was the speed of the film in relation to the normal pouring rate.

Mr. Hird said that the speed was 64 frames per sec., as against normal running of 16 frames per sec., which meant that the film was about four times slower than the actual operation. In actual fact pouring took 4 secs. to accomplish, and in the film it took about 16 secs. In the film the vertical plane had been cut out, but it might well be that this would have to be taken into account, and that in the discussions among the Institute's branches, following the showing of the film, they might get some idea as to whether there was a real demand for some investigation on these lines.

Effect of Pressure

Mr. Groom said during the course of his experience in foundry work, he had carried out experiments with various fluids, to watch the effect of ingate systems, but he had never had the opportunity of taking photographs. There had been no reference in the Report to the flow of metal where there was pressure applied. Was there any reference to any form of ingate system or flow of metal into moulds where such air pressure was applied.

Mr. Hird said that he could give no information on this matter, but all the points raised in the discussion would be referred to the sub-committee, and should anything come to light, information would certainly be passed on.

Mr. Calledon said that the point which interested him most was the turbulence on the bottom of the mould, which apparently was not visible to the naked eye, but was clear when the film was run at slow speed. It appeared that when casting some of the more "difficult" non-ferrous metals, which they endeavoured to do as tranquilly as possible, there was turbulence taking place which could not be seen.

DR. EVEREST added his congratulations to Mr. Hird and the sub-committee and said this was the first time he had seen the film since the committee stage; it was certainly a very fine effort, and all those concerned with it were to be congratulated. Two points he would like to make were, first on the question of studying the flow by using the hydraulic analogy—this aspect had been considered, and he also knew that it was being considered in the U.S.A. and that it was now recognized on both sides of the Atlantic that both methods could offer something, but that the hydraulic method, using wax, would not give an exact analogy. Dr. Everest said he had seen some of the American films and he thought that this British film was superior. On the second point, "where do we go from here," Dr. Everest said he hoped that the sub-committee would carry the matter a stage further and in due course would produce a Code of Practice.

Metal Composition

THE PRESIDENT said that as Dr. Everest had remarked, films of the type shown had been made before in the States, and he also thought that the British effort compared favourably. It seemed to him that the purpose of the film was to show how cleanly metal could be poured, and how it lay on certain surfaces. He had noticed in the script that one method was designed to run such castings as plates and machine-tool parts. Obviously, these would normally be run in low-phosphorus iron. He would like to have Mr. Hird's observations on whether this would introduce variations.

MR. HIRD said that the metal used was a high-duty iron. He did not know what was the effect of moulding material, as this had not been thought of until the film was made and then it was a little late to do anything about it.

MR. HUNTER referred to the 14 by 12 in. block, and said that obviously this was a quite large casting, and fairly heavy, and any runner system would surely have to take into consideration the question of liquid shrinkage. Had the sub-committee borne this in mind when designing the runner system ?

MR. HIRD replied that they had tried to cover the probable ways that a plate of that sort would be cast, to show what would happen, and one was chosen which was thought to be suitable.

MR. FRANCIS said he had been fortunate enough to see the film for the third time, and it was quite true that new things were noticed each time the film was viewed. One was the way in which the metal, in flowing across the bottom, spread out and receeded again and left bare the sand which had been covered by the metal. It had occurred to him that if a sand had been chosen to show buckles or rat tails, then some idea could have been gained of the way in which they formed. This might be an idea which the sub-committee could bear in mind in future work.

MR. SANDFORD said he had noted that the flow-pattern seemed to be repeated consistently with various moulds, and asked whether this was indeed a fact. Also, with regard to the spoked-wheel, did the metal enter the same spoke under the same conditions each time ?

MR. HIRD said he would not like to be too definite about the spoked-wheel, but the metal generally did show the same pattern. If the film was seen several times, and particular note was made of a certain point, it would be seen that the pattern was the same.

Other Points Observed

MR. WEAVER asked whether there was any regularity in the ramming density of the test moulds.

MR. HIRD answered that they were hand rammed by the same apprentices, but ramming density was not recorded.

DR. KONDIK said that he had learned a great deal from seeing the film and would remember the flow-pattern when trying to get a picture of what happened in a mould during casting.

MR. ASTON made the point that the flow-pattern was shown on the bottom mould surface only, and asked whether the remaining flow-pattern was not also very important. Could not this be obtained when casting aluminium, where oxide fumes could be seen from above?

MR. HIRD said that the time elapsing before a test mould was filled to the top face would be only a matter of seconds duration, but in the case where the metal had run all down one side and left the other side free, then that would be the hotter side of the casting and the oxide on the top of molten aluminium would show a swirl.

MR. TAFT said that if the mould was made face upwards and overloaded with coal-dust, then a very good idea could be obtained of the flow-pattern as the metal neared the top.

At this point Mr. Hunter had regretfully to bring the discussion to a close, as the allotted time had run out. He again thanked Mr. Hird for his presentation of the film, and expressed the thanks of all members for a very interesting discussion.

(*To be continued*)

Iron and Steel Institute

At the twenty-second meeting of the iron and steel engineers' group of the Iron and Steel Institute at 4, Grosvenor Gardens, London, S.W.1, on March 19, the programme will be:—

10.30 a.m. to 12.45 p.m.—"Industrial Electric Furnaces," by J. C. Howard, of the Electric Furnace Company, Limited, and 2.0 p.m. to 4.0 p.m.—"Electric Distribution in Iron and Steel Works: Planning and Operating the Installations at Margam and Abbey Works," by T. B. Rolls, of McLellan & Partners, Limited, and E. C. Slater, of the Steel Company of Wales, Limited. When signifying their intention to attend the meeting, members are asked to send a remittance for their buffet luncheon tickets (price 6s. each) if required.

High-duty Iron. A booklet issued by the International Meehanite Metal Company, Limited, 66, Victoria Street, London, S.W.1, after making a statement about the products, lists the names of the makers of Meehanite in this country, in Europe and in South Africa.

Development of Scottish Industries

Scottish firms are ready to take the opportunity of entering new fields of industry when the means are provided, said Lord Bilsland, President of the Scottish Council (Development and Industry), in Glasgow on February 17 in a statement supplementing the Council's annual appeal for financial support. Lord Bilsland said they would continue their efforts to create new industries and attract suitable capital investments of a permanent character from the United States and elsewhere. He was satisfied that Scotland was getting its fair share of rearmament work. The growth of the electronics industry was along sound and steady lines, and several Scottish firms were collaborating successfully with Ferranti, Limited, Edinburgh, in electronic research and development.

Precision Engineering

A scheme had been formulated to encourage the growth of precision engineering in Scotland, which held a most promising future. There was a substantial local need for design and production of jigs, tools, fixtures, and gauges, and that could not be met by existing facilities. If the project were successful—and he indicated that negotiations were in progress to attract an English firm to establish a design and production unit in Scotland—he believed it would fill a major gap in their industrial structure.

A survey was also being made of the possibilities of expanding the non-ferrous metal industry, which was of ever-growing importance. He mentioned other industries in which developments were being made. A team of scientists from the universities and leading industrialists were working together, and he was very confident of the outcome of their work. Commenting on the efforts to secure a firmer footing in overseas markets, Lord Bilsland alluded to the preparations being made for the Scottish Industries Exhibition to be held in Glasgow next year, and said that already a great many inquiries had been made for space. He anticipated that the show would be as successful as the 1949 exhibition, when orders valued at £10,000,000 were known to have been secured, of which half came from overseas buyers.

British Standards Institution

Revised Standard for Oil-burning Equipment
(*B.S.* 799: 1953)

The British Standards Institution have just issued a revision of B.S. 799, "Oil-burning Equipment." The document was originally published in 1938 and was then confined to fully automatic oil-burning equipment for central heating and hot-water supply suitable for fuel oils conforming to grades A and B of B.S. 742 "Fuel oils for burners." The standard has now been extended to include semi-automatic and hand-controlled equipment suitable for petroleum oils, grades A, B and G of B.S. 742 and coal-tar liquid fuels to B.S. 1469.

The standard applies to oil-burning equipment for boilers, heaters, furnaces, ovens and other similar plant, but it is not intended to apply to marine and mobile installations. Oil-burning plant of each of the main types is employed for many diverse purposes, and it has, therefore, been found impossible to cover all details of every plant. Full descriptions are given of items of equipment required (without sizes), including particulars of storage tanks, fittings, oil pipe-lines, etc. Copies of the standard may be obtained from the Institution's sales branch, at 24, Victoria Street, London, S.W.1; price 10s.

Institute of Metals Awards

The Institute of Metals has awarded the 1952 W. H. A. Robertson Medal and a premium of fifty guineas to Mr. John Francis Waight, engineer, West Midlands Gas Board, for his paper on "Gas Equipment for the Thermal Treatment of Non-ferrous Metals and Alloys." This award is made annually through the generosity of W. H. A. Robertson & Company, Limited, for the encouragement of the writing and publication of papers on engineering aspects of non-ferrous metallurgy. Such papers should be addressed to the secretary of the Institute at 4, Grosvenor Gardens, London, S.W.1.

Essay Competition.—The Institute has made two awards, of ten guineas each, for essays submitted in connection with the Institute's annual students' essay competition. The awards are to Mr. R. D. Stacey, of the University of Birmingham, for an essay "Some Experimental Evidence for Dislocations," and Mr. G. Thomas, B.SC., of Cambridge University, for an essay on "Martensitic Transformations in Non-ferrous Metals and Alloys."

Gamma-ray Equipment for U.S.

A subsidiary of the £5,000,000 Delta Tank and Mining Corporation has acquired the right to manufacture in America, a new gamma-ray operating and storage container designed and made by Gamma Rays, Limited, Foundry Lane, Smethwick. Holding Cobalt "60" isotope of a strength up to three Curies, it is believed to have a much larger capacity than any earlier design. The container, and a smaller 250 milli-Currie model produced by Gamma Rays, Limited, in 1949 is to be made at Baton Rouge, Louisiana. The agreement was suggested to Mr. M. Falk, export manager of Gamma Rays, Limited, during a recent visit to the United States. The new container enables an inch of steel to be penetrated in three minutes, compared with half an hour in the case of its predecessor. The container is a lead ovoid containing the pencil-like metal holder for the isotope. It does not need to be operated in a special room.

Theft of Lighting Bulbs Blamed

A Court of Session jury, sitting with Lord Blades, on February 18 awarded damages of £150 to Robert Allan, bush moulder, in respect of injuries he sustained while employed by the Carron Company. Allan, who claimed £600, said he was struck on the chest by a falling pattern in the company's bush pattern store. He was off his work for nine weeks, having sustained severe bruising of the ribs and shock. Allan maintained it was the employers' duty to have the store reasonably lit and to prohibit the use of the store to persons other than him. The company knew, he said, that their failure to prevent other people coming into the store resulted in the electric light bulbs being stolen. The defenders, denying liability, said the accident was caused by Allan failing to take reasonable precautions for his own safety. The jury assessed damages at £200, and held that Allan was 25 per cent. to blame for the accident.

THE DISTINGTON ENGINEERING COMPANY, LIMITED, Workington, is to spend another £60,000 on new machine tools to meet increased demands for the firm's products. Recent orders include 100 mine cars and shaker conveyor troughing for Scottish mines.

"Pinholing" and "Boiling" in Enamelled Light-iron Castings

*By E. Holland**

The reasons for the high percentage of rejects which occur in the enamelling of light iron castings have been sought for many years. This work records a trial-and-error approach which has been made in the foundry itself towards finding a practical solution to the problems and sets out the knowledge and information gained to date.

It is intended to deal only with two of the most complex problems, the one "pinholing" of castings and the other "boiling" or "blistering" of castings during enamelling. At times, for no apparent reason, castings normally perfect are produced which, when shot-blasted, are full of pinholes or when enamelled show blisters. Only a percentage from the same cast may be affected. These facts suggested that the problems should be investigated with an open mind, neglecting the various theories so far put forward to account for the troubles, in spite of which they were still unsolved.

"PINHOLING"

The pinholes, Fig. 1, appeared under the top skin of apparently perfect castings, but only after the top layer of the cast iron had been broken during the impact of shot-blasting. Statistics suggested that the defect was more prevalent in winter than in summer, and it was strongly suspected that hydrogen pick-up was taking place in the cupola melting of the iron. Nothing practical could be done to eliminate this hydrogen and work was therefore concentrated on that which could be done in the foundry itself.

* The Author is attached to R. & A. Main, Limited. Edmonton.

Immediately, several mystifying points arose; why did not all castings from the same bogie of metal show the defect; why was it more prevalent in some types of castings than in others? The moisture content of the sand was checked over a period of four weeks, using one moulder's work as the "guinea pig," but pinholing occurred both when moisture was running at 6 per cent., as well as at 8 per cent. Mould hardness was checked and readings from 35 to 45 were obtained; deliberate ramming to 50 degrees of mould hardness or yet again to 30, still gave about the same percentage of rejects. Variation in the make-up and addition of new sand gave no clue, the general shop facing sand being composed of 40 per cent. Bromsgrove red, 60 per cent. old sand, and 5 per cent. coal-dust. Facing sand made up from 30 per cent. Bromsgove, 10 per cent. Erith medium, 60 per cent old sand and 5 per cent. coal-dust showed no improvement.

On checking the types of castings more prone to pinholes, it was found that they were all run from the ends (Fig. 2). As can be seen, the metal had to cascade downwards and change direction, this caused turbulence in the mould and appeared to release gas that presumably became trapped under the top skin of the casting. Dissolved gas

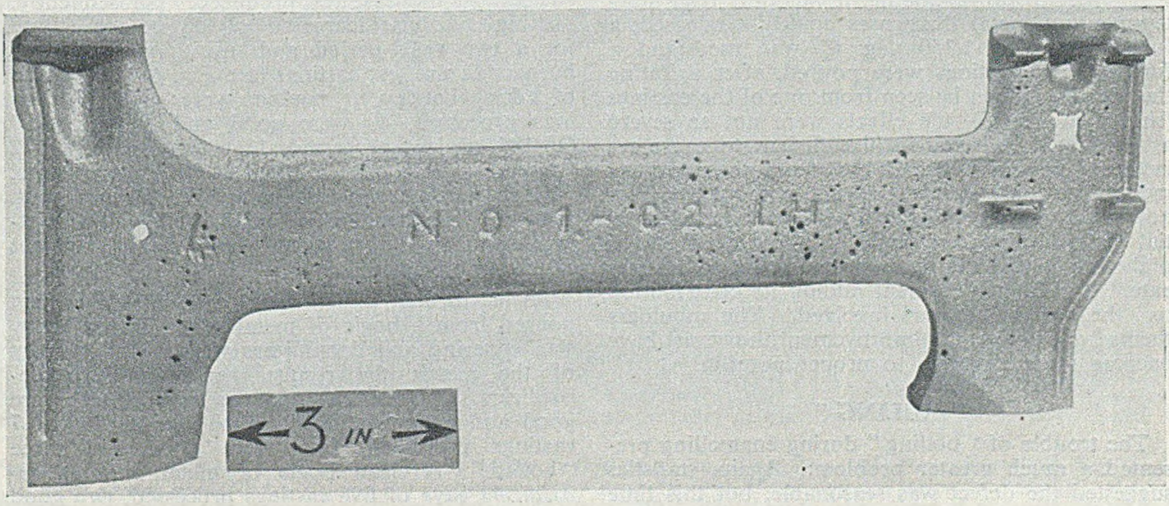


FIG. 1.—*Example of an Enamelled Casting showing the Pinhole Defect.*

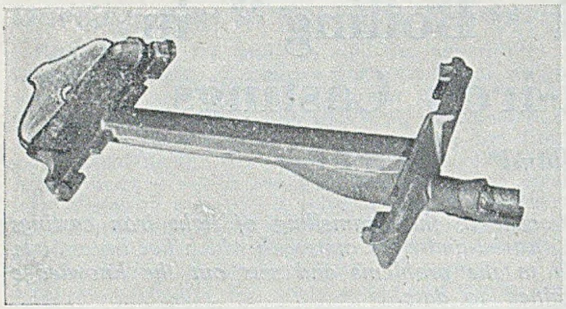


FIG. 2.—*Cooker Burner Casting run from the End (Metal Turbulence was caused).*

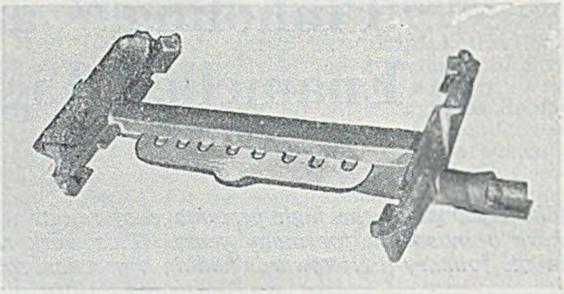


FIG. 3.—*Same Casting as in Fig. 2 with the Runner changed to a Centre Spray to obviate Turbulence.*

in the iron, it was conjectured, was given off at the moment of solidification and rose to the top surface of the casting, which by that time had solidified. Accordingly, to change the direction of flow, runners were moved to the position shown in Fig. 3, resulting in a marked decrease in the percentage of rejects.

Agitation Effects

It was then decided to investigate further the percentage that were still defective, despite their being produced using runners that did not give turbulence. From a ladle of metal at a temperature of 1,350 deg. C., one casting was poured; the temperature was then allowed to fall to 1,250 deg. and a second and similar casting was poured; immediately after this, the remaining metal was violently agitated and a third casting was poured. The casting poured first was perfect, the second had very slight pinholes, the third was one mass of holes. These examples are shown in Fig. 4. There were only a few degrees temperature drop between pouring the second and third castings, so that did not seem to account for the marked difference in the results.

In order to prove whether it was only from low-temperature metal that gases could be released, a further ladle at 1,350 deg. C. was used and a further three castings were poured, after agitating the metal. As can be seen from one of the castings (shown in Fig. 5), the effects were not so severe as previously, but were still sufficient to cause rejection. The inference drawn from these experiments was that steady pouring without swilling, hot metal and smooth-flowing runners were essential for soundness. Despite all these precautions, pinholing still occurs in the foundry but to a lesser extent, the human element adding its contribution to the variable factors involved. The moulders themselves, noting the improvement, however, have become more attentive to proper pouring.

"BOILING"

The trouble of "boiling" during enamelling presented a much greater problem. Again, statistics suggested the defect was seasonable, but this time was more prevalent in summer than in winter. No foundry cause could be found to account for this seasonable effect. Among various theories checked, investigation showed the question of composition was not the main consideration. The incidence of "boiling" seemed to have no relation to composition, providing the silicon content of the casting was above 2.3 per cent., and sulphur below 0.14 per cent., although it was suggested that iron of a high carbon-equivalent value could aggravate the conditions.

Melting Experiments

The cupola used for melting was 3 ft. 6 in. dia. at the melting zone, had six tuyeres, 10 by 7 in., and a syphon-brick tap-hole. The charges of 8 cwt. each were made up from 3½ cwt. of pig-iron, 3½ cwt. of light shop-scrap, 1 cwt. of bought-in scrap, 84 lb. of coke, and 24 lb. of limestone. Ample melting capacity was available, as the maximum demand was for 3½ tons per hour. It was thought that "oxidized" metal might possibly be a cause of the defective castings, so, ignoring theoretically correct values, the blast supply to the cupola was steadily reduced until the amount of metal melted was only just meeting the foundry's requirements, but still "boiling" persisted on enamelling the castings produced. Subsequently, melting coke was increased to 100 lb. per charge for a two-week period and, using one series of burners as the test castings (see Fig. 6), the results of taking batches at random were:—Of 79 castings processed, 40 were good and 39 "boiled." Of 185 castings processed, 13 were good and 172 "boiled." With coke reduced to 84 lb. per charge, various batches showed from 3 to 60 per cent. rejects. The standard of inspection on these castings was high, a very slight "boil" being sufficient cause for rejection.

As a further experiment, castings were next poured from a bogie of metal which had a heavy slag covering and deoxidizers were added to part of the metal; the results were:—*Without* deoxidizers, of four castings processed, four were good and none "boiled." *With deoxidizers*, of 7 castings processed, four were good and three "boiled." A clean bogie of metal *without deoxidizers* gave of five castings processed, two good and three "boiled." Metal from the same bogie *with deoxidizers* gave from six castings processed, five good and one "boiled." These results, again, were inconclusive. Photomicrographs of the metal (see Fig. 6 (B) and (C) show no apparent oxide inclusion; the analysis of this sample showed (per cent.) total carbon 3.18, silicon 2.64, sulphur 0.130, phosphorus 1.51, and manganese 0.56 per cent. In this, the only questionable factor was the phosphorus at 1.51 per cent., but observation of casting rejects when the phosphorus content was running at 1.05 per cent., showed no improvement.

Metal Removal

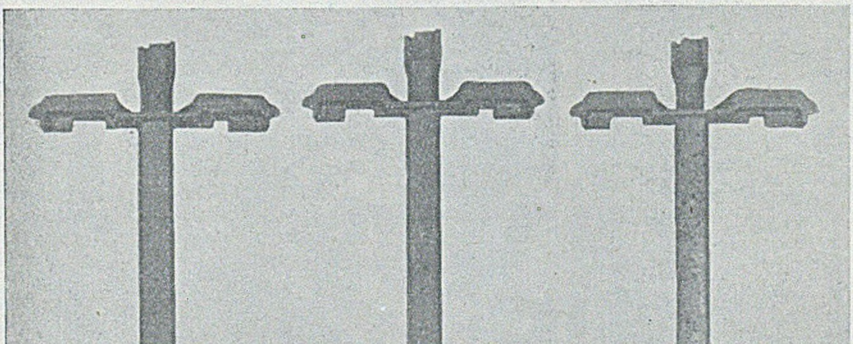
It was next considered that to remove some of the metal thickness of a casting in the region where it was prone to "boil" might help. As this could not be done on the pattern in question without spoiling it, it was decided to remove $\frac{1}{16}$ in.—by grinding—from part of the area where defects were found. The results were that there was no "boil" where the casting was ground, but beyond this area the defect appeared. This result was promising, but it was necessary to decide how much metal it was needed to remove. Other castings were treated by removing successively 0.002 and 0.005 in.—in each case this stopped "boiling." A batch of 12 castings gave 100 per cent. good on enamelling and a further batch of 100 gave 92 good and eight showing "boil." The maximum amount skimmed from any of these castings was 0.005 in. Although shot-blasting was a standard process for all castings, using 16 and 14 grade shot at 75 lb. pressure, or by Wheelabrator cleaning using the same shot, this blasting did not seem to have any helpful effect in reducing "boiling," possibly because of the peening action of the shot which disturbed the surface upon itself without removing any appreciable amount of metal.

From the above it now seemed obvious that metal composition had very little effect, accounting for only a few per cent. of rejects due to "boiling" and that surface phenomena were the main cause. Attention was therefore turned to the moulding sand as the only obvious source of contamination. Possible migration of any constituents in the iron, particularly of gases, was rejected, as "boiling" was more prevalent on the drag side of the castings. It could not be conceived that any form of migration could persist with an average proportion of the casting of 3 to 1 in the drag as compared with the cope. One theory put forward was that slower cooling in the cope could allow gases to escape better. This too was rejected, as it did not account for the fact that removal of 0.002 in. of the skin removed the trouble.

Other Lines of Investigation

Continuing the investigation, facing sand, using only new Bromsgrove red sand, was deliberately contaminated to see if pick-up of any kind could be induced. Two per cent. of sulphur was added and the results with the castings were 100 per cent. "boiled." New Bromsgrove sand without the sulphur used for moulds poured from the same bogie of metal, gave no "boil." This seemed to prove that pick-up was taking place by contamination with some elements in the sand. The precise nature of this element was uncertain, although the sulphur addition showed a possible cause.

The effect of coal-dust in the moulding sand was studied, for this seemed the only means of contaminating the sand, other than escaping gases from the iron. It was found that a perfect combustion of the coal-dust took place immediately adjacent to the casting and to a depth depending on the thickness of the casting and the pouring



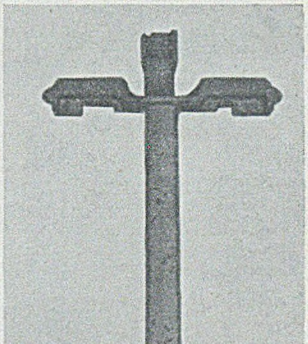


FIG. 4.—*Burner Castings made experimentally in the Investigation into Pinholing. (A) Poured at 1,350 deg. C.; (B) poured at 1,250 deg. C., and (C) cast immediately after (B) but Metal agitated prior to Pouring.*

FIG. 5.—*One of Three Burner Castings poured at 1,350 deg. C. with Metal which had been agitated. Pinholing was evident, but to a slightly less extent than previously.*

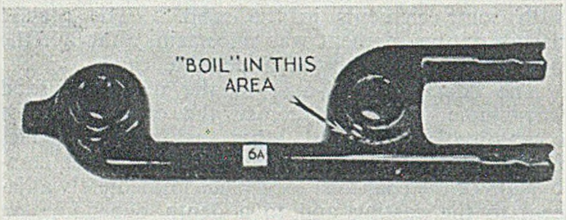
"*Pinholing*" *and* "*Boiling*"

temperature. Beyond this, imperfect combustion took place to a variable degree. The surrounding sand grains, after a few casts, became coated with soot and it seemed they became a "scrubbing" agent to these unburnt or partially burnt gases. To investigate the effects of this, special patterns were made $1\frac{1}{8}$ in. dia. by 12 in. long. These patterns were numbered for each 2 in. length of pattern. A metal template was placed over these numbers in turn in a mould made from the patterns and was filled with varying percentages of "doctored" sand. The first 2 in. received Bromsgrove red sand only, each succeeding 2 in. received Bromsgrove sand and 10, 8, 6, 4 and 2 per cent. of soot. The resulting castings showed no "boil" at 0, violent "boiling" at 10, 8, 6, and 4, with only a slight "boil" at position 2. The experiment was repeated using the same percentages of, alternatively, sulphur, carbon and graphite. Sulphur gave "boiling" with as low as 2 per cent. addition increasing with each addition, while the carbon and graphite did not show any more "boil" with 10 per cent. than with 4 per cent. addition and no defect at 2 per cent. Wedge test-pieces 12 by $1\frac{1}{8}$ by $1\frac{1}{8}$ in. at one end, tapering to $1\frac{1}{8}$ by $\frac{1}{8}$ in. at the other, cast from the same ladle of metal using 5 per cent. sulphur, 5 per cent. soot and 5 per cent. carbon, respectively, in the facing sand, are shown in Fig. 7 (A), (B) and (C). It will be noted that 7 (A) (sulphur) "boiled" for 9 in., 7 (B) (soot) "boiled" for $6\frac{1}{2}$ in. and 7 (C) (carbon) showed a fine "boil" for 5 in.

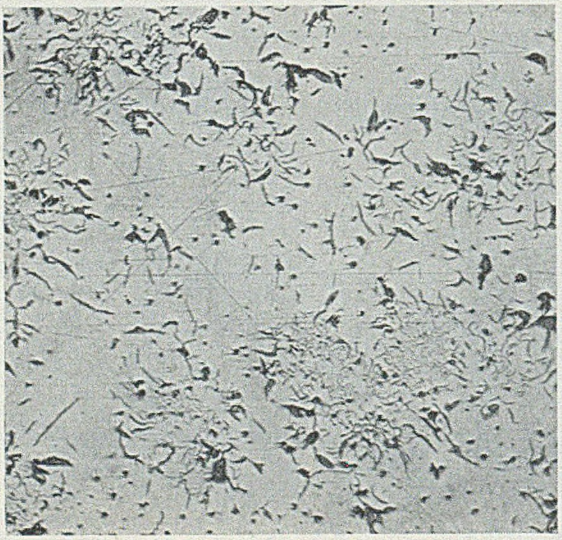
One feature that was still puzzling with regard to the burner casting was why it was only a percentage of castings that "boiled". The fact had already been established that sand grains became sooted by contact with coal gases, so these conditions were created artificially by adding soot to Bromsgrove sand. Using a 5 per cent. addition of soot on the wedge pattern in the drag mould-part only, and using new sand for the cope, three castings were poured from one ladle of metal at 1,300, 1,200 and 1,150 deg. C. respectively. The results were as follows:—

Soot per cent.	Sand.	Temp. of casting, deg. C.	Length of "boil." in.	Type of "boil."
5	Bromsgrove ..	1,300	6	Medium.
5	Bromsgrove ..	1,200	4	Medium.
5	Bromsgrove ..	1,150	3	Medium.

A further experiment was undertaken to see at what temperatures contamination was picked up. Three wedge-test sample castings were poured from one ladle of metal, a thermocouple being inserted in the thick end of the mould cavity $\frac{1}{2}$ in. from the end. One casting was taken out of the mould and brushed free from sand while at 950 deg. C., the second was removed at 900 deg. C., and the third at 850 deg. C. The results (see Fig. 8) after enamelling showed:—



(A)



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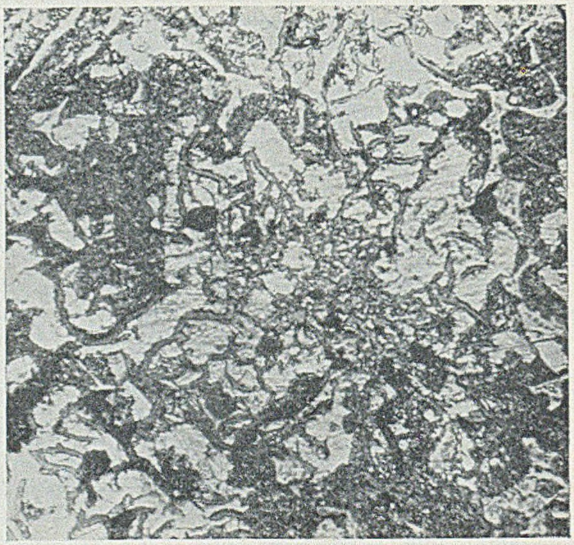

(C)

FIG. 6 (*A*).—*Black Vitreous-enamelled Burner Test Casting, showing the "Boiling" Defect at the Position Indicated.* FIG. 6 (*B*) *and* (*C*).—*Photomicrographs of the Metal Structure of Experimental Burner Castings.* (*B*) *Unetched* ×100 *mags.;* (*C*) *etched* ×300 *mags. There is no evidence of "Oxidation."*

Soot addition to sand (per cent.).	Sand.	Temp. of removal from mould, deg. C.	" Boil," in.	Type of " boil."
5	Bromsgrove ..	950	2	Very slight.
5	Bromsgrove ..	900	6	Medium.
5	Bromsgrove ..	850	6	Medium.

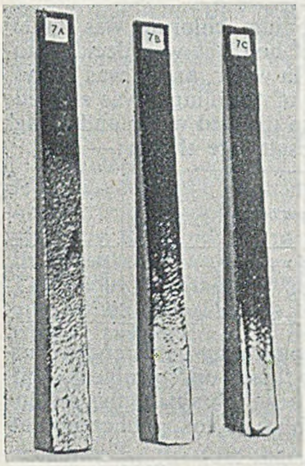

FIG. 7.—*Wedge Test Castings, 12 by $1\frac{1}{8}$ in., tapering from $1\frac{1}{8}$ in. to $\frac{1}{8}$ in. after Black Enamelling. For the Facing Sands, (A) Sulphur, (B) Soot, and (C) Carbon. 5 p.c. additions were made.*

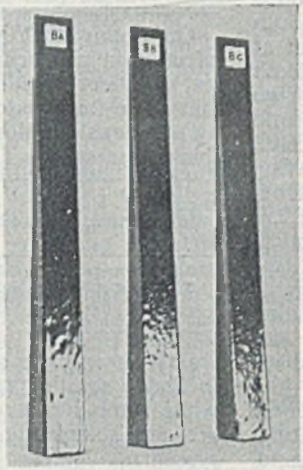

FIG. 8.—*Wedge Test Castings poured in Facing Sand containing Soot, and taken from the mould at various temperatures.* (A) 950, (B) 900, *and* (C) 850 *deg. C., and subsequently Enamelled.*

This test goes some way to suggest that little pick-up of gas takes place above 950 or below 850 deg. C.; this evidently being the critical range.

Interim Findings

These results gave a possible reason why some castings " boiled " and others did not, *i.e.*, that the temperature of pouring had greatly influenced the amount of pick-up, as also had the rate of cooling. The length of time the casting remained within the critical range represented the amount of possible pick-up, dependent also on the degree of contamination of the sand or to what extent the grains had been soot coated. This explanation also accounted for thick sections being more prone to " boiling," as the sand would be heated to a greater degree at this point and would cool more slowly.

The phenomenon of castings being more prevalent to " boiling " in the drag-part becomes understandable after analyzing the above results, as during cooling there is a measure of contraction of the casting away from the cope-part of the mould which starts before the critical range, but contact is continuous on the drag-part surface, by reason of the casting's own weight. The precise element causing the trouble was not positively identified at this stage, possibly it was sulphur, although other elements were not ruled out. A series of experiments was undertaken to see the reactions of other elements on the surface of the castings.

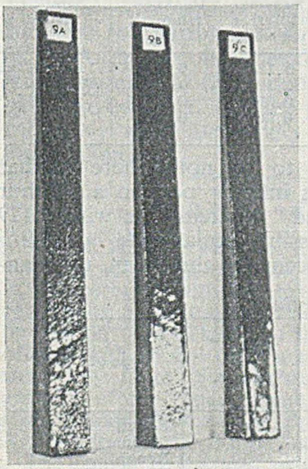

FIG. 9.—*Enamelled Wedge Test Castings for which (A) 0.8 per cent. Sulphuric Acid, (B) 0.4 per cent. Sulphuric Acid, and (C) Sulphur 0.5 per cent. was added to the Sand. Varying Degrees of " Boil " are apparent, (A) being worst in this respect.*

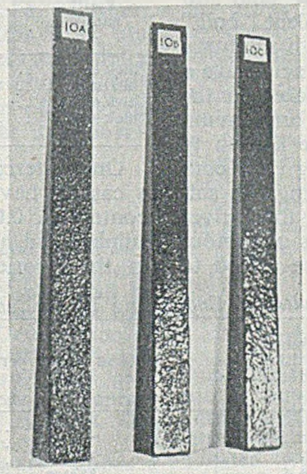

FIG. 10.—*Test Castings for which (A) 1.5 per cent. Ammonium Sulphate (B) 0.5 per cent. Ammonium Sulphate, and (C) 1.5 per cent. Ammonium Chloride were added to the Sand. "Boiling" resulted, (A) again being worst.*

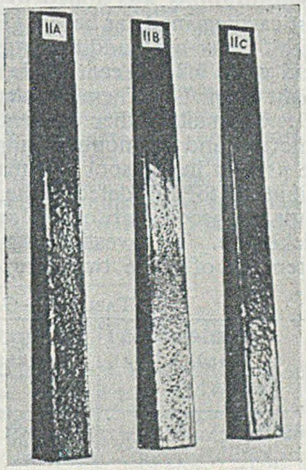

FIG. 11.—*Test Castings made in Facing Sand contaminated with (A) 5 per cent. Soot and Skin-dried; (B) Synthetic Sand with $2\frac{1}{2}$ per cent. Water and 5 per cent. Soot, and (C) Bromsgrove Sand with 5 per cent. each of Water and Soot.*

"Pinholing" and "Boiling"

Effect of Carbon Monoxide

It was considered that carbon monoxide produced by reaction between the soot carbon and the moisture in the sand at elevated temperatures was one possible source of the trouble. In this connection, two moulds were made from Bromsgrove sand containing 5 per cent. of soot and both were skin dried. One was poured with metal at 1,350 deg. C. and the other at 1,250 deg. C. Both castings "boiled" violently when enamelled. Two further moulds were made with a synthetic sand made up from Erith sand with Albond 8 per cent., water 2½ per cent. and soot 5 per cent., and having a permeability of 95. These were also poured from the same ladle of metal at 1,350 deg. C. and 1,250 deg. C. respectively. These "boiled" in identical fashion to the skin-dried moulded castings (see Fig. 11). Low moisture, it is conjectured, aggravated the pick-up owing to its lack of chilling power; the carbon monoxide content was low because of this low moisture and gases could escape more easily with a permeability of 95 (the Bromsgrove sand having a permeability 42). These experiments further reinforce the idea of a blotting-paper type of pick-up in the iron from the sand.

Effect of Sulphuric Acid and Sulphates

On studying the mechanics of the possible reactions taking place, it was thought that sulphuric acids might be formed in the sand by reaction between FeS and H_2O, or that the chlorides in the soot may be reacting to form hydrochloric acid. To test the effects of these, sulphuric acid in various concentrations was added to Bromsgrove sand and test castings made as before (Fig. 9). Violent "boil" with 0.8 per cent. addition was found with sulphuric acid while 1.2 per cent. of hydrochloric acid gave a slight "boil." These results are tabulated in the general results. Other elements, notably ammonium chloride and ammonium sulphate, were known to be present in the soot and maybe adding their contribution to this defect either by assisting the sulphur to become absorbed or by being themselves picked-up. To investigate this, solutions of various strengths of these two compounds were added to the water used in wetting the sand. Some of the results are tabulated below (see also Fig. 10):—

Sand.	Addition per cent.	Inches of "boil."	Type of "boil."
Bromsgrove . .	Ammonium sulphate 1.5	12	Very rough.
Bromsgrove . .	,, ,, 0.5	10	Very rough.
Bromsgrove . .	Ammonium chloride 1.5	8	Very rough.

On noting that ammonium chloride was quite effective in producing a "boil," it was decided to test the effect of chloride in water, and it was found that some further degree of "boiling" was created by additions of chlorine to distilled water and using this in the sand. The results are shown:—

Soot per cent.	Sand.	Addition, per cent.	Inches of "boil."	Type of "boil."
5	Bromsgrove	6.0 distilled water . .	6	Medium.
5	Bromsgrove	6.0 distilled water + 0.01 chlorine	7	Rough.

Experiments are still continuing in an endeavour to find a solution to this "pick-up" problem, and while some success has been obtained, the results are not sufficiently established for publication at present.

A series of wedge test-bars were filed, so as to remove a maximum of 0.003 in. of metal, and these were then enamelled and analysed. The results (tabulated below) show that there is definitely a pick-up of sulphur in the skin of the bars and even if this is only 0.029 per cent. it induces "boiling" whereas when the pick-up is but 0.014 per cent. the casting does not "boil":—

Position sampled.	Sulphur in skin, per cent.	Sulphur in interior per cent.	Metal thickness removed, in.	Enamelling result.
Thick end . .	0.153	0.124	0.003	"Boiled."
Thin end . .	0.143	0.129	0.003	No "boil."
Thick end . .	0.116	0.073	0.003	"Boiled."
Thick end . .	0.210	0.066	0.001	"Boiled."

One interesting fact to be noted here is that a casting having for its interior portion a sulphur content of 0.066 "boiled" whereas one with 0.129 sulphur did not. A possible explanation is sulphur in the interior may occur in the form of man-

TABLE I.—*General Results on Enamelling Wedge-type Test Castings.*

Sand.	Soot, addition per cent.	Sulphur, addition per cent.	Wetting agent, per cent.		"Boil" in inches.	Type of "boil."
Bromsgrove	5.0	—	6.0	Water	6	Rough
,, ...	2.0	—	6.0	Water	6	Medium
,, ...	—	5.0	6.0	Water	10	Rough
,, ...	—	0.5	6.0	Water	7	Very rough
,, ...	—	0.1	6.0	Water	5	Medium
,, ...	—	0.05	6.0	Water	4	Fine
,, ...	—	—	0.12	Hydrochloric acid	3	Fine
,, ...	—	—	0.8	Sulphuric acid . .	12	Very rough
,, ...	—	—	0.6	,, ,, . .	6	Rough
,, ...	—	—	0.4	,, ,, . .	4	Rough
,, ...	—	—	0.15	,, ,, . .	4	Medium
Mechanized plant . .	—	—	6.0	Water	5	Rough
,, ,, . .	—	—	0.8	Sodium hydroxide . .	2	Medium
,, ,, . .	—	—	0.4	,, ,, . .	3	Medium
Floor moulding . .	—	—	6.0	Water	5	Very fine
,, ,, . .	—	—	0.4	Sodium hydroxide . .	None	—

ganese sulphide and the sulphur picked-up may be as ferrous sulphide. To obtain the results recorded, two castings were made for each sample. One was filed and the other enamelled direct as a control. Another point of interest is that the casting with a higher interior content of sulphur did not pick-up as much as one with a lower interior sulphur content. This, it is conjectured, may be accounted for by the saturation point of sulphur affecting the rate of pick-up. Some other general results obtained enamelled on wedge-type test castings were as shown in Table I.

Conclusion

The general summing up, which might be interpreted from the experiments described as well as others, is that sooting-up of the sand grains takes place by the sand acting as a scrubbing agent on the smoke created by partially-burnt coal-dust. This soot, containing ammonium sulphate and ammonium chloride, reacts with the surface of the iron at temperatures of between 950 and 850 deg. C. The pick-up that takes place is quite probably in the nature of ferrous sulphide and (with no manganese present) reacts with enamels to create "boiling." Slow cooling worsens the pick-up, as is shown by the fact that thick sections are always more prevalent to "boiling."

The general depth of pick-up is about 0.002 in. and its effects can be removed by filing or grinding off this amount of metal from the surface. Shot-blasting does not appear to remove this deleterious layer, probably because the ferrous sulphide is harder than the surrounding matrix and may become embedded in the casting surface, only the softer matrix being removed.

Acknowledgment is recorded to R. & A. Main, Limited, for permission to publish this work and to the Author's colleagues for their help and advice. It is realized that there remains much confirmatory work to be done, but the publication of these results may stimulate others to emulate the general lines taken.

Institute of Physics

The H. H. Wills Physical Laboratory and the department of adult education of the University of Bristol, in co-operation with the Institute of Physics, will be conducting a short summer school followed by a conference on "The Theory of the Plastic Deformation of Metals, with special reference to creep and to fatigue" from July 13 to 16 in Bristol. The provisional programme of the course which will precede the conference includes lectures by Professor N. F. Mott, Dr. A. J. Forty and Dr. F. C. Frank.

The course is intended mainly for research students at universities and for members of the staffs of government and industrial laboratories. The fee for the school (on July 13 and 14) is £1 10s.; but there will be no fee for the conference. Further particulars can be obtained from the secretary of the Institute of Physics, 47, Belgrave Square, London, S.W.1.

BRITON FERRY STEEL COMPANY, LIMITED—Mr. Arthur G. Gilbertson, manager and a director of Brown, Lenox & Company, Limited, has been appointed to the board.

Institute of Vitreous Enamellers Awards

The Institute of Vitreous Enamellers has announced the fifth competition for the Whittle silver medal and the inauguration of the A. Biddulph award. The former is intended to encourage junior chemists and other technicians in the enamelling industry to put their ideas into the form of a written paper and the A. Biddulph award is intended for persons who have no access to laboratory facilities and will be assessed on a written contribution or by interview with a panel from the Institute's technical committee to discuss a subject of their own choosing. Conditions of the awards are as follow:—

Whittle Silver Medal and Cash Prizes.—The subject for the fifth competition will be "One-coat White Enamels." The paper should be from 3,000 to 5,000 words, with the necessary illustrations, and must, of course, be written entirely by the competitor, although experimental work done by others can be referred to with due acknowledgment. Care must be taken to see that information given in the paper is not confidential, and competitors are advised to submit their papers to their company for approval before sending them in for consideration. The competition is intended for junior staff, 30 years of age or under, but where a competitor has been on National Service or away from the industry on war service of any kind, and this is stated in a covering letter, the time on such service will be subtracted from his actual age and taken into consideration by the Assessors. All papers must be submitted by June 30, 1953.

A. Biddulph Award.—Persons wishing to present a paper for this competition are advised to consult the notes for the guidance of authors; those wishing to meet the adjudicating panel to discuss a subject of their own choosing should write to the secretaries of the Institute, who will arrange an interview. As with the Whittle award, care should be taken that information given is not confidential and entrants are advised to obtain their companies' approval before either submitting a paper or attending an interview. Papers must be submitted to the secretaries not later than June 30, 1953, and those wishing to attend an interview should communicate with the secretaries as soon as possible in order that a date can be arranged. Entrants must furnish themselves with evidence that they have no access to laboratory facilities.

Notes for the Guidance of Authors may be obtained on application to the I.V.E. secretaries, John Gardom & Company, Ripley, Derbyshire.

Indian Institute of Technology

Among the twelve Midland and Northern firms who are to supply machine tools worth £35,000 to the Indian Institute of Technology at Kharagpur are the two Yorkshire firms of Butler Machine Tool Company, Limited, Westholme Road, Mile Thorn, Halifax, and Dean, Smith & Grace, Limited, lathe manufacturers, Keighley. Mr. Frank Walker, an assistant tool-room foreman with Rolls-Royce, Limited, Derby, has been given a two-year appointment at the Indian Institute of Technology, where he will supervize the installation of new equipment, and will train Indian technicians in the use of the new machines. The Institute is the first of four new technical colleges to be established to provide four-year courses in civil, mechanical and electrical engineering.

Heavy Burden of Taxation

Abolition of the excess profits levy and the profits tax, a reduction in the standard rate of income tax, and the extension of the earned income allowance to the higher ranges of income are among the suggestions for the granting of tax relief included in the representations on Budget policy which the Federation of British Industries has submitted to the Chancellor of the Exchequer.

In the statement accompanying these representations which was published last week, the F.B.I. says that while important remedial measures of a first-aid character have been taken by the Government, the condition of the British economy remains precarious. The primary object of further measures should be to reduce costs and increase productivity to improve the competitive ability of British industry in overseas markets.

Speaking at the annual meeting of the Midland Area of the National Union of Manufacturers, Sir Leonard Browett, director of the N.U.M., said that the remedial policies of the Government plus heavy taxation had created a burden under which industry was staggering. Industrial capital was being drained away and plant was not being allowed to be kept up to date and efficient.

Iron-ore Imports

The appended table shows the tonnage and value of iron-ore imports in January, 1953, and gives comparative figures for the corresponding month in 1952.

Country of origin.	Month ended January 31.		Month ended January 31.	
	1952.	1953.	1952.	1953.
	Tons.	Tons.	£	£
Sierra Leone	45,440	32,428	222.885	181,484
Canada..	28,380	53,600	155,631	223,263
Other Commonwealth countries and the Irish Republic ..	2,270	969	4,540	3,284
Sweden	317,414	193,264	1,499,853	1,178,063
Netherlands	550	930	1,770	3.143
France..	25,822	46,109	88,004	167,474
Spain	54,978	39,213	286,780	214,131
Algeria	170.670	152,486	1,017,051	948.074
Tunis	42,330	46,570	237,818	279,616
Spanish ports in North Africa	19,600	5,000	136,061	46,900
Brazil	—	8,953	—	82.970
Other foreign countries	36,795	93,867	189,115	620,928
TOTAL	744,249	673,989	3,839,508	3,949,330

Latest Foundry Statistics

According to the Bulletin of the British Iron and Steel Federation for January, employment in the iron-foundries had a further set back in December. It stood at 151,688 as against 152,680 in 1951, and showed a reduction of 443 since November, 1952. The steel foundries show an entirely different picture, with employment standing at 20,727 as against 19,779 in 1951. The gain over the November figures was 39. The average weekly output of liquid steel for castings during December was 10,300 tons of which 2,500 tons contained alloys. The corresponding figures for December, 1951, and November, 1952, were 9.500 and 11,700 tons and 2,220 and 2,920 tons. During the first 11 months the average weekly make of actual steel castings was 5,700. Multiplying this by 52 gives 296,400 tons. In 1951 it was 250,500 tons.

Hadfields' Profits Jump

Hadfields, Limited, and its associated steel companies in Sheffield and abroad return a net profit for the 52 weeks ended September 27, 1952, of £507,783, nearly four times the 1951 figure of £130,806.

In a statement which accompanies the annual report and balance sheet, the chairman, Lord Dudley Gordon, says that full use was made during the year of the additional facilities which became available under the 1946 development programme. The aim was to increase output and efficiency, and to do it with the same labour force, rather than merely to maintain output with a smaller force.

The year reviewed was the first full year of nationalization for Hadfields, Limited. Lord Dudley claims that with the full year's working of the new heavy forge, the firm has become the premier European maker and major supplier to continuous mills in Great Britain of fully hardened forged steel rolls.

Largest Blast Furnace

In the last ten years, 20 blast furnaces have been ordered from the Stockton firm of Ashmore, Benson, Pease & Company, Limited. The most recent order, which will be for the largest blast furnace ever built anywhere in the world, was booked by them last week for the Steel Company of Wales. A decade ago, no-one would have believed that so large a furnace would be built outside the U.S.A., where the total output of iron is about five times that of this country. That the industry is prepared to embark upon the construction of a modern furnace of such great dimensions is a tribute to those responsible for the iron and steel industry and provides ample evidence of the courage of its leaders.

Foundry Equipment and Supplies Association.—At a Council meeting of this Association held recently with Mr. Frank Webster presiding, the question of providing plant for the National Foundry College was discussed. Some interesting offers were announced, as well as a number of donations. Reports were given from the convenors of the heating and ventilating and the ventilation (pedestal grinders) committees.

Relaxation of Nickel Control.—The Board of Trade and the Ministry of Supply relaxed, as from February 26, restrictions on the use of nickel under the Nickel Prohibited Uses Orders, 1951, in the case of certain articles, including motor car parts, hospital equipment, table hollow-ware, and some stationers' sundries. Owing to the needs of the defence programme it is still necessary to maintain existing controls over the use of nickel in the manufacture of most goods. The position is, however, being kept under review.

Spare Parts for Brazil.—The provision of spare parts for U.K. machinery and equipment in use in Brazil presents a special problem which calls for action in spite of the present and continuing serious shortage of sterling in that market. Accordingly, without prejudice to the question of general cover for trade with Brazil, the Government's Export Credits Guarantee Department has been authorized, as an exceptional measure, to provide a special and limited type of guarantee for the export to Brazil of spare parts necessary to maintain in working order machinery, apparatus and equipment of U.K. origin. All queries regarding these special facilities should be referred in the first place to the nearest office of the Export Credits Guarantee Department of the Board of Trade.

Matching the machine and the need

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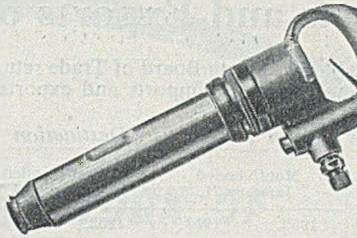

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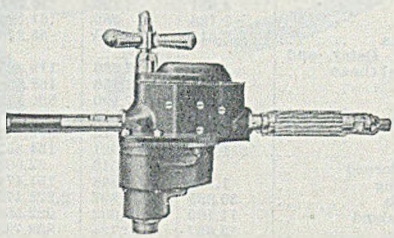

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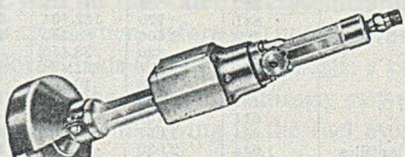

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Imports and Exports of Iron and Steel in January

The following tables, based on Board of Trade returns, give the tonnage and value of imports and exports of iron and steel in January, 1953. Figures for the same month in 1952 are given for comparison.

Total Exports of Iron and Steel by Destination

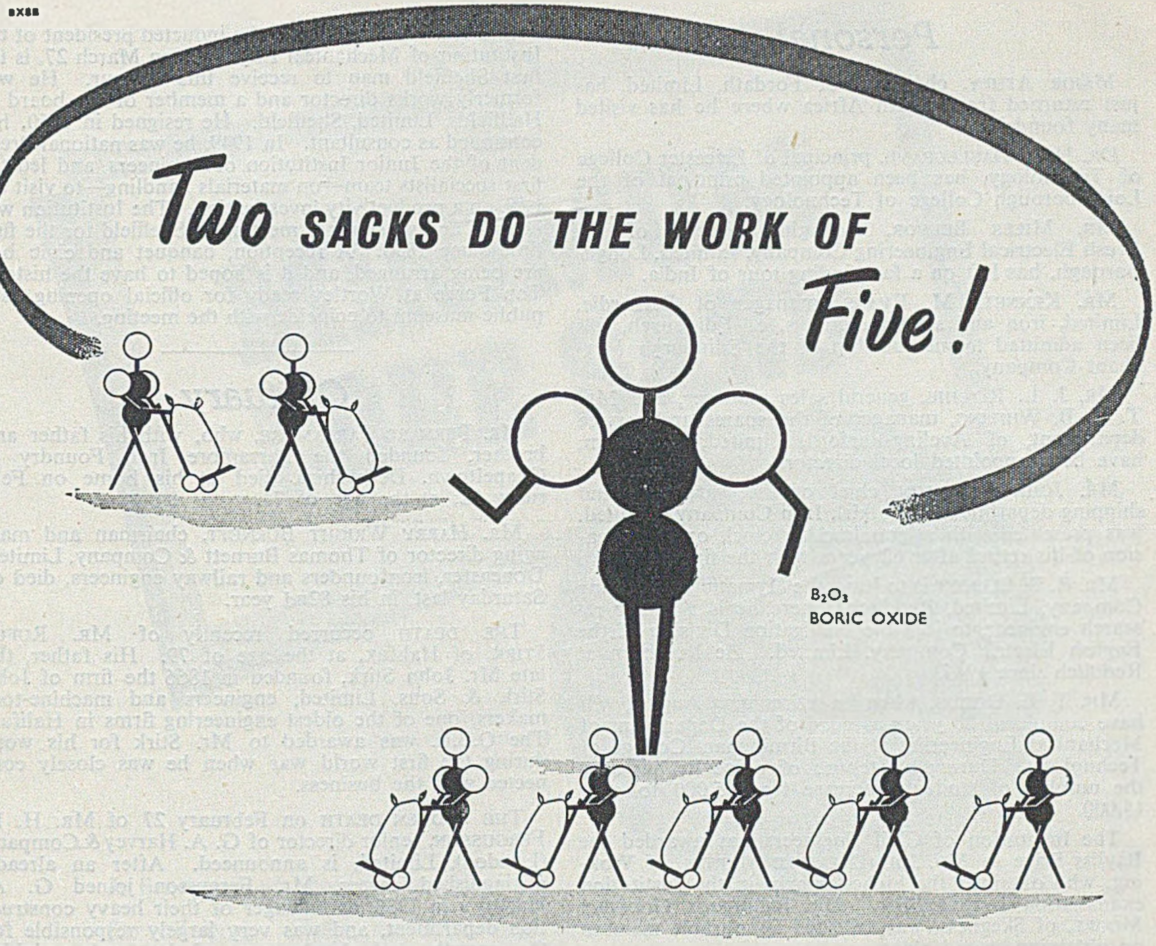
Destination.	Month ended January 31. 1952.	Month ended January 31. 1953.	Month ended January 31. 1952.	Month ended January 31. 1953.
	Tons.	Tons.	£	£
Channel Islands	635	711	55,724	63,754
Gibraltar	55	508	8,743	32,595
Malta and Gozo	224	388	26,950	27,326
Cyprus	139	1,935	12,550	128,748
Sierra Leone	412	418	43,509	48,213
Gold Coast	4,365	4,382	269,188	332,415
Nigeria	3,502	5,511	294,630	470,395
Union of South Africa	11,023	16,186	983,669	1,228,306
Northern Rhodesia	2,323	3,043	169,373	223,443
Southern Rhodesia	5,162	5,904	347,316	411,587
Tanganyika	2,310	2,220	174,885	162,984
Kenya	4,881	8,329	319,781	551,728
Uganda	1,128	759	61,324	65,201
Mauritius	615	948	55,295	73,490
Bahrein, Qatar, and Trucial Oman	1,573	3,386	119,495	259,217
Kuwait	2,675	2,256	168,668	319,845
India	5,935	7,190	596,117	656,225
Pakistan	4,898	6,224	350,115	450,008
Malaya	8,148	6,015	599,117	491,686
Ceylon	1,721	1,921	154,357	136,858
North Borneo	358	516	22,601	55,882
Hongkong	1,799	1,848	151,474	145,509
Australia	30,835	27,397	2,272,475	2,105,435
New Zealand	11,109	12,602	922,558	949,559
Canada	12,037	10,724	833,723	756,522
Jamaica	3,130	2,641	225,404	236,429
Trinidad	5,111	6,463	321,509	461,489
British Guiana	462	457	41,699	42,033
Anglo-Egyptian Sudan	843	2,280	84,141	176,751
Other Commonwealth	3,477	7,448	285,041	570,589
Irish Republic	5,880	5,574	529,871	444,366
Soviet Union	1	—	192	—
Finland	4,518	4,048	303,602	341,644
Sweden	12,097	6,229	599,148	280,490
Norway	6,273	5,643	355,093	402,475
Iceland	198	30	20,492	3,221
Denmark	8,877	11,697	452,112	832,530
Poland	11	56	2,295	7,033
Western Germany	282	149	35,949	26,555
Netherlands	7,693	15,667	427,435	890,498
Belgium	947	2,146	171,657	260,881
France	337	548	71,729	143,741
Switzerland	881	770	132,164	143,502
Portugal	762	2,496	88,430	160,249
Spain	292	320	38,456	40,881
Italy	3,045	2,111	222,428	271,653
Austria	67	208	10,162	33,588
Yugoslavia	431	65	52,225	17,733
Greece	614	157	33,161	18,573
Turkey	684	1,057	65,361	109,049
Netherlands Antilles	1,644	2,030	92,272	144,891
Belgian Congo	292	103	37,552	17,783
Angola	1,514	46	74,482	6,561
Portuguese E. Africa	349	407	35,166	41,509
Canary Islands	83	137	10,018	8,523
Syria	34	18	4,342	4,035
Lebanon	591	130	53,455	19,516
Israel	826	970	65,412	62,295
Egypt	4,066	2,198	261,926	146,468
Saudi Arabia	516	182	49,530	22,443
Iraq	4,275	,602	218,098	447,774
Iran	2,109	313	84,388	18,482
Burma	1,161	853	103,626	78,599
Thailand	562	967	52,753	134,124
Indonesia	777	1,025	57,303	102,557
China	—	7	—	3,341
Philippine Republic	528	24	47,918	5,028
U.S.A.	2,649	1,516	294,092	273,695
Cuba	276	413	28,055	35,208
Colombia	542	1,065	42,976	71,782
Venezuela	3,955	6,369	243,334	467,079
Ecuador	671	501	44,844	44,286
Peru	875	851	71,985	66,388
Chile	502	534	48,049	59,374
Brazil	1,003	710	113,277	66,825
Uruguay	265	139	30,517	12,638
Argentina	2,478	1,458	280,429	153,689
Other foreign	1,401	1,433	129,417	171,347
TOTAL	210,319	240,582	16,158,699	18,750,204

Total Imports of Iron and Steel and Origin

From	Month ended Jan. 31 1952.	Month ended Jan. 31 1953.	Month ended Jan. 31 1952.	Month ended Jan. 31 1953.
	Tons	Tons	£	£
India	42	67	7,860	1,327
Canada	4,412	12,744	562,789	738,309
Other Commonwealth countries and the Irish Republic	819	9,079	75,779	306,292
Sweden	1,968	2,786	255,339	337,444
Norway	5,057	5,370	394,483	468,475
Western Germany	7,588	3,115	614,854	446,159
Netherlands	8,070	8,216	429,982	263,703
Belgium	19,031	39,152	1,296,397	1,812,518
Luxembourg	8,717	18,606	500,406	862,836
France	32,666	19,836	1,213,517	635,662
Italy	1,348	24	98,103	4,427
Austria	8,018	23,886	247,146	574,668
Japan	3,120	3,937	190,022	208,290
U.S.A.	11,264	43,469	724,614	1,914,022
Other foreign countries	265	9,736	38,098	252,461
TOTAL	112,385	200,023	6,649,389	8,827,493
Iron and steel scrap and waste, fit only for the recovery of metal	50,403	68,616	1,157,360	1,468,551

Exports of Iron and Steel by Group

Product.	Month ended Jan. 31 1952.	Month ended Jan. 31 1953.	Month ended Jan. 31 1952.	Month ended Jan. 31 1953.
	Tons	Tons	£	£
Pig-iron	401	300	8,997	9,591
Ferro-tungsten	—	16	—	27,607
Other ferro-alloys	200	208	51,015	205,399
Ingots, blooms, billets, and slabs	79	17	6,523	1,471
Iron bars and rods	395	232	17,112	12,490
Steel and tinplate bars and wire rods	334	1,605	13,290	52,365
Bright steel bars	1,574	1,922	87,135	112,816
Alloy steel bars and rods	1,002	1,730	323,402	380,903
Other steel bars and rods	10,142	10,234	470,989	545,150
Angles, shapes, and sections	12,155	15,058	489,386	701,741
Iron and other castings and forgings	1,117	821	138,114	116,507
Girders, beams, joists, and pillars (rolled)	3,536	2,021	135,583	101,808
Hoop and strip	4,122	3,414	249,851	233,244
Iron plates and sheets	6	57	426	5,102
Tinplate	23,821	25,285	2,340,939	2,310,626
Tinned sheets	165	161	20,273	23,294
Terneplates and decorated tinplates	72	242	11,633	23,177
Other steel plate (⅛ in. thick and over)	20,356	22,725	681,125	1,025,205
Galvanized sheets	5,753	7,775	480,623	609,799
Black sheets	13,745	12,818	853,150	1,017,736
Other coated plates and sheets	975	801	79,859	80,517
Cast-iron pipes up to 6 in. dia.	8,539	7,994	313,032	334,039
Do., over 6 in. dia.	6,855	6,341	221,743	232,266
Wrought-iron tubes	34,356	39,909	2,435,853	3,179,118
Railway material	16,992	24,217	752,162	1,147,837
Wire	5,351	4,817	412,888	389,969
Cable and rope	2,290	3,154	323,073	499,432
Wire nails, etc.	1,215	675	73,117	39,402
Other nails, tacks, etc	734	348	75,832	39,989
Rivets and washers	498	396	43,968	37,818
Wood screws	433	255	93,548	50,573
Bolts, nuts, and metal screws	2,427	1,791	350,109	258,003
Baths	474	264	47,341	26,956
Anchors, etc.	1,067	1,252	88,861	124,639
Chains, etc.	1,019	949	254,497	238,319
Springs	707	534	84,829	53,389
Holloware	8,346	10,736	972,067	1,061,894
Doors and windows	2,066	2,159	283,671	360,846
TOTAL, including other manufactures not listed above	219,319	240,582	16,158,609	18,750,204



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HAVE YOU TRIED 'BORAXO'? CLEANS DIRTY HANDS

Personal

MAJOR ATHEY, chairman of Fordath, Limited, has just returned from South Africa where he has visited many foundries.

DR. H. L. HASLEGRAVE, principal of Leicester College of Technology, has been appointed principal of the Loughborough College of Technology.

MR. MILES BEEVOR, managing director of the Brush Electrical Engineering Company, Limited, Loughborough, has left on a fact-finding tour of India.

MR. KENNETH M. EVANS, manager of Balbardie, Limited, iron and steel merchants, of Edinburgh, has been admitted to membership of the Edinburgh Merchant Company.

MR. J. L. RITCHIE, general sales manager, and MR. T. H. B. WHITING, manager of the spares and service department, of Aveling-Barford, Limited, Grantham, have been appointed local directors.

MR. JOHN JOHNSTON, chief of the warehouse and shipping department of Falkirk Iron Company, Limited, was presented with a grandmother clock on the occasion of his retiral after 62 years with the firm.

MR. R. B. ELLIOTT is to leave the Hymatic Engineering Company, Limited, Redditch, where he is a senior research engineer, to join the Navigation Division of the English Electric Company, Limited. He has been at Redditch since 1945.

MR. T. E. DODDS, when he retires next August, will have completed 28 years as head of the Department of Mechanical Engineering at the Birmingham College of Technology. During his tenure of office he has seen the number of students increase from 5,000 to over 15,000.

The Institution of Civil Engineers has awarded the Bayliss Prize to MR. JOHN NEVILLE MARTIN, of Woking, who obtained the highest marks in the Institution examination last October. MR. FREDERICK GODFREY MOORE, of Skegness, was awarded honourable mention on obtaining second place.

MR. H. CLARKE, works manager of Qualcast Limited, Derby, presented awards for proficiency in engineering drawing and metal work to pupils of Rykneld School, Derby. Mr. Clarke is senior vice-president of Derby and District Association of Engineering and Allied Employers' National Federation.

MR. T. W. EDWARDS, J.P., F.C.I.S., joint managing director of the Park Gate Iron & Steel Company, Limited, Rotherham, retired on February 28 after 54½ years' service with the company. During his long association with the firm, Mr. Edwards has served under six chairmen, and has attended 54 consecutive annual meetings.

MR. H. HILLIER, O.B.E., M.I.MECH.E., M.I.N.A., engineering and technical director of G. & J. Weir, Limited, Cathcart, Glasgow, has been awarded a James Clayton Prize to the value of £805 for his contributions to marine engineering, particularly in the field of auxiliary machinery, communicated in part in a paper submitted to the Institution of Mechanical Engineers during 1952.

PROFESSOR F. C. THOMPSON, of the Metallurgical Department of the University of Manchester, will assume office as President of the Institute of Metals at the Annual General Meeting to be held on March 24. Professor Thompson was educated at King Edward VII School and the University of Sheffield under Professor Arnold. For over thirty years he has occupied the chair of metallurgy at Manchester University.

MR. ALFRED ROEBUCK, to be inducted president of the Institution of Mechanical Engineers on March 27, is the first Sheffield man to receive this honour. He was formerly works director and a member of the board of Hadfields, Limited, Sheffield. He resigned in 1950, but continued as consultant. In 1949, he was national President of the Junior Institution of Engineers, and led the first specialists team—on materials handling—to visit the U.S. on a productivity investigation. The Institution will hold its annual summer meeting in Sheffield for the first time since 1890. A reception, banquet and civic ball are being arranged, and it is hoped to have the historic Top Forge at Wortley ready for official opening as a public museum to coincide with the meeting.

Obituary

MR. BERNARD PARRAMORE, who, with his father and brother, founded the Parramore Iron Foundry at Chapeltown, Derbyshire, died at his home on February 22, at the age of 71.

MR. HARRY WRIGHT BURNETT, chairman and managing director of Thomas Burnett & Company, Limited, Doncaster, ironfounders and railway engineers, died on Saturday last, in his 82nd year.

THE DEATH occurred recently of MR. RUFUS STIRK, of Halifax, at the age of 79. His father, the late Mr. John Stirk, founded in 1866 the firm of John Stirk & Sons, Limited, engineers and machine-tool makers, one of the oldest engineering firms in Halifax. The O.B.E. was awarded to Mr. Stirk for his work during the first world war when he was closely connected with the business.

THE SUDDEN DEATH on February 27 of MR. H. B. FERGUSSON, senior director of G. A. Harvey & Company (London), Limited, is announced. After an already distinguished career, Mr. Fergusson joined G. A. Harvey's in 1933, as manager of their heavy construction department, and was very largely responsible for the growth and development of the firm's activities in the oil, chemical and heavy engineering industries. He was appointed to the Board in May, 1938.

MR. ARTHUR GIRLING, who has died in Aberdeen, was an expert in agricultural machinery. For 14 years, before he retired in 1945, he was works manager with Barclay Ross & Hutchison, Limited, Aberdeen. He served his apprenticeship as an agricultural engineer in his native town of Leiston, Suffolk. He was previously departmental manager with an agricultural firm in Ipswich and conducted much of this firm's foreign business on which he travelled extensively in many parts of the world.

MR. DOUGLAS JEPSON, head of the Department of Metallurgy at the Birmingham College of Technology since 1947, has died at the age of 51. He joined the College in 1945 as a senior lecturer, coming from Bradford Technical College, where he had been since 1940 a lecturer in metallurgy. A Derbyshire man, Mr. Jepson graduated in metallurgy at Manchester with first class honours. His first industrial appointment was with Imperial Chemical Industries, Limited, as plant manager. While in Birmingham he has done much to assist local industrialists to obtain suitably qualified technical staff. Mr. Jepson had been a member of the Institute of British Foundrymen since 1940, and took a great interest in the West Riding of Yorkshire branch. He served on the Institute's Education Committee for many years, and only recently was appointed to the Joint Committee for Metallurgical Training as the Institute's representative.

News in Brief

G. S. Lavender & Company, Limited, iron, steel, and non-ferrous metal merchants and stockholders, of London, W.C.2, reopened their home trade department last Monday.

Sir Walter Monckton, Minister of Labour and National Service, will be the chief guest at the annual Cutlers' Feast, which is to be held in the Cutlers' Hall, Sheffield, on April 21.

The directors of the English Electric Company, Limited, announce that the company's group profit for 1952 expanded by £716,893 to £4,359,034 compared with 1951. A final dividend on ordinary shares of 10 per cent. is recommended, payable on March 20.

An order from the Railway Board of the Government of India has been received by the North British Locomotive Company, Limited, Glasgow, for twenty, 600 h.p., Diesel hydraulic locomotives. The order is worth £600,000 and the locomotives are the first of their type to be introduced to India.

The Canadian Bureau of Statistics states that Canada's production of steel ingots achieved a new record in 1952 at 3,599,755 tons, which compared with the 1951 level of 3,446,125 tons. Output in December last was 310,018 tons, compared with 300,226 tons in November and 286,755 in December, 1951.

An order has been placed with the Glasgow engineering firm of Watson Archibald & Dundas, Limited, for specially designed windows for a 4,350-ton ferry ice-breaker, yet unnamed, being built by Vickers Corp. in Montreal for car and passenger service on the St. Lawrence. It is worth 12,000 dollars and is the second from Canada in recent months.

Steel is included in a list of items which can now be imported into Japan from the sterling area under the automatic approval system. Approved applications for scrap steel and steel will be valid for three months. Fluorspar, nickel ore, scrap copper, and scrap aluminium are included in a list of items removed from the group of commodities importable from the dollar area under the system.

The Steetley Company, Limited announce that over 98 per cent. of the 411,463 new ordinary shares offered to Ordinary Shareholders were taken up by way of rights and application for a further 437,725 shares were received. Those not taken up are being allocated in proportion to the registered holdings of applicants on January 16, 1953, and their allotments will be restricted to approximately 2 per cent. of such holdings.

An extraordinary meeting of members of Coltness Holdings, Limited, will be held at 7, West George Street, Glasgow, C.2, on March 13, at 12.30 p.m., at which it will be proposed that the resignation of Mr. I. W. Macdonald as joint liquidator of the company be accepted and that Mr. A. J. Couper, a partner with Mr. Macdonald in the firm of Kerr, MacLeod & Macfarlan, chartered accountants, of Glasgow, be appointed joint liquidator in his place.

The potential demand for steel outside Europe is the subject of a study which has been undertaken in Geneva by the secretariat of the United Nations Economic Commission for Europe. It is to be published in about two months' time, and will stress the importance of the so-called under-developed countries overseas as future outlets for substantial quantities of European steel. It will urge that the expansion of these markets be encouraged by reasonable prices and assured supplies.

Tubewrights Limited, a subsidiary of Stewarts and Lloyds, Limited, specializing in the design and manufacture of fabricated tubular steel work, are exhibiting a wide range of their products on Stand No. 68 at the Factory Equipment Exhibition, to be held in the Royal Horticultural Society's New Hall, Westminster, from March 23 to 27. The exhibits include the "Pallage," which permits the rapid building-up of various forms of mechanical-handling equipment (tray, crate, rack, pallet, stillage) from standard components.

To assist in solving the problem of the shortage of suitable youths for the engineering industry, a joint meeting of the West Midland group of the British Association for Commercial and Industrial Education, and the Midland branch of the Incorporated Association of Headmasters is to be held in Birmingham on March 12. Before the meeting, parties of headmasters are to visit factories in the area to discuss with former students their prospects and how their entry into industry might have been facilitated while they were at school.

New baths at the Erewash Foundry of the Stanton Ironworks, near Ilkeston, were opened by the Mayor of Ilkeston (Coun. Mrs. Ellen E. Bostock) recently. The opening ceremony was presided over by Mr. F. Scopes, managing director, of the Stanton Company; among those present were Mr. H. Wilson, O.B.E., deputy managing director; Mr. J. H. Butler, chief engineer; Mr. J. I. Blackbourne, chief works maintenance engineer; Mr. L. Hearnshaw, foundries superintendent; and Mr. G. R. Buckley, general manager, furnaces and spun plant.

Founders considering personal intercommunication systems will be interested in equipment to be shown for the first time at the Olympia (London) section of the British Industries Fair (from April 27 to May 8) by Hadley Sound Equipments, Limited, of Smethwick, Staffordshire. Through a master unit linked with extensions there is immediate and direct contact between, say, a manager and his foremen. An additional useful feature provides for loudspeaking reception of telephone calls avoiding inconvenience and wasted time when "holding on."

The Budget should be framed to leave industry with adequate funds not only to maintain its competitive ability but also to develop new ventures as the prelude to healthy expansion, Col. C. W. Clark said at the annual meeting of Coventry Chamber of Commerce on February 18 when he was re-elected president. There was something in the nature of a revolt against the excessive purchase tax on a large part of Coventry's products, he said. No one who appreciated the paramount need for exports could view with complacency the appalling difficulty of maintaining efficient production with the present burden of taxation.

At the annual meeting of the National Union of Manufacturers (Midland Area) in Birmingham on February 24, Mr. William Blackwell, chairman for 10 years, was elected president in place of Sir Bernard Docker. Sir Patrick Hannon, Mr. C. Sidney Bache, and Alderman Paddon Smith were re-elected vice presidents. The meeting was addressed by Sir Leonard Browett, national director of the N.U.M. who said that of the union's total membership, a large majority were in the Midlands area. There was still a big field to be covered however, Sir Leonard said, before the union became comparable to manufacturers' organizations in other parts of the world.


HAVE YOU SEEN..
"THIS STRIPPING JOB IS A LOT EASIER SINCE WE STARTED USING 'SUPINEX R.' NO NEED FOR CROW BARS, EH!"
"YES, AND I CAN USE THOSE CORE IRONS AGAIN"

Raw Material Markets

Iron and Steel

Orders for castings show no appreciable increase; buyers appear to be confining their demands to cover only immediate needs, with the result that forward bookings are on a small scale. There is thus keen competition for fresh business. The engineering and speciality foundries, apart from those catering for steelworks, collieries, and machine-tool makers, are hoping for a revival in export trade to bring them more business: this applies particularly to those foundries connected with the motor, tractor, and allied trades, as well as textile and agricultural implement makers. The light-castings makers and some of the jobbing foundries are also adversely affected by the continued decline in export business, many of them having productive capacity available. Foundries catering for the building trades are hoping that better weather will shortly result in more business for them.

Pig-iron makers, assisted by adequate supplies of ore and fairly satisfactory quantities of coke, are obtaining maximum outputs. Production of pig-iron is, of course, to a large extent dependent upon satisfactory deliveries of coke, and the proposed blowing-in of additional furnaces will be largely governed by the fuel situation.

While the demand for pig-iron from the foundries is reduced, there is no lessening in the call for basic pig-iron from the steelworks, and they will continue to depend mainly on the supply of this in the absence of sufficient scrap. Although deliveries to the steelworks are increasing, larger quantities will be needed if their output target is to be achieved. Fairly large tonnages of pig-iron are still being imported, and the authorities will no doubt aim at reducing them by changing over one or more furnaces to the production of steelmaking iron. Scrap supplies are now better, although there is a ready market for the better and heavier grades of cast-iron and machinery scrap. Foundry coke, ganister, limestone, and firebricks are received to requirements.

The re-rollers continue to be incommoded by shortage of semi-manufactured steel, and their efforts to obtain additional tonnages have so far met with little success. Business from home users for small bars, sections, and strip is well maintained, but it is difficult to undertake this with the small amount of steel on hand. No stocks are available, and consignments of imported steel semis have practically ceased. Very little business is obtained from oversea markets for merchant bars owing to the wide difference in price of U.K. and foreign producers.

Sheet re-rollers are busy, but are in need of additional supplies of sheet bars and slabs. Up to the present they have been able to quote competitively with oversea producers, but recently, in some markets, Japanese prices for galvanized sheets are lower and competition from Continental makers is becoming keener.

Non-ferrous Metals

Some surprise was occasioned when news came through that copper and aluminium had both been decontrolled as to price in the United States, for, so far as copper was concerned any way, it was believed that the ceiling quotation would not be lifted before March 31 at the earliest. April 30 was, of course, the date when all controls had to be lifted according to schedule, but it looks as if the new *régime* intends to be forward in its programme of getting rid of these limiting arrangements. While nothing special seems to have happened to aluminium, there has been a jump in the price of copper, and the old domestic level of 24½ cents is now a thing of the past, except that apparently the Central Bank of Chile will continue to pay the producers on this basis, reselling as heretofore at 35½ cents. But in the States values moved up sharply as soon as the announcement was made on Wednesday of last week, the cheapest quotation being 27½ cents and the dearest (one of the Custom smelters) 32 cents.

Just where the market will settle is a matter for conjecture, but in the meanwhile Chile is credited with the intention of maintaining her price at 35½ cents with the idea of trying to sell in Europe if the American consumers do not take up all her output. Since copper appears to be pretty freely available on this side at from 33 to 33½ cents, the chances of selling at 35½ cents would seem to be poor.

Markets in London have been mostly easier, zinc especially showing weakness following the cut in the U.S. price to 11½ cents, equal to approximately £90. Lead is also marked down; the backwardation has now narrowed to 25s., and before long should disappear altogether, for there does not seem to be any shortage of lead now in this country. The continuation of the backwardation is unfortunate, for it militates very much against hedging. Tin is steady; business with consumers in tin is quite good, and the rate of use in this country keeps steady at rather less than 2,000 tons monthly. Metal Exchange stocks are low; hence the big backwardation.

Official prices of zinc were:—

February—February 26, £80 5s. to £80 10s. *March*—February 27, £79 15s. to £80; March 2, £79 5s. to £79 10s.; March 3, £78 7s. 6d. to £78 10s.; March 4, £76 10s. to £77.

May—February 26, £80 12s. 6d. to £80 15s. *June*—February 27, £80 5s. to £80 10s.; March 2, £79 12s. 6d. to £79 15s.; March 3, £78 15s. to £79; March 4, £77 to £77 5s.

The following official quotations for tin were recorded:—

Cash—February 26, £958 to £960; February 27, £960 to £961; March 2, £957 to £959; March 3, £960 to £962; March 4, £957 to £959.

Three Months—February 26, £938 to £939; February 27, £942 to £943; March 2, £941 to £942; March 3, £942 to £943; March 4, £942 to £944.

Official prices of refined pig-lead were as follow:—

February—February 26, £93 5s. to £93 15s. *March*—February 27, £91 5s. to £91 10s.; March 2, £91 to £91 5s.; March 3, £89 10s. to £89 15s.; March 4, £87 5s. to £87 10s.

May—February 26, £91 5s. to £91 7s. 6d. *June*—February 27, £90 5s. to £90 10s.; March 2, £90 5s. to £90 10s.; March 3, £88 10s. to £88 15s.; March 4, £86 to £86 5s.

Electric Motors. Higgs Motors Limited, of Witton, Birmingham 6, have issued an abridged but nevertheless very handy price list of their extensive range of electric motors. It is available to our readers on application to Witton.

Steel Price Offences. Fines totalling £152 with 10 guineas costs were imposed at Middlesbrough on February 20 on Michael Baum & Company, Limited, of Middlesbrough. The company was found guilty on three charges of selling steel above the permitted price. The firm was alleged to have sold 21 tons 2 qrs. of steel bars to Clayton Dewandre Company, Limited, Lincoln, at £99 6s. 1d. over the maximum price.

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

(Delivered unless otherwise stated)

March 4, 1953

PIG-IRON

Foundry Iron.—No. 3 Iron, Class 2:—Middlesbrough, £13 8s.; Birmingham, £13 1s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £16 8s., 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, £16 12s. 3d.

Scotch Iron.—No. 3 foundry, £16 1s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £17 18s.; South Zone, £18 0s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £18 18s.; South Zone, £19 0s. 6d.

Cold Blast.—South Staffs, £18 2s.

Hematite.—Si up to 2½ per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. Coast and N.-W. Coast of England, £16 2s.; Scotland (Scotch iron), £16 8s. 6d.; Sheffield, £17 3s.; Birmingham, £17 9s. 6d.; Wales (Welsh iron), £16 8s. 6d.

Basic Pig-iron.—£13 19s. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered).

Ferro-silicon (6-ton lots).—40/55 per cent., £57 10s., basis 45 per cent. Si, scale 21s. 6d. per unit; 70/84 per cent., £86, basis 75 per cent. Si, scale 23s. per unit.

Ferro-vanadium.—50/60 per cent., 23s. 8d. to 28s. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 10s. to 11s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £204 to £210 per ton; 38/40 per cent., £235 to £265 per ton.

Ferro-tungsten.—80/85 per cent., 22s. 10d. to 23s. 6d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 25s. 9d. to 28s. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent. C, £85 4s., basis 60 per cent. Cr, scale 28s. 3d. per unit: 6/8 per cent. C, £80 17s, basis 60 per cent. Cr, scale 26s. 9d. per unit; max. 2 per cent. C, 2s. per lb. Cr; max. 1 per cent. C, 2s. 2½d. per lb. Cr; max. 0.15 per cent. C, 2s. 3½d. per lb. Cr; max. 0.10 per cent. C, 2s. 3¾d. per lb. Cr; max. 0.06 per cent. C, 2s. 4d. per lb. Cr.

Cobalt.—98/99 per cent., 20s. per lb.

Metallic Chromium.—98/99 per cent., 6s. 5d. to 7s. 6d. per lb.

Ferro-manganese (blast-furnace). — 78 per cent., £48 12s. 11d.

Metallic Manganese.—93/95 per cent., carbon-free, £262 to £275 per ton; 96/98 per cent., £280 to £295 per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 40s. to 70s. per lb., Nb + Ta.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—Basic: Soft, u.t., £25 4s. 6d.; tested, 0.08 to 0.25 per cent. C (100-ton lots), £25 14s. 6d.; hard (0.42 to 0.60 per cent. C), £27 12s.; silico-manganese, £33 8s.; free-cutting, £28 8s. 6d. Siemens Martin Acid: Up to 0.25 per cent. C, £32 4s.; case-hardening, £32 12s.; silico-manganese, £34 9s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 8s.; basic, hard, over 0.41 up to 0.60 per cent. C, £30 8s.; acid, up to 0.25 per cent. C, £32 12s.

Sheet and Tinplate Bars.—£25 3s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £29 14s.; boiler plates (N.-E. Coast), £31 1s. 6d.; chequer plates (N.-E. Coast), £31 3s.; heavy joists, sections, and bars (angle basis), N.-E. Coast, £27 17s.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £31 15s. 6d.; flats, 5 in. wide and under, £31 15s. 6d.; hoop and strip, £32 10s. 6d.; black sheets, 17/20 g., £41 12s. 6d.; galvanized corrugated sheets, 24 g., £51 1s.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £50 18s. 3d.; nickel-chrome, £71 7s. 9d.; nickel-chrome-molybdenum, £79 2s. 6d.

Tinplates.—57s. 1½d. per basis box.

NON-FERROUS METALS

Copper.—Electrolytic, £285; high-grade fire-refined, £284 10s.; fire-refined of not less than 99.7 per cent., £284; ditto, 99.2 per cent., £283 10s.; black hot-rolled wire rods, £294 12s. 6d.

Tin.—Cash, £957 to £959; three months, £942 to £944; settlement, £959.

Zinc.—March, £76 10s. to £77; June, £77 to £77 5s.

Refined Pig-lead—March, £87 5s. to £87 10s.; June, £86 to £86 5s.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £106 15s.; rolled zinc (boiler plates), all English destinations, £104 15s.; zinc oxide (Red Seal), d/d buyers' premises, £110.

Other Metals.—Aluminium, ingots, £166; magnesium, ingots, 2s. 10½d. per lb.; antimony, English, 99 per cent., £225; quicksilver, ex warehouse, £70 10s. to £71 (nom.); nickel, £483.

Brass.—Solid-drawn tubes, 26d. per lb.; rods, drawn, 34⅛d.; sheets to 10 w.g., 280s. per cwt.; wire, 32d.; rolled metal, 266s. 9d. per cwt.

Copper Tubes, etc.—Solid-drawn tubes, 32⅜d. per lb.; wire, 317s. 9d. per cwt. basis; 20 s.w.g., 346s. 3d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £206 to £218; BS. 1400—LG3—1 (86/7/5/2), £218 to £238; BS. 1400—G1—1 (88/10/2), £320 to £375; Admiralty GM (88/10/2), virgin quality, £325 to £380 per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £350 to £385 L.P.Bl, £250 to £275 per ton.

Phosphor Bronze.—Strip, 412s. 9d. per cwt.; sheets to 10 w.g. 434s. 6d. per cwt.; wire, 49⅝d. per lb.; rods, 44½d., tubes, 42¾d.; chill cast bars: solids 3s. 8d., cored 3s. 9d. (C. Clifford & Son, Limited.)

Nickel Silver, etc.—Ingots for raising, 2s. 8½d. per lb. (7 per cent.) to 3s. 11d. (30 per cent.); rolled metal, 3 in. to 9 in. wide × .056, 3s. 2½d. (7 per cent.) to 4s. 5d. (30 per cent.); to 12 in. wide × .056, 3s. 2¾d. to 4s. 5¼d.; to 25 in. wide × .056, 3s. 4¾d. to 4s. 7¼d. Spoon and fork metal, unsheared, 2s. 11½d. to 4s. 2d. Wire, 10 g., in coils, 3s. 9¼d. (10 per cent.) to 4s. 11d. (30 per cent.). Special quality turning rod, 10 per cent., 3s. 8¼d.; 15 per cent., 4s. 1¾d.; 18 per cent., 4s. 6½d. All prices are net.

Forthcoming Events

MARCH 9

Institution of Production Engineers

Luton graduate section:—Annual general meeting and film evening, 7.30 p.m. at the Luton Library Lecture Hall, Williamson Street.

Sheffield section:—"Preventive Maintenance," by O. Lewis, 6.30 p.m. at the Grand Hotel.

Purchasing Officers' Association

London branch:—Film show, 6.15 p.m. at Salisbury Square House, Salisbury Square, W.C.2.

MARCH 10

Institution of Mechanical Engineers

"Engineering Changes," by Harold Drew, 5.30 p.m. at Storey's Gate, St. James's Park, London, S.W.1.

Beeston Boiler Foremen's Association

"Manufacture of Ball and Roller Bearings," by P. A. Champion, 7.30 p.m. in the Canteen, The Beeston Boiler Company, Limited, Mona Street, Beeston, Notts.

Institute of Industrial Supervisors

South Wales section:—"Inspection Aids to Production," by H. G. Dixon, 7.30 p.m. in the South Wales Institute of Engineers.

MARCH 11

Institute of British Foundrymen

Birmingham students' section:—"Recent Developments in the Production of Cast Iron," by H. G. Hall, 7.15 p.m. at Dudley and Staffs Technical College.

Burnley section:—Annual general meeting, followed by a short paper, 7.30 p.m. at the Municipal College, Ormerod Road.

Lancashire branch:—"Simple and Cheap Mechanical Layout for the Small Jobbing Brass Founder," by F. C. Evans, 7 p.m. at the Engineers' Club, Albert Square, Manchester.

Institution of Works Managers

Tees-side branch:—"Modern Legislation," by R. Hillier, 7.30 p.m. at the Vane Arms Hotel, Stockton-on-Tees.

Purchasing Officers' Association

Sheffield branch:—Short papers by members, 7 p.m. at the Three Cranes Hotel, Queen Street.

Tees-side branch:—"Engineering in the Steel Industry." Film show, 7.30 p.m. in the Council Room of the Cleveland Scientific and Technical Institution, Corporation Road, Middlesbrough.

Institution of Production Engineers

Birmingham section:—"Materials Handling for Batch Production," by F. E. Rattlidge, 7 p.m., at the Cadena Café, Worcester.

Halifax section:—"Engineering Potentialities of Spheroidal-graphite Cast Iron with special reference to the Machine-tool and General Engineering Industries," by Dr. A. B. Everest, 7.15 p.m. at the George Hotel, Huddersfield.

MARCH 12

Institute of British Foundrymen

Lincolnshire branch:—"Application of Ferrous Alloys in the Iron Foundry," by H. P. Hughes, 7.15 p.m. at the Lincoln Technical College.

Southampton section:—"Manufacture of Chill and Grain Rolls," by L. H. Grainger, 7 p.m. at Southampton Technical College, St. Mary Street.

Institution of Production Engineers

Rochester section:—"Control of Quality in Large- and Medium-quantity Production," by J. Loxham, 7.30 p.m. at the Rotary Room, Sun Hotel, Chatham.

Institute of Welding

"Construction of the new Testing Laboratory of the British Welding Research Association at Abington," by E. M. Lewis, 6 p.m. Joint meeting with the Institution of Structural Engineers, 11, Upper Belgrave Street, London, S.W.1.

MARCH 13

Institute of British Foundrymen

Tees-side branch:—Works visit. (Further details from the Secretary.)

Institution of Mechanical Engineers

"Steels for Steam Power Plant," review compiled by A. M. Sage, 5.30 p.m. Storey's Gate, St. James's Park, London, S.W.1.

Institute of Economic Engineering

London branch:—"Management in Action," by G. P. E. Howard, 7 p.m. at Cowdray Hall.

MARCH 14

Institute of British Foundrymen

Newcastle branch:—Joint meeting with students of King's College. (Further details from the Secretary.)

Scottish branch:—Annual business meeting. Paper "Practical Application of some Modern Ideas in the Brass Foundry," by J. M. Douglas and W. S. Richardson, 3 p.m. at the Royal Technical College, George Street, Glasgow. The Annual Dinner will be held after the meeting at the Grosvenor Restaurant.

West Riding of Yorkshire branch:—"Production of Castings for Internal Combustion Engines," film and lecture by H. Haynes, and C. R. van der Ben, 6.30 p.m. at the Technical College, Bradford.

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

YOUNG MAN (25) public school; N.F.C. Diploma, with practical foundry experience, seeks position as Assistant to Manager, or similar, in grey iron or non-ferrous foundry.—Box 3306, FOUNDRY TRADE JOURNAL.

FOUNDRYMAN, age 49, seeks position with small jobbing iron foundry; experienced moulder; managerial qualifications ferrous and non-ferrous production; wide experience of trade; accustomed to full control; A.M.I.B.F.—Box 3305, FOUNDRY TRADE JOURNAL.

GENERAL MANAGER, aged 40, married, with family, M.I.B.F., experienced aluminium, yellow metals, iron, mechanised and general, accustomed complete control works and administration, sales, buying, costs, etc., would consider any senior appointment any area. House required.—Box 3297, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER, A.M.I.B.F., desires change; 30 years' experience in all classes of Foundry practice; ferrous and non-ferrous metals; wide knowledge of mechanisation, pattern layout, castings up to 6 tons for M/c tool and marine engine trade; rate fixing and costing ext.; capable of taking complete charge.—Box 3265, FOUNDRY TRADE JOURNAL.

EX-FOUNDRY MANAGER (aged 49), 30 years' experience Textile repetition, C.I. and Brass founding, seeks position with prospects in the South or Midlands with small firm.—Box 3271, FOUNDRY TRADE JOURNAL.

CORE Binders.—TECHNICAL SALES REPRESENTATIVE, well known in trade, M.I.B.F., desires change, Midlands. Commission only, on term agreement, with company able to offer consistent quality at right prices.—Box 3284, FOUNDRY TRADE JOURNAL.

GENERAL MANAGER will shortly be requiring change. Fully experienced in controlling iron foundry, high duty and special irons. Covering accounts, sales staff, estimating, planning and ratefixing, laboratory control, methods, pattern shop, etc.—Box 3282, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN (40) seeks situation. Jobbing, 3 tons, machine, plate, mechanised and sand slinger. Experienced method, sand and cupola.—Box 3280, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN (45), M.I.B.F., accustomed full charge, technically trained, metallurgist, and fully practical, life experience trade, grey, high duty, malleable and non-ferrous, rigid control, experienced sales, commercial, desires change to small foundry (Midlands preferred), requiring organisation and increased economic production. Salary/results basis. Available short notice.—Box 3279, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order 1952.

STEEL FOUNDRY FOREMAN required, for small Mechanised and Jobbing Foundry. Only those persons with steel foundry practice required.—Box 3291, FOUNDRY TRADE JOURNAL.

ASSISTANT required in Metallurgical Department for the technical control of the Iron Foundry and general metallurgical duties. A knowledge of foundry technology is more important than analytical ability.—Apply giving full particulars, including age and salary expected to Manager, ENGINEERING DEPARTMENT & LABOUR, VICKERS-ARMSTRONGS, LTD., Crayford, Kent.

WANTED—An experienced machine moulder age 30/35 years. Must be of good appearance, willing to learn to drive a car and travel in a limited area. Applicants should preferably reside in either the Birmingham or Lancs/Yorks areas. The position is one of great interest and will involve visiting foundries demonstrating new equipment. An extensive training being provided before taking over a territory. Salary and expenses commensurate with experience. Applications to Personnel Manager, COLEMAN-WALLWORK CO., LTD., Stotfold.

FOUNDRY WORKS MANAGER required by modern Grey Iron Foundry in Midlands, producing general and repetition engineering castings. Applicant must have thorough experience of general and mechanised production. Ability to introduce new business an advantage. Write, stating age, experience, and salary required.—Box 3300, FOUNDRY TRADE JOURNAL.

DIRECTORSHIP available for experienced Foundry Manager in small jobbing iron foundry employing 20 men, in East Midlands. Excellent scope for man with sound Foundry/Commercial experience to use drive and initiative in developing excellent iron connections and also lay down and develop non-ferrous floor. Experience and personality of greater importance than capital investment.—Box 3242, FOUNDRY TRADE JOURNAL.

METALLURGICAL CHEMIST wanted by old-established firm of Light Metal Founders. Staff appointment with pension scheme.—Box 3303, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

METALLURGIST and CHEMIST required for Foundry Laboratory. Familiar with chemical analysis of iron and steel. Duties also include Furnace and Sand control. Only those applicants with the above experience need apply.—Box 3289, FOUNDRY TRADE JOURNAL.

ASSISTANT METALLURGICAL CHEMIST required, age 25-35, for laboratory attached to iron and steel foundry.—Write, giving full particulars of training and experience, stating age and salary required, Box 3277, FOUNDRY TRADE JOURNAL.

QUALIFIED METALLURGIST, between the ages of 25/35, with technical control and research experience, to take charge of laboratory and development Section in progressive Mechanised Grey Iron Foundry in the North-West.—Box 3293, FOUNDRY TRADE JOURNAL.

WANTED — Fitter / Engineer with foundry experience to install and maintain semi-mechanised plant in small iron foundry.—TOWER FOUNDRY, LTD., Spurgeon Road, Leicester.

ASSISTANT METALLURGIST for foundry in Southern England; grey and alloy iron; experienced mechanised and sand foundry and cupola control; age about 25; house available suitable applicant.—Write Box M.768, c/o STREETS, 110, Old Broad Street, E.C.2.

PATTERNMAKER WORKING FOREMAN required. Must be accustomed to making, supervising, inspecting and estimating first-class wood pattern equipment to highest possible standards and dead-on limits.—Write, giving details of experience, age, references, wages required, to WRIGHT & PLATT, LTD., world's largest engineering master patternmakers, Irving Street, Birmingham.

SALES EXECUTIVE (aged 30-40) required by Polygram Casting Co., Ltd. Close association and good contacts with the foundry industry essential. Knowledge of stock control advantageous, and some practical founding experience essential. A substantial salary will be paid to suitable applicant possessing drive and organising ability.—Reply, giving fullest details of experience, to POLYGRAM CASTING CO., LTD., Terminal House, Victoria, S.W.1.

TECHNICAL ASSISTANT required to Works Manager by Non-ferrous Metal Refining Company in Birmingham area for Chemical and Metallurgical Research and Development. Applicants should possess a sound knowledge and practical experience of metallurgy and/or chemical engineering, and have marked inclination to this type of work. Please supply full details in confidence, of experience, salary required, and when available.—Apply Box 3301, FOUNDRY TRADE JOURNAL.

AGENCIES

REPRESENTATION. — Qualified Foundryman, calling on Engineers and Founders, willing to represent reputable Company and/or Foundry with interest in above trades Expenses and commission basis. London and Southern Counties.—Box 3299, FOUNDRY TRADE JOURNAL.

COMPANY, situated in the centre of London, having well-established business with foundries, seeks additional AGENCIES for London and the Home Counties.—Box 3285, FOUNDRY TRADE JOURNAL.

A PROMINENT Public Company in Australia, operating large steel foundries, forges and machine shops, seeks link with kindred concerns in Britain and Overseas Countries by acquiring manufacturing rights suitable for Australian requirements, proprietary lines in general engineering and new devices. Manufacturing rights involving steel castings would receive special consideration but not an essential condition. Suitable Agencies would also receive consideration. An executive officer from the Company's Works in Australia will be in England throughout March and April to undertake negotiations.—Please write: "TRADE LINK," c/o Australia and New Zealand Bank, Limited, 71, Cornhill, London, E.C.3.

PATENT

THE Proprietor of Patent No. 630560, for "Method and Apparatus for Cooling a Powder Formed from a Molten Metal," desires to secure commercial exploitation by licence or otherwise in the United Kingdom.—Replies to HASELTINE, LAKE & CO., 24, Southampton Buildings, Chancery Lane, London, W.C.2.

FINANCIAL

ADVERTISER, interested in purchase of small Iron and Non-ferrous Foundry in Midlands, or would consider Partnership.—Write, giving full particulars, Box 3304, FOUNDRY TRADE JOURNAL.

MACHINERY WANTED

WANTED.—Core Sand Mixer, 5-10 cwt. capacity. 240 volts, 3-phase, a.c.—ERIPO, LTD., Manor Road, Erith, Kent.

WANTED.—Sand Testing Equipment. —HOWARTH & WALTER, LTD., Handel St. Foundry, Bradford.

CUPOLA 25/35 cwt.; Sand Mill; 18 in. D.E. Grinder; all 400/440 volt, 3 phase equipment and urgently required.—Box 3307, FOUNDRY TRADE JOURNAL.

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494 C.F.M., BELT DRIVEN, THREE CYLINDER, WATER COOLED, by BROOM & WADE. Cyls. 10 in. dia. by 12 in. stroke; 120 h.p. SLIPRING MOTOR AND STARTER, 400-440/3/50. EH.251.

350 C.F.M., MOTOR DRIVEN, VERTICAL, TWO STAGE, WATER COOLED, by ALLEY & McLELLAN. 100 h.p. BROOK SLIPRING MOTOR, 440/3/50. Allen West O.I. Starter, Intercooler, etc.

240 C.F.M., MOTOR DRIVEN, TWO STAGE, AIR COOLED AIR COMPRESSOR, by INGERSOLL-RAND, Model 50B, Type 40. Cyls. 6 in. and 5 in. by 5 in. stroke; 970 r.p.m.; 60 h.p. SLIPRING INDUCTION MOTOR, by L.D.C., 400-440/3/50; Intercooler, Aftercooler; all mounted on bedplate.

80 C.F.M., MOTOR DRIVEN, TWIN CYLINDER, WATER COOLED, by BROOM & WADE, Type D21. Cyls. 6 in. by 7 in. stroke; 20 h.p. SLIPRING MOTOR, 400/3/50. ERSKINE HEAP OIL IMMERSED STARTER, vee rope drive, etc.

30 C.F.M., TWO STAGE, MOTOR DRIVEN, AIR COOLED. 175-lbs. p.s.i. pressure; cyls. 4½ in. by 2½ in. by 3 in. stroke; 660 r.p.m.; 7½ h.p. S.C. MOTOR, 400-440/3/50, all mounted over Horizontal Air Receiver; pressure gauge, safety valve, etc.

25 C.F.M., VEE ROPE DRIVEN, THREE STAGE, AIR COOLED, by INGERSOLL-RAND. Cyls. 3½ in. by 2¼ in. by 1 in. by 2½ in. stroke; pressure up to 2,000-lbs. p.s.i.; 900 r.p.m.

22 C.F.M., MOTOR DRIVEN, SINGLE STAGE, AIR COOLED. 150-lbs. p.s.i. pressure; cyls. 3½ in. by 3 in. stroke, speed 650 r.p.m.; 5 h.p. S.C. Motor, 400-440/3/50; automatic pressure switch; Air Receiver 60 in. long; pressure gauge, etc.

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16 C.F.M., MOTOR DRIVEN, TWO STAGE, AIR COOLED. 150-lbs. p.s.i. pressure; cyls. 4½ in. by 2¼ in. by 3 in. stroke. 4 h.p. S.C. Motor, 400/3/50; Air Receiver, 48 in. by 18 in.

14 C.F.M., REAVELL, BELT DRIVEN, SINGLE ACTING, TWO STAGE, HIGH PRESSURE, Type HCSA3. 1,000-lbs. p.s.i. pressure; Intercooler, etc.

13.5 C.F.M., SINGLE CYLINDER, SINGLE STAGE, AIR COOLED. 150-lbs. p.s.i. pressure; cyls. 3½ in. bore by 4 in. stroke; speed 600 r.p.m. 3 h.p. S.C. Motor, 400-440/3/50; Starter, Automatic Pressure Switch. Air Receiver 48 in. by 18 in. dia., pressure gauge, etc.

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MISCELLANEOUS—*Contd.*

PATTERN Equipments, Machined Plates, Castings, Components, Assemblies, Jigs, Fixtures, Corebox Air Vents and Dowels. Developing firm requests enquiries. Keen personal attention.—BOOTH BROS. ENGINEERING, Baggrave Street, Leicester.

D.C.M.

QUALITY
INGOTS
IN
ALUMINIUM ALLOY
TO
ALL SPECIFICATIONS
ON A.I.D. LIST

D.C.M. METALS (SALES) LTD
LONGLEE WORKS, BAILLIESTON, GLASGOW
Phone: Baillieston 1061

NOTICE TO ADVERTISERS AND AGENTS

It is greatly regretted that, owing to acute lack of space both at our offices and at our printer's works, it is not possible to retain in store indefinitely obsolete blocks used in past advertisements in the "*FOUNDRY TRADE JOURNAL.*"

NOTICE IS THEREFORE GIVEN that we shall be obliged to dispose of all advertisement blocks that have not appeared in the Journal since **December 31st, 1949**, if no application has been received for their return on or before **March 31st, 1953.**

March 5th, 1953

Foundry Trade Journal
49, Wellington St.,
London, W.C.2.

HOOKERLITE

- CORE TRAYS
- MOULDING BOARDS
- PATTERN BOARDS
- BATTENS FOR WOOD SCREWS

"Hookerlite" Regd. Trade name.
Sole manufacturers and Suppliers.

Are hard, durable, and unburnable. Light in weight, and have an accurate smooth surface.

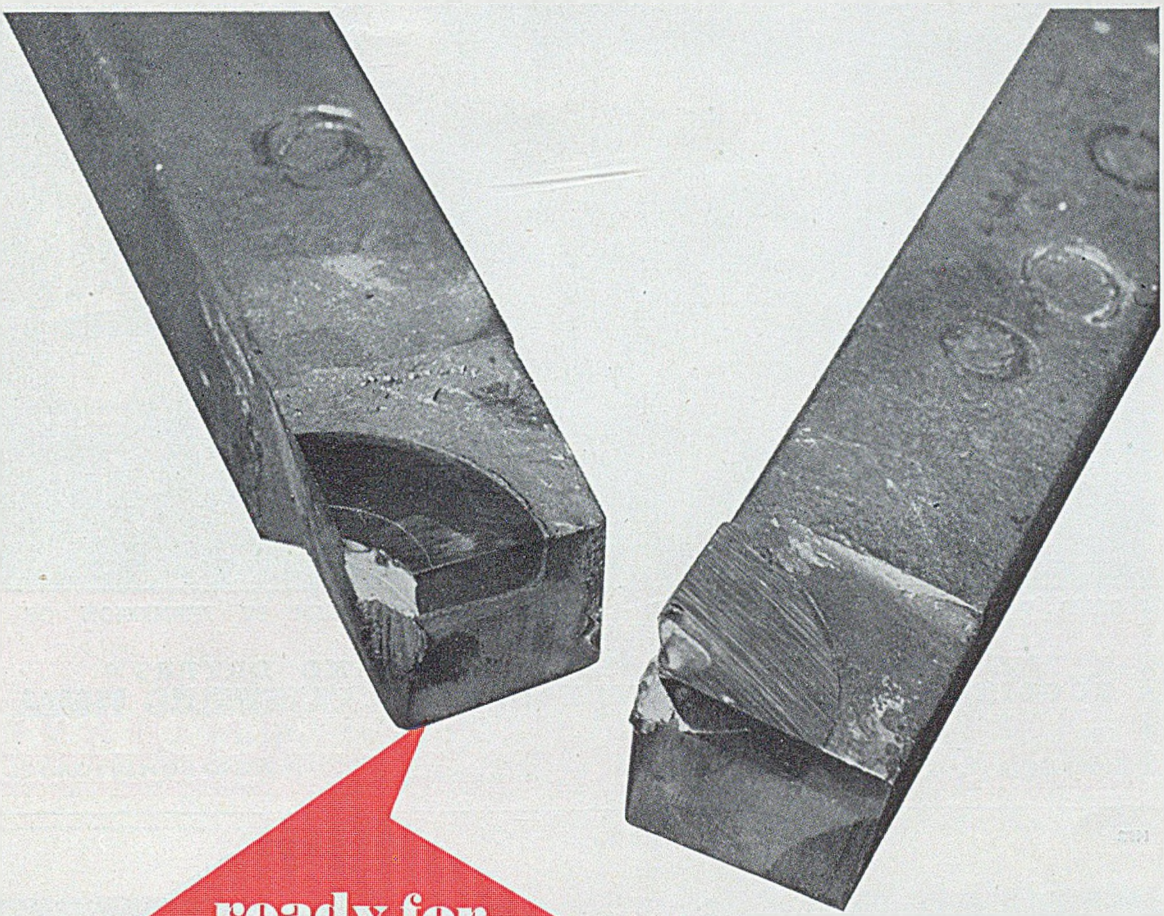
HOOKER

W. J. HOOKER LTD.
4 MIDLAND CRESCENT, LONDON, N.W.3
Phone: HAMpstead 2495

PATTERNMAKERS' Section

PATTERNMAKERS' Section

PATTERNMAKERS' Section



What a bind!

" Every week I have to mess about with dirty clay, daubing the stuff until I feel like an old fashioned potter—and every day I've got to put back the bits that've come unstuck. It's an absolute waste of time."

Have you ever calculated the working hours saved by using pre-fired liners? With hand daubing it takes thirty minutes to refit a ladle, 2 hours to dry out, 15 minutes every day to repair it, with another 10 minutes to dry out, that's 4½ hours a week—and it only lasts a week ! *117 hours in 6 months spent in maintenance. Salamander liner lasts as long without any maintenance. That is only one ladle—think of the hours saved on *all* your ladles. Added to this, there is no wetting or contamination of the metal, reduced heat loss, easier working conditions and a perfect casting every time. It will pay you to change to Salamander Plumbago Ladle Liners.

★ *Figures based on ladle with 1 cwt iron capacity.*

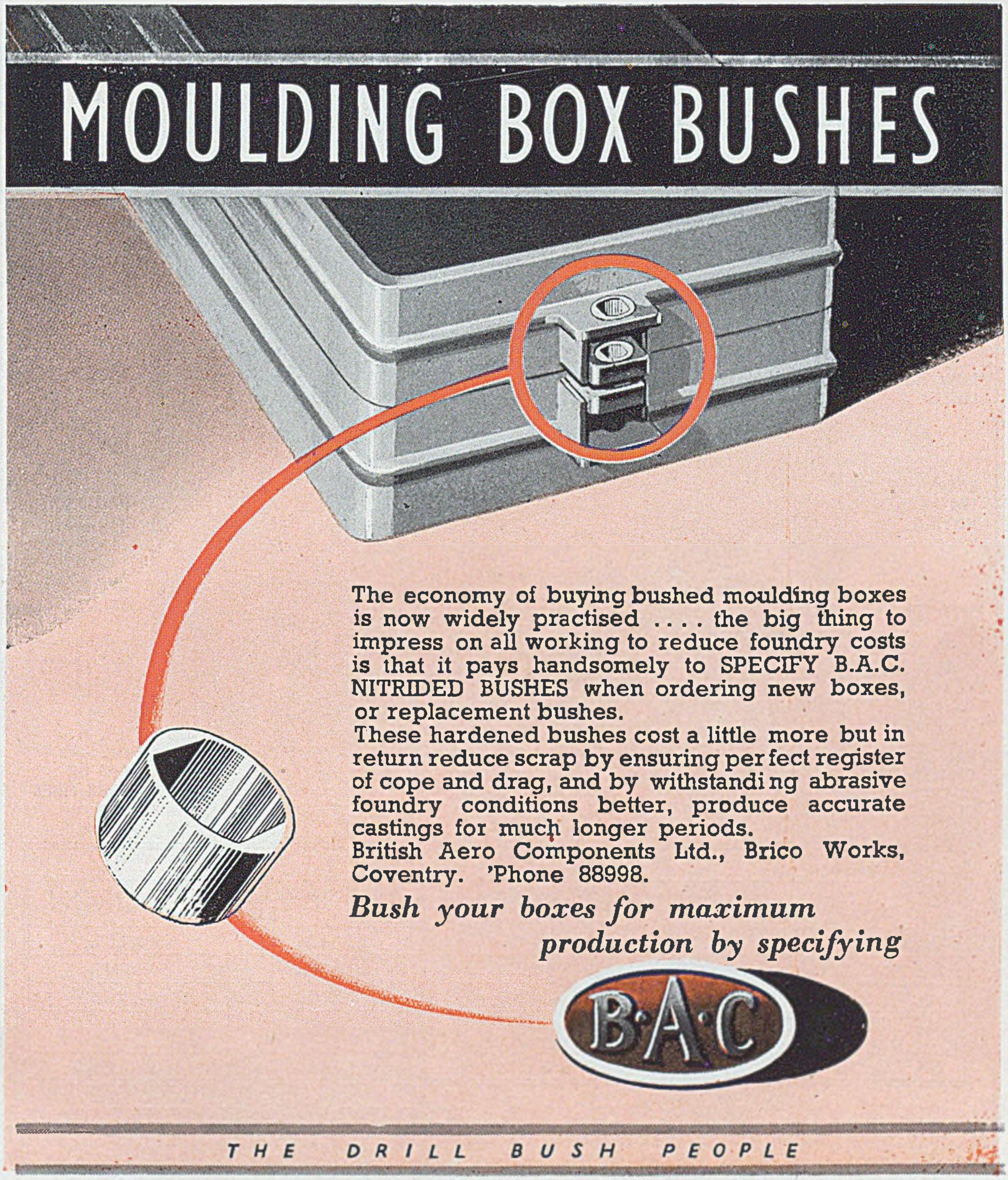
Salamander PLUMBAGO LADLE LINERS

- No contamination of metal
- Cannot cause porosity in casting
- Reduced heat loss
- Simple easy fitting
- Maximum working life
- No slagging
- Regular capacity

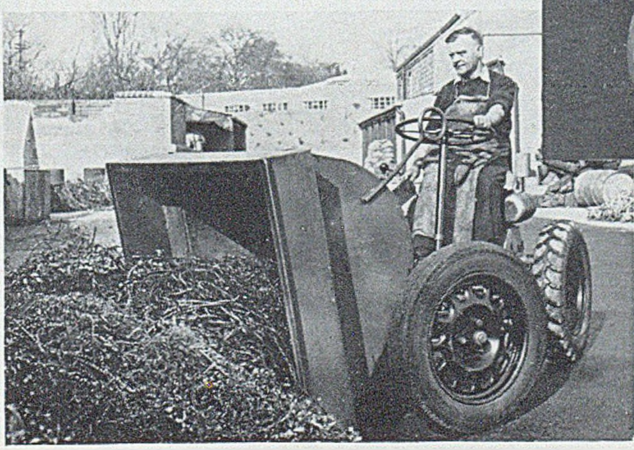
THE MORGAN CRUCIBLE COMPANY LTD

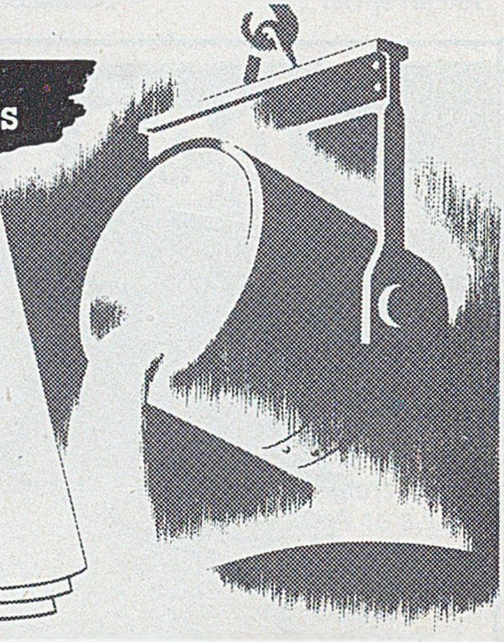
BATTERSEA CHURCH ROAD, LONDON, S.W.11.
Telephone : BATtersea 8822. Telegrams : Crucible, Souphone, London

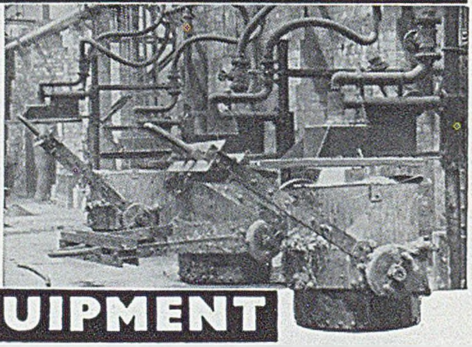
CR 100


MOULDING BOX BUSHES
The economy of buying bushed moulding boxes is now widely practised . . . . the big thing to impress on all working to reduce foundry costs is that it pays handsomely to SPECIFY B.A.C. NITRIDED BUSHES when ordering new boxes, or replacement bushes.
These hardened bushes cost a little more but in return reduce scrap by ensuring perfect register of cope and drag, and by withstanding abrasive foundry conditions better, produce accurate castings for much longer periods.
British Aero Components Ltd., Brico Works, Coventry. 'Phone 88998.
Bush your boxes for maximum production by specifying
B·A·C
THE DRILL BUSH PEOPLE

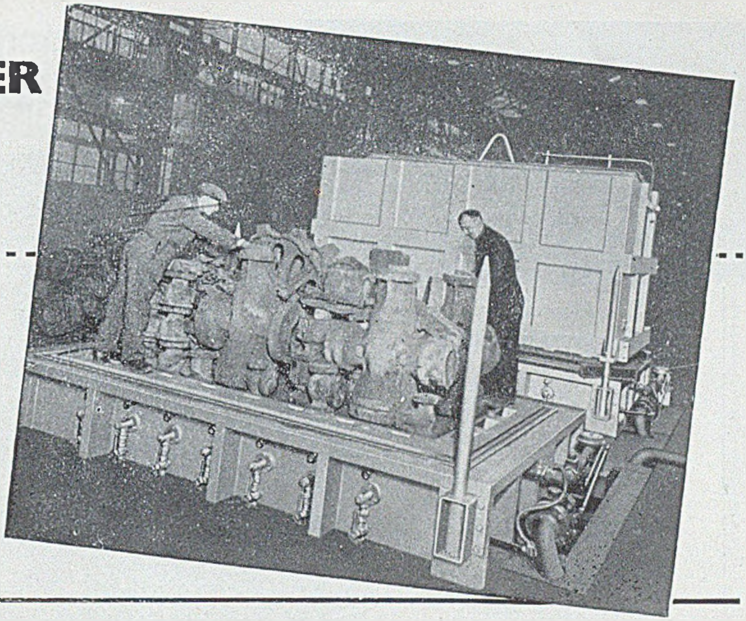
Cogent







PORTABLE COVER ANNEALING FURNACE



The furnace is particularly suitable for the Annealing and Normalising of Iron and Steel Castings.

Features —
Uniform temperature distribution.
High Thermal Efficiency.
Wide range of operating temperatures.

THE DOWSON & MASON GAS PLANT CO. LTD

LEVENSHULME, MANCHESTER Telephone: HEATON MOOR 2261 (3 lines)

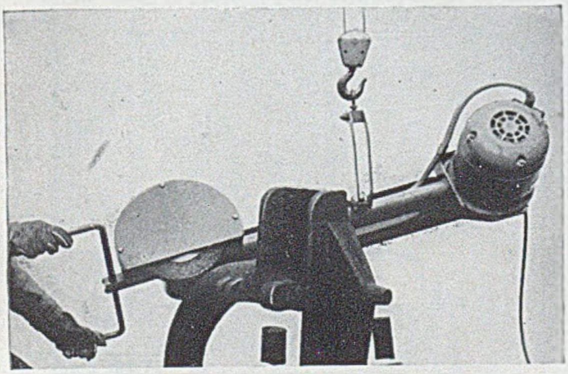
Ballinger

HEAVY DUTY

SWING FRAME GRINDER

DESIGNED FOR MODERN HIGH SPEED RESINOID WHEELS

Powerful Performance for Reduction in Fettling Costs



- LONGER WHEEL LIFE
  AMPLE POWER
- LOW PRICE
- DEEPER AND FASTER CUTS
- GRINDS AT ANY POSITION
- EARLY DELIVERY

Write for List III

L. J. H. BALLINGER LTD.

Station Road, Woodchester, Gloucestershire. *Phone: Amberley 3231*

CREAM X
XX

SS AND SSS
COMPOUNDS

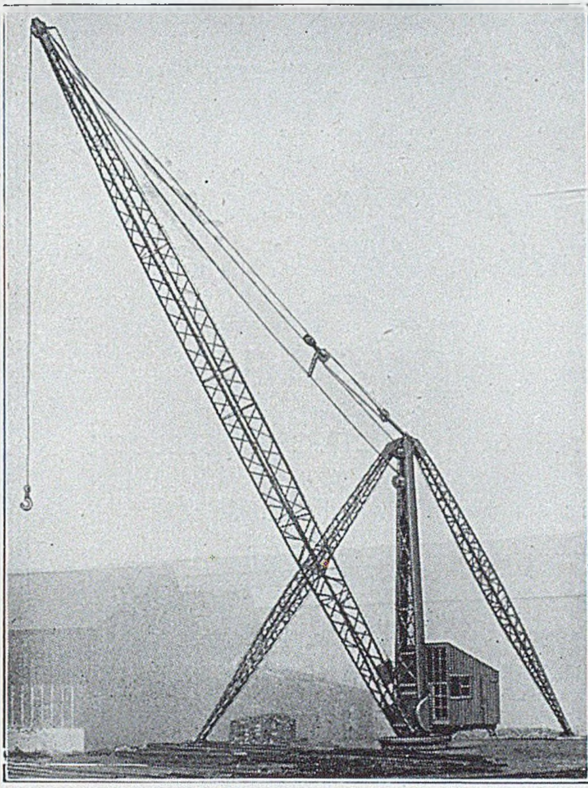
ULTRA

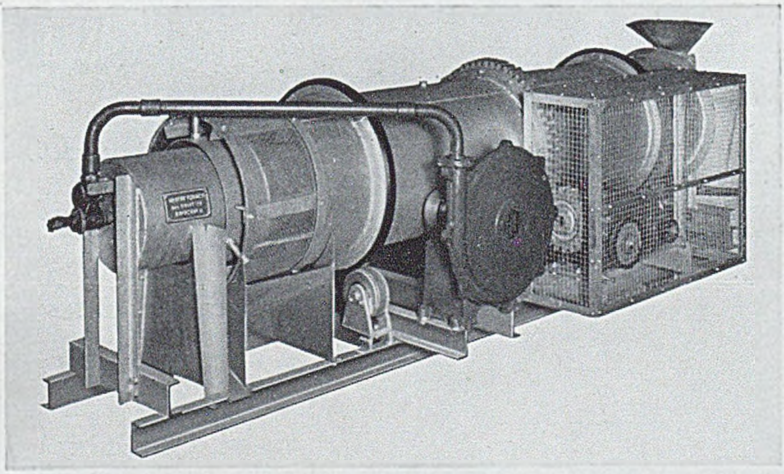
"COROL"

A1 OILS

CORE OILS LIMITED

RIVER STREET WORKS
ROCHDALE
TELEPHONE 2866





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famous throughout the world
BT Moulding machine
BRITISH MOULDING MACHINE CO. LTD
FAVERSHAM KENT

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EST. 1902

VOL. 94
No. 1905
Registered at the G.P.O. as a Newspaper

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