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# Grey-iron Productivity—II

In our leading article of September 21 we commented on the more general conclusion to be drawn from the Report made by a team of ironfounders after their visit to the United States. Attention has since been turned to the more technical aspects. The overall picture of the industries of the two countries is not very different. Yet there are divergencies in detail; these are:—(1) the low-phosphorus content of the pig-irons used in the U.S.A.; (2) the stress laid upon machinability of the product; (3) the importance attached to engineering rather than to metallurgy as the fundamental background to successful foundry practice.

The Report describes and illustrates a wide range of aids to production, yet we should not be surprised to learn that every one of them was used in one or other of Britain's two thousand iron foundries. Moreover, we should be equally surprised to learn that their existence was universally known in the States. For instance, since the publication of the Report we have received a letter from Mr. Bullock of Cruickshank & Company, Limited, of Denny, which points out that he disclosed in an article printed in the JOURNAL many months ago the successful use of pitch as a sand binder. Significantly he says he had a number of enquiries as to the process from our American readers. Yet we deem that the authors of the Report were correct in including a description of the process as it lends weight to its importance. A noteworthy feature of the Report is that it is obvious that there is a diversity of means in use to accomplish any one process. Cupola charging affords an excellent example. A really useful gadget described is the "gapped" crane track which allows routes to be installed at the one level, whilst permitting the passage of goods say at right angles on a monorail. It is a simple notion capable of solving many transport problems. Another feature which must be studied and emulated in this country is the provision of pressure-cast aluminium match plates. There is a good deal of "know how" connected with this process and we understand that substantial progress has been made in this country towards their successful manufacture, despite difficulty in importing an essential material.

There is a phase of the Report which to our mind is most significant. It is one which Mr. S. H. Russell is stressing at every available opportunity and that is, in America, it is the foreman's first duty to see that his operatives are properly supplied with everything they need. Thus the waste of time by the men in going to the stores or another part of the shop for a tool or an extra supply of materials has been completely eliminated. One case of vastly-increased production on essentially jobbing foundrywork was solely due to this factor, plus a rational organisation of the processing. The American attitude to foundry practice is one of the application of "horse sense" to every phase. When a shop is mechanised, there is a realisation that new skills are required and people possessing them are placed in charge at each strategic point. We, too, have been pioneers, and when we first made steel by electricity, some of the old boys gazed at the fractures, even smelt them, and pronounced that it was "All reet—but not as good as t'old stuff." In answer to the query—Why?, all we could get was "It hasn't got *body*." Some of this attitude persists to-day.

## Contents

## Metallurgical Education

THE RECOMMENDATIONS on University full-time degree courses in metallurgy have now been published. They result from the work of a committee, the personnel of which was drawn from the Iron and Steel Institute, the Institution of Mining and Metallurgy, the Institute of British Foundrymen, the Institute of Metals, the Institution of Metallurgists and the scholastic professions. The committee have summarised their recommendations in the following terms:—

(1) The University Schools of Metallurgy should ensured that entrants have attained to a higher standard of English than is at present required.

(2) The instruction given during the first year of a four-year degree course should include some work in the humanities in addition to intermediate chemistry, physics and mathematics.

(3) No university should confer a degree in metallurgy without proof that the graduate can read technical literature in at least one foreign language with reasonable ease.

(4) University instruction should be held to a middle course, avoiding both excessive detail in the study of metallurgical processes and undue concentration on pure science.

(5) Universities and industry should keep in close touch in order to concert the best means of teaching the undergraduate something of the technique of metallurgy during his vacation periods.

(6) Industry and graduates should both accept the fact that a university graduate on gaining his degree can become proficient in the technique of the special branch of metallurgy which he has chosen only by further study and experience.

(7) All assistance possible should be given to the universities to enable them quickly to provide adequate halls of residence.

No views have been expressed as to post graduate courses.

Editorially, we submit the following comments:—

(1) It is worth remarking that those who have advanced in the profession of metallurgy can and do express themselves excellently both in the spoken and written word. This is not just accidental.

(2) It can be presumed that modern conditions call for such instruction. More leisurely times enabled the student to acquire this knowledge by participation, voluntarily, in diverse literary and artistic pursuits.

(3) The acquisition of a second language is desirable, not merely from the mundane aspect cited, but from a cultural point of view.

(4) This is an excellent recommendation for one encounters metallurgists who are abysmally ignorant of processes outside their immediate interests, due to the restricted nature of their professional training.

(5) This, too, is excellent, but a phrase reading, " preferably abroad," might have been included.

(6) and (7) These are a *sine qua non* and apply to all professions.

## Public Works and Municipal Services Exhibition

THE JOINT EXHIBITION of public works and municipal engineering equipment held at Olympia from November 13 to 18 was a revelation of the degree to which mechanisation can be applied nowadays to what were traditionally pick, shovel and wheelbarrow jobs. As would be expected, many well-known foundry concerns were amongst the list of over 230 exhibitors, in fact one of the largest and most impressive was that of Stothert & Pitt, Limited, of Bath, who showed *inter alia* a modern mobile asphalt plant producing 15 tons per hour.

Oil-engine and compressor manufacturers were well represented, such names as Armstrong-Whitworth, Associated British Oil Engines, Aveling Barford, Broom & Wade, W. H. Dorman, Holman Bros., R. A. Lister, Marshall & Sons, Ruston Bucyrus and Sentinel being among the founders whose finished products come within this category. Not less important were the makers of miscellaneous contractors' machinery, such as for instance, Wingets, Limited, Consolidated Pneumatic Tool Company, Limited, Mavor & Coulson, Thos. W. Ward, Limited, and Newton Chambers & Company, Limited. On the Winget stand a powered wheelbarrow was shown for the first time. This was originally designed for servicing a concrete mixer, but has obvious application for moving sand in foundries.

There was shown a plethora of earth moving and excavating equipment, tractors and the like, the emphasis throughout being on extreme robustness. Several very large crusher castings on the stand of Pegson, Limited, demonstrated the peculiar fact that for jobs of this type roughness of surface finish is no detriment to the working and actually enhances the impression of solidity and strength.

This mechanisation of heavy outdoor work has grown to such proportions over the last decade that the plant now exhibited is most awe-inspiring when so much is seen together. One tractor may look quite small in a 40-acre field, but put a dozen or so in Olympia and give them numerous bulldozers, road rollers, excavators, graders and crushers for company and the result is an earthworm's nightmare.

Gulley-grates, manhole covers, pipes, road signs and the like were well exhibited by the foundry makers, the stand of Dover Engineering Company, Limited, holding a prominent position. Vitreous-enamelled signs likewise were shown in considerable variety.

Among the galleries mainly was shown ancillary equipment ranging from pipe-bending machines to duplicating and accounting machinery. No section of the industry seemed neglected and the consensus of opinion showed worthwhile interest by buyers and general public alike. Healthy competition was obviously a ruling motive in the enormous collection of machinery presented; the organisers and stand holders are to be congratulated in assembling together so great a representation of British-made plant; home and overseas visitors alike must have received an indelible impression of British pre-eminence in this field.

**INDEX TO VOLUME 88**

**The index for Volume 88 of the "Foundry Trade Journal" covering the period January 5 to June 29, 1950, has now been printed and is available to readers on writing to the Publishing Office of the Journal, 49, Wellington Street, London, W.C.2.**

# Hot-dip Tinning of Cast Iron

*By W. E. Hoare, B.Sc. (Eng.), F.I.M.*

*As a finishing process for cast-iron articles and components, hot-dip tinning is attractive due to the relative simplicity of the process, the protective and hygienic values of the coating, and the pleasing, bright appearance of the finished goods. These virtues have led to wide adoption of the process in the manufacture of food-preparing and handling equipment and kitchen wares such as pans, mincing machines and heavy vessels. The process is also used, though to a lesser extent, in the engineering industries, since hot-tinning provides a bond layer which facilitates, for example, the good lining of cast-iron bearing shells and the joining of cast-iron parts by soft-soldering.*

THE COMMONLY-ESTABLISHED methods for hot-tinning steel, which involve the successive steps of cleaning, pickling, fluxing and dip-tinning, give only a limited degree of satisfaction when applied to usual grades of cast-iron. The basic reason for this is that the structure of grey machinable irons contains graphitic carbon which is inimical to tinning and which has adverse effects unless special preparation procedures are employed.

Cast irons intended for tinning are either grey machinable irons or certain high-duty or special cast-irons such as are used for engineering applications. It is interesting to observe that certain of these latter irons, where special attention may have been given to homogeneity and type of structure, may tin more readily than the commoner grades. In general, high-carbon, high-silicon irons are less amenable to tinning, and it is deemed advisable not to exceed 3.5 per cent. carbon. A limit of 2.7 per cent. for silicon has previously been advised but recent experience has shown that irons up to 3 per cent. silicon can be tinned if the proper procedure is used. Phosphorus up to at least 1.3 per cent. is not disadvantageous and probably higher contents can be tolerated. Annealed cast iron is generally inferior in tinning quality to iron in the as-cast condition.

Castings which are porous are the bane of the tinner, particularly if the porosity be close to the surface or extends from it. In making castings destined for tinning, every effort should be made to turn out a solid, homogeneous product.

### Principles of Surface Preparation

When the surface of cast iron is attacked by a pickling or etching agent, graphite tends to exude from exposed flakes and form a scum over the whole surface. Molten tin will not alloy with or spread on such a surface, and if cast iron is prepared for tinning by simple pickling, very little success will be obtained (see Fig. 1). It will be clear that there are several logical lines of approach towards the solution of this problem of the obtrusive effect of graphite. These lines have been followed up in various investigations and have resulted in the development of a number of satisfactory and acceptable preparation procedures (Fig. 2).

First, it is generally desired that as much preparation as possible should be done by mechanical methods such as grinding, machining or shot-blasting. Grinding and machining give very satisfactory initial preparation but, where technically feasible, fine shot-blasting seems to give the best results. Not only does it provide a clean surface with a good " key " but the blasting effect may itself lift out some of the surface graphite. No. 70 angular grit has been found very good. Also, the finish given by machines of the " Wheelabrator " type provides a suitable surface for tinning. Secondly, a fruitful line of approach is that of attempting to remove surface graphite so that it cannot interfere. This principle has led to the development of such procedures as furnace de-carburisation (now not greatly favoured) and to chemical oxidation procedures such as the T.R.I. nitrate process and the Kolene process.

A third method is to cover the offending graphite by plating over it, either by electro-deposition or by chemical replacement, a thin coating of a readily-tinnable metal such as iron, copper or nickel. Chemical replacement coatings are deemed of little value, and electro-deposits of copper and nickel suffer from certain inherent disadvantages in this particular application. Pure iron plating is, however, widely used as a preparation for tinning cast iron. A fourth line of approach is to improve the fluxing action to a point where no pickling is necessary. Developments in this direction have been the T.R.I. chloride method,* and other methods, suitable for certain irons, using special aqueous flux solutions.

Although all the above basic methods are, or have been, used, the three most important procedures extant are appraised to be iron plating, chemical oxidation and the special fluxing techniques. These are briefly described below.

### Iron Plating Method

*Electro deposition*

The casting is first mechanically cleaned by one of the methods mentioned above, or by barrel tumbling. If there is any possibility of oily contamination (*e.g.*, from the blasting air compressor) the pieces should be given a vapour treatment in trichlorethylene. A light pickling treatment is sometimes deemed necessary but it is emphasised that

* It is interesting to note that in an article published in our issue of June 15, 1944, it was stressed that the process would only be revealed after permission from the Ministry of Supply to firms engaged on war-work—*Editor.*

*Hot-dip Tinning of Cast Iron*

this should be of very short duration and, when possible, avoided altogether. Suitable acid mixtures are:—

| | | parts by volume |
|---|---|---|
| 1. | Commercial hydrofluoric acid* | one |
| | Concentrated sulphuric acid | one |
| | Water | eight |
| | (Use at shop temperature) | |
| 2. | Hydrochloric acid (conc.) | one |
| | Water | four |
| | (Use at shop temperature) | |

After thorough rinsing the articles are hung in the plating bath by wiring or on special jigs. Internal as well as external anodes are required for articles of complicated or hollow shape. A number of electrolytes are employed, a typical one being ferrous ammonium sulphate. The bath is operated at shop temperature and at a cathode current density of 10 to 15 ampères per square foot. Plating is continued until all parts of the castings are covered with a smooth, uniform, light-grey deposit of pure iron. The thickness of the iron plating is usually from 0.0002 to 0.0005 in.

### *Tinning*

After thorough rinsing, the plated castings should be tinned as soon as possible, but if the tinner is not ready they should be stored until required in water containing 0.5 per cent. hydrochloric acid. The castings are then fluxed by dipping in an aqueous chloride solution. There are a multitude of formulæ for aqueous tinning fluxes but one which gives excellent results contains:

| | |
|---|---|
| Zinc chloride | 24 lb. |
| Sodium chloride | 6 lb. |
| Ammonium chloride | 3 lb. |
| Commercial hydrochloric acid | ½ pint |
| Water | 10 gallons |

Normally, two molten tin pots are used in this process. The temperature of the first dipping bath should be 300 deg. C. (± 5 deg. C.) and its surface must carry a thin layer of molten flux. This layer has the triple purpose of preventing surface oxidation, promoting tinning, and obviating spatter when the cold castings are introduced. The duration of immersion in the first pot, in the case of electro-ironed work, need only be long enough to ensure that the casting has fully reached 300 deg. C. The piece is then immediately transferred to the second tin pot, held at 245 deg. C. and covered with a thin layer of palm oil, tallow or mineral-base tinning oil. The time of immersion here is about one minute, after which the piece is removed, shaken mechanically or by hand to remove excess tin, and quenched by plunging into a bath of kerosene, light quenching oil or into a 6-in. layer of kerosene floating on water. Vapour degreasing or rubbing in warm wood meal with sheepskin rubbers completes the finishing process.

The second tin dip followed by oil-quenching is employed where coatings of fine appearance and high protective value are required. Where tinning is being employed only as a preliminary to soldering or bearing lining, these steps may be omitted and the castings are air-cooled or water-quenched after the first tin dip. However, the use of pure iron plating as a preparation procedure usually presupposes that the former type of coating is sought.

(a) (b)

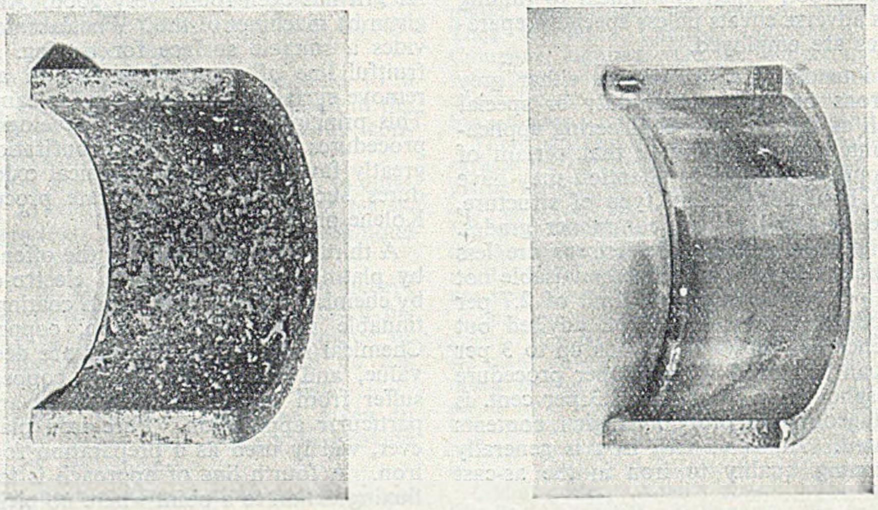

FIG. 1.—*Tinned Iron Bearing Shells, showing Effect of Preparation:—(a) Non-wetting Tendency after Ordinary Pickling, (b) Perfect Wetting after Fused Salt Treatment.*

* When handling solutions containing hydrofluoric acid, gloves should always be worn and contact with the hands carefully avoided.

### Chemical Oxidation Processes

*Kolene Process*

This process, developed by the Kolene Corporation, has achieved an interesting degree of acceptance in the United States. Full technical details have not been published and some variations in procedure have been noted since the process was first developed. Generally, however, a treatment in molten oxidising salts at about 470 deg. C. is followed by a series of surface oxidation and reduction steps obtained by imposing a reversible electrolytic potential between the work, which forms one electrode and the steel tank which forms the other. The purpose of the processing treatment, which, on basis of results inspected, appears to do its job very well, is to oxidise surface graphite and finally to reduce any surface iron oxides which may have formed during the oxidation cycles. Once the iron surface is correctly prepared, tinning is carried out by the usual methods.

*T.R.I. Nitrate Method*

This chemical oxidation method was devised for use when the highest possible adhesion values are required as in bearing lining and soldering. Its use is not generally recommended for article tinning where the more convenient "chloride" process is applicable. In the nitrate method, the mechanical cleaning is followed by light pickling, *e.g.*, 30 sec. in 10 per cent. sulphuric acid (inhibited) at 85 deg. C., or 2 to 5 min. in cold 50 per cent. (by volume) hydrochloric acid. The castings are then rinsed in hot water, *thoroughly dried* and subsequently immersed in an oxidising salt bath containing a mixture of equal parts of sodium and potassium nitrates held at 350 to 400 deg. C. The molten salt* may be contained in an ordinary welded steel or cast-iron pot suitably heated by gas burners or other convenient means.

Usually a time of immersion of 15 min. is sufficient to oxidise surface graphite but the time may be extended if necessary. The castings are removed, allowed to cool and the adhering layer of nitrate salt rinsed off with cold water. It will be observed that in oxidising out the graphite flakes (see Fig. 3) the surface ferrite has also been oxidised and to remove this film the work is pickled for 1 min. only in a cold 10 per cent. solution of hydrofluoric acid. Aqueous fluxing and tinning are then carried out in the usual way.

### Fluxing Methods

*T.R.I. Chloride Method*

This method is widely applied to article tinning and has the merit of simplicity both in operations and plant required. It is applied particularly to the tinning of light articles, *e.g.*, domestic mincing machines (Fig. 4), and in a modified form is used for wipe-tinning of large bearing shells.

The mechanical preparation may be carried out by machining, grinding, or fine shot-blasting, the

* Molten nitrates are highly dangerous unless the proper precautions are observed. A nitrate salt must not be used before the relevant instructions and advices have been carefully studied and understood. Such instructions are obtained from A.I.D. Inspection Instruction No. M414, or from the Fire Offices Committee, or from suppliers of the salts, *e.g.*, Imperial Chemical Industries.

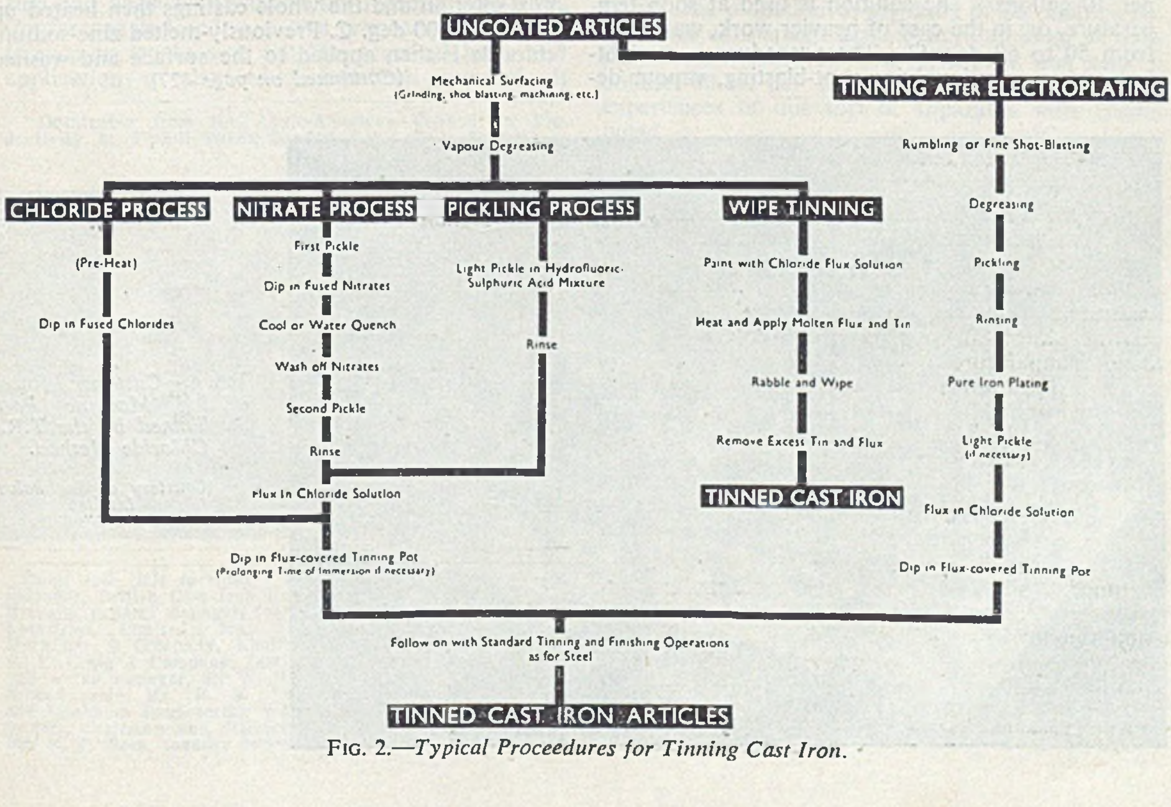


FIG. 2.—*Typical Proceedures for Tinning Cast Iron.*

*Hot-dip Tinning of Cast Iron*

last method being generally preferred. A vapour treatment in trichlorethylene may be interposed if deemed necessary and the work then immersed in a bath of molten flux prepared by mixing $3\frac{1}{2}$ parts zinc chloride and 1 part of sodium chloride. The fused salt bath is maintained at about 310 deg. C. and the container must be made of a material which is not attacked by the hot salt. The heat-resisting nickel-chromium-iron alloys are eminently suitable; Monel and graphite have also been used successfully.

The duration of immersion in the salt bath is quite short, and usually in the range of 10 to 40 sec. after the crust of solidified salt, which initially forms on the cold castings, has melted off. The articles are then immediately transferred to the first tinning pot (at 300 deg. C.) and held immersed there for at least 5 min. before passing to the second pot. In the chloride process, prolongation of the time of immersion in the first tin pot is beneficial, but the period of immersion in the fused salt should never be increased beyond the *minimum* required to give a satisfactory coating.

In certain cases it is found that the time of immersion in the salt bath has to be very short indeed, sometimes less than 5 sec. This is often a good indication that the iron is suitable for tinning by aqueous fluxing only. The aqueous flux may be the solution given earlier though the content of ammonium chloride is sometimes increased to 5 to 6 lb. per 10 gallons. The solution is used at shop temperature, or, in the case of heavier work, warmed to from 50 to 60 deg. C. The procedure is straightforward, merely involving shot-blasting, vapour degreasing, aqueous fluxing and tin-dipping. The time of immersion in the first pot should be at least 5 min.

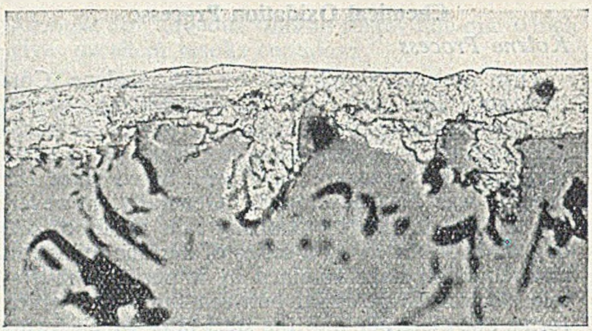


FIG. 3.—*Tin Coating on Cast Iron prepared by the T.R.I. Nitrate Method* (× 500). *The Tin has Penetrated Surface Fissures left after Graphite Flakes have been Oxidised Out.*

### Wipe-tinning with Chloride Flux

Wipe-tinning of cast iron is frequently practised both on food vessels, where a coating may be required only on inside surfaces, and on large bearing shells which are too cumbersome to dip-tin (Fig. 5). After thorough cleaning of the tinning surfaces, the castings are placed on trestles, or on a hearth, or surrounded by a suitable mantle so that they may be conveniently heated by gas burners or coke fire.

In order to avoid undue oxidation during heating, the tinning surfaces are first painted with aqueous flux solution and the whole castings then heated up to 270 to 300 deg. C. Previously-melted zinc-sodium chloride is then applied to the surface and washed

(*Continued on page* 427)

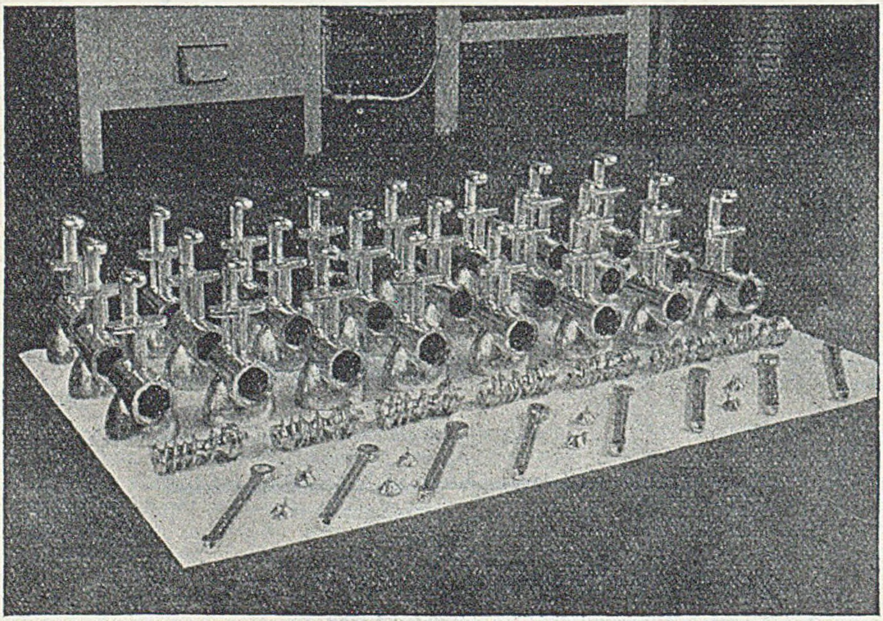

FIG. 4.—*Cast-iron Mincing Machine Parts Tinned by the T.R.I. Chloride Method.*

[*Courtesy of Technalov, Limited*

# Technical Aspects of Productivity

## *B.C.I.R.A. Two-day Conference at Ashorne Hill*

A GATHERING which strained the accommodation at Ashorne Hill, near Leamington Spa, was present at the Conference on October 12 and 13 organised by the British Cast Iron Research Association to discuss the technical aspects of the Grey Ironfounders' Productivity Report.* There were registrations of about 250 delegates, though of course, this total was not present at all the sessions; approximately 150 foundries were represented. Practically all the members of the Productivity Team were present throughout the Conference, and contributed in no small measure to its success by being available to answer questions both in public session and in private discussion. The first session, on the afternoon of October 12, was preceded by an address of welcome by the president of the Association, Mr. P. H. Wilson, O.B.E., deputy managing director, Stanton Ironworks, Limited. He stressed mainly the need for intensive study of the Report in all its manifold implications. During this welcome to delegates it was disclosed that the response had been so large that many applications to attend had to be refused.

The first speaker of the afternoon session was Mr. S. H. Russell, who had acted as Productivity Team leader. In discussing the general aspects of his team's report, he said that, as the managerial side had been dealt with at the recently held C.F.A. Conference in London, it was proposed at this conference to try to sort out the practical hints and applications of plant which had been recorded. It was, however, impossible strictly to separate technical from managerial sides and discussion embracing both would not be barred.

* Obtainable from the Anglo-American Council on Productivity, 21, Tothill Street, London, S.W.1, price 3s. 6d.

### Sand Practice

The next speakers, Mr. W. B. Parkes, Mr. H. B. Farmer, and Mr. M. Martin, dealt with sand practice in the United States, covering such aspects as handling and storage, green-, dry- and core-sands, and mixing and distribution methods. Their remarks followed closely the lines of the report itself and it was in the discussion which followed that some greater detail was elucidated. Well brought out were the uses to which Sandslingers could be put; the advantages of wood flour and pitch in moulding sands and the adaptation of mechanisation to sand handling and storage. Speakers contributing to the discussion mainly quoted individual examples to show as-good-as or superior results to the Americans.

The next section, on metallurgical aspects, was opened by Dr. Angus; Mr. G. W. Nicholls, and Mr. N. Charlton, dealing with the stockyard, equipment and methods respectively. Again, the Report itself was closely followed, though amplified in some minor respects. In the discussion, the varied uses of a magnet crane for metal handling were stressed as was the reduction in manning of the melting department consequent upon better handling. A dust-suppression outfit fitted to a cupola was said to collect 40 lb. per hour per ton charged; British experiences of this sort of apparatus were contributed.

*Members of the Grey Ironfounders' Productivity Team photographed on their return from the United States.*

*Front row (left to right)*: Dr. H. T. Angus, development manager, British Cast Iron Research Association; Mr. G. W. Nicholls, general manager, foundries and patternshop, Modern Foundries, Limited; Mr. M. Martin, foundry foreman, Markham & Company, Limited; Mr. J. Stewart, moulder, A. F. Craig & Company, Limited; Mr. A. Kirkham, director and works manager, Sir W. H. Bailey & Company, Limited. *Second row*: Mr. R. M. Lumsden, patternmaker, Fraser and Chalmers Engineering Works; Mr. S. H. Russell (team leader), chairman and director, S. Russell & Sons, Limited; Mr. E. J. Ross, foundry technician, G. & J. Weir, Limited; Mr. W. R. Marsland, foundry technician, Newman Hender & Company, Limited. *Third row*: Mr. H. B. Farmer, director and works manager, Rice & Company (Northampton), Limited; Mr. G. B. Judd (team secretary), chartered accountant, Mann, Judd & Company; Mr. W. B. Parkes, assistant development manager, British Cast Iron Research Association; Mr. H. Hendy, moulder, Davy & United Engineering Company, Limited. *Fourth row*: Mr. N. Charlton, chief foundry metallurgist, C. A. Parsons & Company, Limited; Mr. C. Blackburn, moulder, T. H. & J. Daniels, Limited.

*Technical Aspects of Productivity*

Perhaps the most significant finding from these first sessions was that little if anything in America was new to us, and in many cases individual citations showed improvement over the States. Where, however, our experience was confined to one or two foundries, in the States the methods were more generally applied.

### Second Session

During the first session, questioners had been asked to come to the rostrum to address the audience. It became apparent that this practice was a deterrent to free interchange of opinion, and the second session, on the Friday morning, was prefaced by an announcement reverting to the normal method of discussion from the body of the hall. Similarly, it had become clear that the majority of the audience were already cognisant with the text of the Report and its incorporation in the remarks of the individual speakers was superfluous. Therefore, it was decided to dwell only on those aspects of the Report which seemed to offer most profit from exchange of opinion among the delegates.

A further explanatory note was given by Mr. S. H. Russell, concerning the selection of foundries which the Team had viewed. Mr. Russell said the American arrangements for the visits had concentrated deliberately on mass-production foundries because it was felt the team would learn more from them. Several quite small foundries were however visited, some producing a large range of castings on short runs only. The fundamental difference between the small American foundry on really short runs and the British foundry on similar work lay in the servicing which was rendered and the thought and planning put into jobs before they reached the foundry floor.

### Training and Education

Training and education was the first general heading for the morning and was dealt with by Dr. Angus on the technical side, and by Mr. G. B. Judd on the managerial side. It appeared that the States has an advantage in the vocational bias of education at an early age and the readiness with which even high-school graduates accept jobs in the lower grades of foundrywork to begin with. The emphasis was not so much on craft training as on inculcating receptiveness of mind to provide operatives who get on with the job while all the time searching around for a better way to do things and improve their individual status. Mr. Judd in a lively, all-embracing summary boiled the American attitude down to "sink or swim—personal ego—independence—and confidence in self and the industrial future". It was provocative also to hear his appreciation of the profit motive, the observation that perhaps British management got the type of Union co-operation it deserved, and his appraisal of the American attitude to capital expenditure. The American system of costing, Mr. Judd described as possibly inaccurate in fine detail but infinitely to be preferred to the total lack of any system, from which so many British foundries suffered. This section was concluded by remarks by Mr. Charlton on foremanship. In the discussion it was queried how American foremen would react to British conditions and in the face of our restrictive practices. American managements in this country were said to have a lower record of productivity than our own. Finally, the assurance of the team was sought that the obvious implications of their findings as to the disastrous effect of present-day taxation had been made clear in Government circles. This was replied to in the affirmative by Mr. Russell.

### Mechanical Aids

Next came talks by Mr. Kirkham and Mr. Marsland on mechanical aids, and by Mr. Farmer on transportation. The first two were illustrated by a number of slides showing methods adopted in America; the use of the pop-off flask receiving considerable emphasis. Fork-lift trucks with high manœuverability were said to be replacing the conventional platform type. The discussion on this part ranged around the lack of detail in the method given for aluminium match-plate pattern production and the difficulty in obtaining materials; was maintenance better taken care of in the States—the reply being that maintenance was no better in quality but much quicker in arriving.

### Moulding and Core-making

Mr. E. J. Ross was the first speaker in the next section on moulding operations and foundry layout. He stressed that the emphasis on repetition methods was not a bad thing because jobbing founders could thus "borrow" successful and well-tried methods for adaptation to their own. Mr. G. W. Nicholls showed a number of illustrations including one of the foundry of Mr. H. P. Good, president of the Gray Iron Founders' Society of America. This showed a mechanised installation of combined roller, bank, and powered-loop conveyors. The relative merits of jolt-ram and Sandslinger moulding were subsequently discussed, Mr. Nicholls favouring jolt-ram machines for his type of work. A delegate who was actually exporting raw iron castings to America in spite of local competition, said that the Americans seemed amazed at our reasonable charges for pattern work.

Core-making was dealt with by Mr. M. Martin after the luncheon break. Points from the Report were elaborated upon and further illustrated. A two-storey core shop adjacent to a single-storey foundry was picked out as a worthwhile layout for using vertical continuous stoves. An account of phenomenal core-production figures from cartridge-type core-blowers in this country and the use of Sandslingers for ramming multiple core-boxes was given by a member of the audience to emphasise that, on some individual units, British technology was in front. It transpired that the team in America saw little use being made of synthetic-resin bonded sands or electronic core baking.

### Planning and Amenities

On the topic of planning of operations and saving of time, Mr. H. B. Farmer introduced the subject by saying that in the United States control was vested in the initiative of executives and not in any rigid system. Prompt action on the spot was always possible. Among a smaller staff over-all there were more floor executives. Mr. H. Hendy dealt with planning from the operatives' standpoint—the elimination of non-productive time, servicing of producers and the application of standard times and labour-saving gadgets. The lack of provision in U.S. foundries for box-part storage was quoted in the discussion as another example of American specialisation—there were no "spare" box parts.

On the purely one-off jobs, much use was made of wooden boxes or boxes assembled from standard parts. Much further discussion took place at this juncture on American and British labour relationships with managements, Mr. Russell emphasising the statement that American Unions and labour are fully co-operative as long as they get a share from any increased productivity or improved method.

The lighting, heating, and ventilation of foundries in America was next introduced by Mr. N. Charlton. Generally, it seemed that discounting provision against the normal climatic conditions of very-hot/very-cold according to season, American foundries paid less attention to these subjects than we had in this country in recent years. The discussion concerned points of detail, *e.g.*, vacuum cleaners; side *versus* underground-suction at knock-outs; rate of atmosphere change and the use of wetting agents for dust suppression.

### Duplicate Conference

An interjection at this point in the proceedings was made by Dr. J. G. Pearce, director, B.C.I.R.A., who announced such had been the overwhelming nature of applications that a duplicate conference would be held for those who had had to be refused accommodation at the present one.* Priority would be given to those disappointed earlier, and it was hoped that many members of the team would again be able to participate.

Dr. Pearce also proposed a vote of thanks to Mr. Russell and the other team members for their preponderating share in making a success of the conference. There were, he said, still openings for further productivity teams under the existing scheme, due to expire in June, 1952, at the latest.

The concluding section of the conference began with a commentary by Mr. G. B. Judd on the statistical information disclosed in the Report. Although he admitted in detail the possible loopholes which might render some of the comparisons less accurate, Mr. Judd emphasised the inescapable conclusions of the Report. On tonnage, sales value, power, wages, costs and all bases of comparison, our figures were much poorer than the Americans.

* This second conference was held at Ashorne Hill on November 16 and 17. About 160 participated, comprising mainly the younger foundry technologists. Much worthwhile discussion followed the presentation of the papers.

So convincing was Mr. Judd that it would perhaps have been an improvement for him to have initiated rather than concluded the proceedings. Such "shock tactics" might have provided a useful stimulant.

In the subsequent remarks from the floor, the pertinent question as to the part played by capital investment on productivity was posed, but not statistically answered owing to the impossibility of expressing capital in man/hours or production value/tons. Without information on this aspect, the questioner implied that to compare figures for this country and America was like relating the sand-moving capacity of a man with a hand shovel with that of a man with a 5 cub. yard dumper. Another speaker considered it was the size of orders and the acceptance only of suitable orders which contributed so much to American productivity. Dr. Pearce asked was it possible for the United States to export castings to Great Britain or *vice versa*. No cases of incoming raw castings were reported, but there were several cases of raw castings from this country being sold competitively in the States.

### Summing-up

The implications to be derived from the papers and discussions were ably summed up by Mr. S. H. Russell in terms not dissimilar from those listed in this account. Finally, he proposed the setting-up in each foundry of a small committee with time to plan production in advance, and capable of taking executive decisions. It was obvious that many delegates felt that for greater productivity technical advancement in this country was well in pace, at least in individual cases, with that in America. It was also clear that in the minds of the delegates these matters were secondary to the managerial problems and labour relationships which had been discussed at the London C.F.A. Conference. What was wanted was some means of overcoming the general frustration of effort in all spheres of activity due to high taxation, lack of real incentives and "feather-bedding" of drones.

## Bradford Firm's Saving Effort

Crofts (Engineers), Limited, founders, power and transmission engineers, of Thornbury, Bradford, add 2½ per cent. interest to all employees' savings invested through Crofts Bank, and are able to report a record total of £37,798 saved during 1949-50, the highest of any year since the war. A further appeal has been launched by the directors of the firm and all its subsidiaries for employees to make a special effort for the Festival of Britain Savings Year, which ends next July. The target aimed at is £60,000, and the result will mean increased sums to spend on holidays and for visits to the Festival exhibitions in London. The efforts of the employees of this firm have resulted in a total of £349,275 being raised since 1940.

MR. D. G. ARMSTRONG has joined the staff of the research laboratories of the General Electric Company, Limited, at Wembley.

# Testing the Metal or Testing the Casting*

## Notes on the New Swedish Cast-iron Specification

### *Discussion of Mr. E. O. Lissell's Paper*

PRESENTING THE PAPER, Mr. Lissell said it redeemed a promise he had made, when members of the Institute had visited Sweden in 1948, that he would deliver a Paper at the Annual Conference when Mr. Sheehan was president.

THE CHAIRMAN (Mr. Colin Gresty) commented on the great interest of the Paper and the very concise manner in which it was presented. Some years had passed since Mr. Lissell had addressed an audience in the English language, and he had acquitted himself well.

MR. C. A. PAYNE added his congratulations to Mr. Lissell on a most admirable presentation of the Paper. He said the thoughts expressed by Mr. Lissell were the same as his own, and he had no greater criticism to offer than that they had not arrived at quite the same conclusions. He felt, however, that to some extent possibly Mr. Lissell was handicapped by considering the larger sizes of castings, just as he himself was handicapped by considering smaller sizes.

As the result of his study of the "rim" effect and the sensitivity of the section and the volume under stress, the Author had arrived at a test-bar of 0.8 in. diam.—roughly the same as our 0.798 in. diam. bar—as being about the ideal. Incidentally, Mr. Payne regarded the 0.798 in. bar as being too large for many light castings. In connection with rim sensitivity and the size of test-bar he said that his company had used test-bars, cut from actual castings, and machined somewhere in the region of 0.6-0.7 in. diam., and they had not been satisfied with the results. Anticipating that they might obtain lower results, they had had some smaller test-bars made from the broken pieces, down to 0.254 in. diam. suitable for the tensometer machine, and he had records of at least six cases where the tensile strength in these smaller diameter bars was higher than in the original bars. He mentioned that merely as an experience.

For a number of years they had practised production control by means of test-bars cast in oil-sand moulds poured under standardised conditions. They made somewhere in the region of 300,000 castings per week, and it became a matter of correlating tensile tests numbering about 120 with that very large number of castings. The answer was that there were too many other variables for it to work in a direct manner. But they could satisfy themselves and their customers that their melting and mixture control was reasonable; the remaining aspects were in the hands of the moulders and the men pouring the iron. They might take one test-bar every 40 min., but during that 40-min. period several thousand castings might have been poured under varying conditions.

His firm made very great use of the correlation between Brinell hardness and tensile, which was mentioned in the Paper. But it was found that they could not take any given Brinell figure and apply it directly to everyday production. Thus, the practice was to take a representative portion of castings each day and subject it to Brinell tests. They also took certain tensile tests, and they might find that for 60 per cent. of the time a given Brinell figure would correlate, in a particular casting, with the required minimum tensile, but for the other 40 per cent. of the time they had to test one or two castings at different Brinell numbers in order to find out what was the minimum acceptable Brinell. With the limitation that they must be prepared from day-to-day to check the Brinell tensile relationship on a given casting, it was an exceedingly useful means of inspection.

#### Statistical Approach

The customer was obviously interested in the minimum tensile strength that he would find in any particular casting out of a batch of possibly 500 or 1,000; and the statistical approach was the only means of providing that information. The reference to statistical methods was a most valuable feature in the Paper. Bearing in mind the statistical approach, they must look at the results from the tensile test-pieces as a means of control of operations. Periodically they would cast 12 moulds from the same ladle of iron. The test-bars were then machined and tested by a purely routine method—not a research one—to obtain the average tensile and also the range. Under good control, the range was within ±5 per cent. of the average tensile. But if that variation were found with test-bars alone, then obviously in (say) 800 castings the range would be somewhat wider. In respect of correlation between test-bar and casting, in 75 or 85 per cent. of cases a particular tensile factor would apply.

At the risk of stealing the thunder of the chairman of sub-committee T.S. 16, in considering the specification for cast iron, Mr. Payne said they had thrashed out the point. They were not particularly concerned with sensitivity, and they did not just consider an iron of 18 tons per sq. in. tensile and say that in a 2 in. bar the tensile strength would be 16 tons, and in an 0.6 in. bar it would be 20 tons. Rather did they consider that a certain tensile strength was required; in a varying section it would be more difficult to achieve the strength than in a uniform, thin section. He believed he was right in accepting the British specification, not as an indication of sensitivity, but as having regard to the diffi-

* Presented to the Buxton Conference of the Institute of British Foundrymen and printed in the JOURNAL, November 2 and 9, 1950.

culties of achieving a particular tensile in a range of sections. One would not use the same metal for all sections.

### Influence on Design

In his experience, the designer did not ask the foundryman what was the tensile strength of his iron. The designer calculated the stresses and stated that he would like an iron of (say) 20 to 23 tons per sq. in. The founder supplied an iron which might or might not come up to that figure, and the designer tested it. If it satisfied him, then whatever the original tensile strength, it was used as an inspection guide. So that the factors applying were translated with a certain amount of imagination. In many cases, a 12-tons per sq. in. iron, provided the castings were completely sound, would meet the case, even though the designer wanted a 16 to 18-tons per sq. in. iron.

Summing up, Mr. Payne said the essential factor in the Swedish specification was to provide a basis for the control of production, whereas the customer was concerned with the individual castings. Ultimately there was bound to be a compromise between the two, the supplier producing evidence that he had maintained control of metal quality. He was also bound to investigate the actual strength in the castings, so that by a comparatively simple non-destructive test, which in the case of the light castings was the Brinell test, he could satisfy himself regularly by a percentage check that he was meeting the specification of the customer.

Mr. Lissell, discussing the influence of the rim effect, suggested that it was a function of the kind of iron that one was using. If using a low-grade iron, the limit to which one could go down in respect of size of test-bar would be higher than if using a high-grade iron. The problem had not been investigated sufficiently to enable him to say, for instance, in the case of a 16-tons per sq. in. iron, where the limit should be, or, for a 22-tons per sq. in. iron, how far down it was permissible to go without running the risk of getting too much deviation in the results. But he was dealing with a practical means of determining the danger limit in a tensile test and therefore had to work on the safe side from a specification point of view. If the limit were exceeded, the bar would burst with a snap; if below the limit, the bar would break without a sound. For a low-grade iron, one could not be quite sure if one went below the limit when using a 0.798 in. bar, whereas for a high-grade iron one could be sure. However, if he had discussed that problem in the Paper he would have had a lot more to write and he did not feel that it was so very important.

### Compromise of Interests

Expressing his interest in the fact that Mr. Payne had attempted to correlate hardness and tensile strength, he said that Dr. Collaud, of *Ludw. von Roll'schen Eisenwerke,* in Switzerland, had done quite a lot of work on the subject and had presented two Papers in which he had suggested a similar method of controlling the castings and giving evidence to the customer that he was getting what he wanted. The trouble with the application of all specifications was that one had always to arrive at some kind of compromise between the interests of producer and consumer. It was always very difficult for the founder even if he had the test figures for the quality of the iron, to prove that it was exactly the iron the customer wanted in the castings. The customer would not be satisfied, and probably would want a test-bar taken from the casting or one that was attached to it. Mr. Lissell considered that it was a matter for education and that more statistical evidence was indeed needed. The consumer had had to trust the producer, and in Sweden they had evidence in two cases that that worked out very well. The Government and the railway authorities accepted castings where the iron had been subjected to a test of its quality; but they did so only where they knew the foundry, where they knew the advice they obtained from the foundry would be sound and that the metal and the castings would have the properties they wanted.

Mr. P. A. Russell said that in the British Specification there were bars of five sizes, related to the section thickness of the castings, which governed the type of metal that was used. Those five sizes of bars were stated in the British Specification purely to help the manufacturer. He agreed that the test-bars were a gauge of metal quality and did not represent the strength in any particular casting. He did not wish Mr. Lissell to think that we believed it did, we certainly did not. Fig. 1 in the Paper bore that out. It was interesting that the Swedish Specifications had similar nomenclature to ours, specifying strength but in kg. per sq. mm., so that it was necessary to use a correction factor to make comparisons.

Commenting on the Author's statement that section sensitivity was not so great in the casting as in the test-bar, he said Mr. H. J. Young was very critical of the British Standard Specification when worked out on the theory of surface area and cooling rate. But we emphasised that our specifications, in respect of the relation of test-bar size to casting, were purely empirical, based on long years of experience—going back to the work of Mr. Shaw and Mr. Gresty many years ago, and, personally, he did not wish to see them altered.

### Relative Bar Dimensions

He thought the British Specification was open to criticism in many respects and was very interested to note that the short tensile test-piece was used in Sweden, and said that he could see no reason why we should not use it ourselves. But he asked what was Mr. Lissell's practical experience of that bar. We had been frightened by the difficulty of determining the exact diameter at the root, and he asked whether Mr. Lissell had found that to be easy or difficult. On the straight bar a turner could use a micrometer. If Mr. Lissell could overcome our fear in that respect, Mr. Russell would strongly advocate that shape of bar. It was more economical to produce.

Another difficulty was that of the very long transverse test-bar that we used. He appreciated that he

*Discussion Testing the Metal or the Casting*

had had a good deal to do with specifications and had stuck up for them, but he did feel that for the high-duty irons, particularly to-day, a perfectly sound transverse bar was almost an impossibility. The new wedge-cutting test seemed to offer possibilities as a substitute. He believed the only reason why we retained the transverse test-bar in the British Specification was to give an idea of ductility. In its present form he did not think the minimum deflections specified were of any great value. But if we could have our present transverse bar and insist on a minimum plastic and elastic deflection at a certain proportion of the final specified breaking load, it would have more value. He believed that what the Swedish people missed in their specification was that they relied entirely on tensile, and so far as he could see they were getting no evidence of the deformation characteristics of the iron.

### Disadvantages of a Single Bar Size

One great fear that he had in respect of the new theory put forward by Mr. Lissell concerned the single size test-piece. We, in this country, were the pioneers of the variation of bar size and we should not be prepared to give up that variation of size without a terrific struggle. It might be argued that if we used only the 1.2-in. diam. bar, when we ran the soft irons we knew we should get low results and if we had the statistical evidence behind us there was no very great difficulty of correlation. There was not the same argument in the case of very large castings, we should then get an iron the normal characteristics of which had gone, and it was in connection with the larger-section castings that he had the greatest fear. He did not think that Mr. Gresty, for example, would be prepared to make all his tests on a bar of 1.2 in. diam.

Mr. Lissell said he was bound to agree with Mr. Russell's remarks to a certain extent regarding the different sizes of bars. But in Sweden they had started from the point of view that they were for the moment only going to test the iron; they were not concerned with the properties of the castings unless they had a statistical relationship between metal and castings. The size of bar he had mentioned would be good, at least in Sweden, for 90-95 per cent. of all their engineering castings. If someone were making some heavy castings, then it was up to him to decide on a test-bar for his purpose. For small castings Mr. Lissell had no fear about using the test-bar mentioned. In Sweden it served them well, so long as they were testing only the properties of the metal. He pointed out that we in this country were casting larger castings than were normally produced in Sweden, where they did not make, for instance, the very heavy equipment for collieries, and items of that sort.

Up to the moment they had not considered the transverse test. But if one required to find out something about the ductility of a cast iron one definitely needed a further test. In Sweden they had started some work on the wedge-cutting test, where the sinking-in of the edges before breaking gave a figure indicating the ductility, but so far he had no definite answer to give, although he believed it was possible to use that test for the determination of ductility. It seemed that the test was very simple. But before specifying the transverse test or the wedge-cutting test for the determination of ductility they wanted to do some further work.

As to the regularity of the diameter of the test-bar at the thinnest section, they had had no difficulty in limiting the deviation in size in machining. Investigations, covering a great number of test-bars, were made to see whether the test-bar results duplicated the properties of the iron, and the bars had all burst at the thinnest section. In respect of heat-treated irons they had in some cases experienced trouble because of fracture occurring in the threads; but so long as they kept the ratio of the gauge diameter to the nominal diameter below, he believed, 0.70, fracture would occur in the thinnest section. This figure obviously was a function of the minor or core diameter of the thread. The bar had been used in Sweden for many years and had not given rise to much difficulty.

Dr. A. B. Everest conveyed to Mr. Lissell the president's apologies for being unable to attend the session, his very best wishes and his thanks for the Paper. Recalling that earlier that week there had been meetings of the International Technical Committees, including the Committee on the Testing of Cast Iron, he stated that Mr. Lissell's Paper would be of the utmost help to that committee. Dr. Everest said he was glad to know that Sweden had now been elected to membership of the committee. There was adequate evidence from his Paper that Mr. Lissell was doing a great deal of valuable and interesting work on the subject of testing cast iron.

With regard to the British Specifications for cast iron, he had presented a Paper* to the London Branch about two years ago. It was written just after the new B.S. 1452 had appeared, and it was an attempt to explain the reasoning behind the various clauses of that specification. That Paper should clear Mr. Lissell's mind particularly on the question of section sensitivity, because the test figures quoted for tensile and transverse tests on different sizes of bars represent a compromise between the American system of taking one strength (irrespective of the size of bar), and section sensitivity. That was fully expained in his Paper.

### Specifying the Metal

He agreed that the test-bars as set out in the specification did not represent the castings. But he was the representative of the Institute of British Foundrymen on several Committees of the British Standards Institution dealing with cast-iron products of one sort and another, and there, he believed with the concurrence of the whole of the Technical Council of the Institute, he was following a definite policy in trying more and more to get all the British Standards to refer to B.S. 1452 to cover the quality of cast-iron metal used for the particular kind of castings covered. Subsequently, any of the committee would include in the specifications any specialised tests required on particular castings. For example,

* A. B. Everest. "Specification and Testing of Cast Iron," *Proc. Inst. Brit. Foundrymen*, XLI, 1947-8, B75.

in the specification on cast-iron hydraulic pipes, Dr. Everest said the draft had contained several clauses under the heading " Material Testing." But these were cut down finally to one paragraph only, stating that the metal should conform to the appropriate grade of B.S. 1452. With regard to the castings, however, obviously in the case of hydraulic pipes there must be a pressure test, and coupled with it there was a rough impact test, the pipes being subjected simultaneously to pressure and to hammering. That indicated our entire agreement with the view expressed by Mr. Lissell that test-bars were a check on the metal only and could not be regarded as giving a true indication of the strength of any casting, because each casting was quite different from others.

During the war an attempt was made to relate test-bar results with the strength of brake drums, and a comparison was made between separately cast test-bars and pieces cut from the brake drums. Very good results could be obtained with small test-bars cut across the rim or across the plate at the back, but if the casting were going to break, it would break in the shoulder. But it was almost impossible to devise a test-bar which really represented the casting at this point, and it proved impossible to use a test-bar except as a control test on the quality of the metal used.

It was indicated by Mr. Lissell in his Paper that he did not like the transverse test-bar, and he had suggested dispensing with it. Several members of the B.S.I. Committee had tried to get the transverse test dropped from our specifications. There was a feeling that it was extremely difficult to interpret the results; further, the transverse test-bar was an awkward casting to make on account of its length/diameter ratio, and as we went to higher-duty irons it became increasingly difficult to make a transverse bar which was truly representative and of good quality. In connection with some recent work an attempt had been made to develop stocks of standard test-bars. Working to B.S. sizes it had succeeded at first with irons of up to 18 tons per sq. in., and after a great deal of trouble with irons up to 21 tons per sq. in.; but, in respect of higher-strength irons, stocks were still awaited. It was impossible to know whether there was soundness and density in the middle of the bar, where the testing was carried out. That was an argument for doing away with the transverse bar; it seemed impossible to ensure the structure that was needed in the centre of the bar and in the middle of a long cylindrical casting.

### Method of Casting for Test Bars

With regard to the standardising of methods of casting test-bars, to which Mr. Lissell had referred, Dr. Everest said the B.S.S. stipulated that the test-bar should be cast in the same type and condition of sand as would be used for the casting. But there had always been much argument about standardising methods of casting the bars. For example, some years ago a sub-committee of the Institute's Technical Council (T.S.4) had tried to devise recommended methods, and there was a report on the matter in the proceedings.* There were nine working members and himself on the committee, and their first task was to say how they would cast the British Standard test-bar. At the end of the first part of the work there were nine recommended methods; but eventually they had ironed out the problem and had recommended the vertically-cast bar. Although that was published in the Institute's Proceedings, so far as he knew the method was little used.

If a man thought he knew the best way in which to cast a bar, and provided his method was reproducible, Dr. Everest did not think it was necessary to worry about standardising; indeed, he believed the tendency in all countries was to leave the foundrymen to decide the method by which they could best cast their bars.

MR. LISSELL said there could be endless arguments about specifying the casting methods. But he asked Dr. Everest whether test specimens from castings made in all the different ways he had mentioned were actually machined, and whether the same results were obtained in all cases. On studying the present literature on gating one felt that quite a lot of what had been considered in the past to be good practice has not been in fact very good, and until definite evidence was adduced that all the different ways of casting would give the same results he did not think the point could be settled.

In his presentation of the Paper he had tried to make it clear that in Sweden they had chosen the method of casting which he had described just in order to make a cheap test-bar. Earlier they had cast test-bars in a somewhat different way, but had experienced some difficulty in producing bars which were dense and free from internal shrinkage. There might be some better method than the one they had adopted, but it was a cheap method, in which they had achieved directional solidification, and nobody had objected to the method; so that perhaps one could say that it was fairly satisfactory.

There might be several good ways of casting; but if one were satisfied with regard to the expense of making the mould, the possibilities of getting the test-bar dense and free from defects, and that the test-bar was so designed that it was easy to machine, then one could say the method was suitable as a standard.

Some work had been done in America recently, and a paper was presented at the recent A.F.S. Convention by Flinn and Kraft, who had studied different designs of test-bars and had shown quite definitely that different designs yielded different results. He felt it might be worth while to make some investigations along those lines.

DR. EVEREST was very pessimistic about the possibility of the success of any attempt of that sort. As previously remarked, one of our best foundries, using a very high degree of technical control, had been trying to make stocks of bars; where (say) 150 bars had been ordered as standard stock material for testing, and as samples. Although the

* *Proc. Inst. Brit. Foundrymen*, XXXVIII, 1944-5. A131.

bars had been made under the closest control, there was still a variation of from 5 to 10 per cent. in the mechanical properties of those bars.

He did not think it practical to suggest that a number of foundries should try out the different methods and determine which gave the best results. If they were tried in a number of different foundries there would be variations in sand conditions, and so on, and variations of metal temperature. When a ladle of metal was poured along a series of boxes, variations would be introduced which probably would be of far higher order than the differences which would be disclosed between the methods of casting the test-bars. One might get a clear indication that one method would not give a representative bar under the conditions in one particular foundry, but the same method might be satisfactory in another foundry. He felt, therefore, it was best to leave the founders to carry on with their normal methods as they thought best.

MR. LISSELL felt bound still to disagree with Dr. Everest to some extent. In Sweden they had made comparative tests in several foundries and had also varied some of the factors, such as the sand used, the pouring temperature of the metal, and so forth, in order to determine how sensitive the design was to variations of those factors. To keep the pouring temperature for the same iron within a fairly reasonable range was an important point, so far as they were able to find out, as was also a reasonably constant rate of pouring. If we were to specify iron grades, and if those grades were to be accepted nationally, the variation from foundry to foundry should be kept as low as possible. It would be quite confusing if every foundry stood for its own qualities and had a data book of its own concerning its irons, and so on, to suit its customers. There would always be variations; but if we were to specify grades we must keep down those variations at much as possible.

DR. EVEREST said he hoped to leave it there. His point was that a foundryman who had established a method in his own foundry, which gave him a representative result with his iron, was better left to carry on with it than to be forced to use another method with which he did not agree.

THE CHAIRMAN, Mr. C. Gresty, said that although Dr. Everest did not believe in transverse bars, he himself liked them and he would use the same argument as Dr. Everest had used to Mr. Lissell, that if a foundry had used transverse bars for many years and had built up its business on them, it was going to be very difficult to persuade that foundry to become no longer interested in them.

He agreed with Mr. Lissell that, if we could standardise a methods of producing whatever bar we decided upon, it should be done, because it would be foolish to refrain from wiping out any variations which could be wiped out. His recollection was that, when he started to use the 1.2 in. bar many years ago (it was actually 1¼ in. in those days) the method of moulding and casting was stipulated. He believed that a description was given in Moldenke's book.

DR. EVEREST agreed, but said the stipulation had since been abandoned.

THE CHAIRMAN replied that he did not know it was abandoned completely; he believed the specification still stipulated, or advised on the methods and gave more than one alternative.

MR. H. MORROGH (British Cast Iron Research Association), said Mr. Lissell's Paper drew attention to the fact that a general specification for cast iron could be very simple. The transverse test could be eliminated and the specification based on one size of tensile test-bar. It was perhaps not wise to reduce the British specification to this simplicity since specifications in different countries serve somewhat different functions. It had, however, emphasised the need for a reconsideration of the suitability of the transverse test for inclusion in a general specification. He joined with Dr. Everest in asking for the position of the transverse test to be reconsidered and took the opportunity to draw the attention of the Institute's technical council to this matter.

### Full Standardisation

MR. LISSELL said his recollection was that in the American specification there was a recommendation concerning the casting of transverse bars. There was no recommendation, however, as to how tensile bars were to be cast, because he believed it was recommended that all tensile bars be taken out of the transverse bars. Previously there was a recommendation for casting tensile bars to shape, but that had now been abandoned.

It seemed to him that, if we worked out specifications, we should specify as much as possible. Some day we might find that there was one best method of casting a test-bar, as seen from all the different points of view. Why should we not use that method, even if there were some foundrymen who believed they could cast it better in another way?

MR. PAYNE said that the difference between a production control test-piece and one recommended, for instance, for the acceptance of castings was a matter which he had experienced. His company used a short test-bar for production control. It was not in accordance with the British Standard Specification either in diameter or in length, but they continued to use that "unstandard" bar because they were accustomed to it. They also cast the standard test-bars and correlated them with bars of their own design. If a standard method were agreed upon he believed their attitude would remain the same, that they would be prepared, to an extent, to duplicate their test-bars in so far as they were able to correlate their routine experience with the requirements of the new standard, running the two in parallel for a sufficient length of time to be able to correlate the old and the new and to give them confidence in the new test-bar to operate it as a standard.

They felt that by using a short test-bar they had a better chance of ensuring soundness. They machined the bar with a single tool to obtain the form. With the short bar they had the least machining to do, and fewer were cast unsound.

### Vote of Thanks

DR. EVEREST welcomed the opportunity to propose a vote of thanks to Mr. Lissell for his Paper. In Sweden, he said, Mr. Lissell had a most interesting job in following up cast-iron specifications, and so on, for the Swedish mechanical engineers; he had comprehensive laboratory facilities and a wonderful grasp of the whole subject. The Institute was very much honoured by his attendance at the meeting, and in future the International Committees would benefit very greatly from his cooperation.

MR. P. A. RUSSELL seconded; and the vote of thanks was warmly accorded.

MR. LISSELL, responding, said he was very glad to have had the opportunity to attend the conference and to present the Paper, and he appreciated very much the kindness extended to him.

## WRITTEN CONTRIBUTIONS

MR. H. J. YOUNG wrote expressing his great regret at being unable to be present at the reading of this valuable and suggestive Paper by Mr. Lissell, which was outstanding by reason of its courage in expressing flatly what is obviously true but nevertheless popularly denied.

The Author states, Mr. Young continued, that separately-cast test-bars only represent the metal in the ladle *if* their shape and size, gating, mould position, mould material, casting temperature, *etc.*, are kept constant. He noted with amusement and approbation the "*if*" at the start and the "*etc*" at the end. Of course, hundreds of test-bars produced with countless variables are cast daily. He (Mr. Young) knew of three not inconsiderable iron foundries where a batch of separately-cast 1.2 in. diam. test-bars are cast and when they give the results desired, the bars are put into stock to be drawn upon as and when required. One such foundry thought that " nobody really cared and that, after all, the bars represented nothing practical."

### Turning Back the Years

He had been an active member of the original cast-iron test-bar committee which formed the first British specification but confessed that he had since become aware that he acquiesced then in something which, trivial as it appeared, had grown to alarming size and, in his experience and opinion, had become highly disadvantageous. Could he go back, he would fight for (*a*) one bar size; (*b*) a specified dimension of moulding box; (*c*) a specified pattern for the runner and head; (*d*) a silica-base oil-bonded moulding sand; and (*e*) only three types of cast iron to be embraced within the specification, for example, 9, 15 and 18 tons per sq. in. on a 1.2 in. diameter test-bar as cast. That range would, he believed, cover seventy-five per cent. of the country's tonnage of sand-cast iron castings. Any industry dealing with mass-produced castings or some speciality could and should have its own specification just as had existed for years in the piston-ring trade.

### Cast-on v. Separately-cast Test Bars

In 1921 he (Mr. Young) read a Paper before the Institute of Marine Engineers in which he showed photomicrographs of the graphite (at x 25 diams.) and of the pearlite (at 1,100 diams.) first in a test-bar cast attached to a $3\frac{1}{4}$-ton cylinder-liner casting, and then in the metal of the casting itself. There was not the slightest similarity between the two metals, graphite size and distribution, pearlite lamellae, grain size, Cook-Hailstone network, size of phosphide "lakes", dendritic size and extent of dendrites, all being quite different in the two irons. To argue from the results of a separately-cast or a cast-on test-bar what will be the properties of the casting, or *vice versa*, was to fail to comprehend work done long ago. Experience showed that the larger and more complicated our cast iron specification grew the less it was used by engineers.

The writer's object in thus contributing to the oral discussion was to add his congratulations to those of others on such a fine outspoken Paper. He hopes it may lead to a thorough pruning of our present cast-iron specification so as to make it more usable to the surveying or consulting engineer.

### Wedge-cutting Test

MR. TWIGGER wrote that in connection with the suggested wedge-cutting test he thought that the statement that in this test rupture occurred from tension, read in conjunction with the stress diagram, Fig. 17, represented an over-simplification. This diagram suggested a stress-pattern which was uniform throughout the sample, but in fact, the stress was not uniformly applied round the sample, and the application of two knife edges to a round bar would not produce a uniform stress-pattern such as that shown.

In spite of this limitation, there seemed to be no reason why such a test should not be used for control purposes, but he would feel it necessary to correlate any such test with the commonly-accepted tensile test. Because of differences in ductility, etc., of differing types of cast iron, he felt that a factor relating the wedge-cutting test to tensile, which might be reliable for one grade of iron, would not necessarily apply to other grades.

MR. LISSELL, in reply to Mr. Twigger's remarks, pointed out that Fig. 17 should not be taken too literally. It was quite obvious that the stress pattern could not be symmetrical. The object of the illustration was only to show in principle that the test was actually a modified tensile test. Close upon 500 cast irons of different grades had been tested in Sweden with respect to wedge-cutting and tensile strength. There had been no indication that the factor relating the wedge-cutting strength to tensile varied to any appreciable extent with iron quality; as a matter of fact the ratio proved to be surprisingly uniform.

# British Cast Iron Research Association

*Twenty-ninth Annual Report*

REFERENCE WAS MADE in the last report to extensions planned to provide adequate accommodation and facilities for the present staff. On May 5, 1950, Lord Bilsland opened the new Scottish laboratories at Blantyre, Glasgow. A full account of the ceremony was given in the *Bulletin* for May, 1950, and of the layout and equipment in *External Report No.* 301. On July 5, 1950, at the end of the year under review, the president, Mr. P. H. Wilson, O.B.E., M.I.Mech.E., formerly inaugurated the laboratory extension at Alvechurch, this function coinciding with the members' annual visit. Full details were given in the *Bulletin* for July, 1950, together with details of the layout and equipment in *External Report No.* 303. The Scottish laboratories now have 5,000 sq. ft. of covered space, while at headquarters the covered space totals about 20,000 sq. ft. and the buildings and equipment represent assets approaching £100,000.

When the Grey Ironfounding Productivity Team went to the United States in January, 1950, two members of the Association's staff accompanied the party, as indicated below, and the team visited the Association's headquarters before departure. By arrangement with the Joint Iron Council and with the co-operation of the team and its leader, Mr. S. H. Russell, the Association's conference* in October, 1950, is being planned to provide discussion of the purely technical aspects of the report of the Productivity Team. Thus the metallurgical aspects, melting practice, sands and moulding practice, mechanical equipment and foundry layout will receive attention.

### Council and Committees

The annual general meeting was held in London on November 2, 1949. Mr. P. H. Wilson, O.B.E., M.I.Mech.E., was unanimously re-elected president, and the vice-presidents, Mr. P. A. Abernethy, Sir William Griffiths, D.Sc., Dr. J. E. Hurst, J.P., and Mr. F. Scopes were also re-elected. The retiring members of council were re-elected and the names of Mr. J. F. Stanier and Mr. N. P. Newman, J.P., were added. Since the meeting Mr. E. C. Dickinson, M.Met., has been co-opted to the council, which during the year had six meetings. The council has great pleasure in reporting the election of Mr. Everard P. Major, F.C.A., as honorary treasurer in succession to the late Mr. G. T. Lunt. The trustees of the pensions scheme, Mr. T. M. Herbert, Mr. A. E. Pearce and the director, elected the first-named as chairman. The scheme has been formally approved by the inland revenue authorities.

The research board and its two committees, the Fundamental Research Committee and the Industrial Research Committee, re-elected Mr. A. E. Peace as chairman. Mr. J. J. Sheehan was re-elected chairman of the Development Committee, and Mr. T. M. Herbert chairman of the Information Committee. Of these main committees of the council, thirteen meetings have been held, together with thirteen meetings of other committees of the council, eight of which were meetings of the Operational Research Team Committee, to which reference is made below. Of the research sub-committees (nine in number), twenty-two meetings have taken place. In view of the interest in methods of analysis shown by the existence of panels on absorptiometric and spectrographic methods of measurement, a Methods of Analysis Sub-Committee has been constituted. As indicated below, towards the close of the year a Foundry Atmospheres Committee of the council was established.

* Reported on page 415 of this issue.

### Research Department

Considerable changes have taken place in the research programme during the past year. Several investigations have been completed and removed from the programme, and new work is being planned for the near future The current research programme is given in the Appendix. Work has continued on the general subject of graphite formation during the solidification process in cast iron, with special reference to the effects of small amounts of the elements sulphur and oxygen. Attention has also been concentrated on the relationships existing between the form of manganese sulphide in cast iron and the graphite structure. A Paper describing the results of this work has appeared in the *Journal of the Iron and Steel Institute* for April, 1950. Work has also continued on the subject of the production of nodular cast irons and an extensive Paper on this subject was published in the February, 1950, issue of the Association's *Journal*, by the research manager, Mr. H. Morrogh. A preliminary investigation on the effect of melting cast iron under a wide range of different slags has been completed.

Very good progress has been made in the investigation dealing with the fluidity of molten cast iron and it is expected that this will soon be completed. The influence of all the common elements on fluidity has been studied and a final report will be issued shortly.

Investigations on chemical analytical methods have continued. A method for the chemical determination of magnesium in cast iron has been perfected and a description of this appears in the August, 1950, issue of the *Journal*. Work has continued on the development of spectrochemical methods. The construction of a direct-reading attachment is also in progress.

The work originally envisaged on the cavitation erosion of ship propellers (in conjunction with the British Shipbuilding Research Association) has been substantially completed. Various corrosion problems arising in the course of the normal development work of the Association have been investigated.

The group of investigations in progress for the Engineering Castings Sub-committee has been brought to a conclusion and reports on the various investigations have been issued or will appear in due course. The *Journal* for April, 1950, gave the results of fatigue tests on flake and nodular cast irons using notched and unnotched test-pieces, and the issue for June, 1950, contained results of work on the relation of the mechanical properties of ring test-pieces and those of test-bars. An extensive programme of work on the properties of cast iron at sub-zero temperatures has been completed and a Paper on this subject was presented to the Annual Conference of the Institute of British Foundrymen on June 6, 1950. Work has continued on the evaluation of the mechanical properties of nodular cast iron. The programme of work on the resistance of cast iron to thermal shock has been completed. A new Engineering Castings Sub-committee has been formed and for this sub-committee, investigators have been appointed to carry out work on the fatigue properties and on the impact strength of cast iron. It has also been decided to carry out work on the soundness of iron castings and for this purpose it is proposed to engage a team of three to investigate the various aspects of the problem.

Work has continued on the determination of gases in cast iron. A new high-frequency set has been installed, a complete new vacuum fusion apparatus built, and work (some of it in conjunction with the joint I.B.F.—B.C.I.R.A. Committee on Gases in Cast Iron) has been begun, using this apparatus. The isolation of the microstructural phases by chemical methods, with the object of determining the distribution of the various elements among the phases, has been studied and makes good progress.

Work on the mechanism of graphite formation during the annealing of white cast iron has been continued, with particular emphasis on the effect of rate of heating and the effect of gaseous atmosphere on carbide decomposition.

Experimental work upon sands has included a study of scabbing defects. The work on the use of urea and phenol formaldehyde resins for bonding has been completed, and the completion of work on pelleted pitch as a substitute for coal dust has been supplemented by various field tests. Work on the use of dielectric heating for core-baking has also been completed. An apparatus has been constructed for the determination of the stress-strain curves to fracture on sand-compression test-pieces.

### Development Department

During the year the development department dealt with 1,138 problems, 966 at headquarters and 172 in Scotland. The lower figure for Scotland, as compared with last year, is largely the result of the changeover of premises referred to above. Of the total number of enquiries received, 186 were received from members who have joined since the new membership basis was established. Approximately one-sixth of the time of the members of the staff was spent in visiting works in this country on specific problems, and in the early part of 1950, Dr. H. T. Angus, manager of the department, and Mr. W. B. Parkes, assistant manager, spent nearly three months on a visit to the United States as members of the General Ironfounders' Productivity Team; during this period they were not available for visits to members' foundries.

The experimental work carried out in the department has been actively continued, and papers have been published dealing with cracking in light castings, *Journal* for December, 1949, and foundry chaplets in the issue for February, 1950. A Paper on hot-blast cupola operation was published in the issue for December, 1949. Work on the welding of cast iron is still continuing.

A growing feature of the department's activities is the manufacture, for member-firms and others, of prototype castings for special purposes, and a considerable number have been made in straight, alloyed and nodular cast irons for purposes ranging from high-pressure air-compressor cylinders to nodular-iron components for shock-resisting purposes. An extension of the department's work has also included the measurement of surface strains in casting *in situ* by means of strain gauges.

The staff of the department has assisted in arranging two important exhibitions at which the Association was represented: the Engineering and Marine Exhibition at Olympia, in September, 1949, and the exhibition on "Metals in the Service of Mankind," at the Science Museum, South Kensington, which opened in May, 1950.

The Association is represented by Mr. W. J. Driscoll, Mr. L. W. Bolton and Mr. E. Morgan, on the Foundry Coke Panel of the British Coke Research Association, and this body is very actively engaged. The department also provides Association representatives on committees dealing with British Standards, on the sub-committee of the Joint Standing Committee on Conditions in Ironfoundries, the Melting Sub-committee of the British Iron and Steel Research Association, and on other committees associated with the Institute of British Foundrymen and the British Iron and Steel Research Association.

*Scottish Laboratories*—The work of the Scottish laboratories during this period was affected during the transfer from Falkirk to the new laboratories at Blantyre. A considerable amount of new equipment has been installed and the staff has been augmented. The new laboratories are more favourably situated in relation to the main industrial centres of Scotland and there is every reason to expect a considerable increase in the work carried out under the superintendent, Mr. A. N. Sumner, and that the services and facilities offered by the Association to Scottish ironfounders will be greatly enhanced.

### Intelligence Department

The editorial responsibilities of the department continue to grow, as is shown by the considerable increase in the number of research reports published in the *Journal of Research and Development* during the year under review, thirty-three in all being published, more than double the number issued during the previous year. The present volume (v. 3) began in August, 1949, and as from this date the *Journal* has been made available to non-members on a

*B.C.I.R.A. Annual Report*

subscription basis. The *Bulletin* has appeared at regular intervals; an index to Volume 9 has been published and the binding of this volume undertaken for those members requiring it. Eight external reports, of which four consist of papers given by members of the Association's staff to external bodies, have been made available to members. The number of translations issued during the year totals sixty.

Library loans, and accessions of new books, periodicals and pamphlets are:—*Library Loans*: books 525; periodicals 3,123, and pamphlets 1,433. *Library Accessions*: books 189; new periodicals 7, and pamphlets 615.

The figure for loans is the highest yet reached and averages twenty per working day. Over 450 enquiries (excluding library loans and other enquiries) were dealt with by the intelligence department during the year.

Two conferences have been organised at Ashorne Hill during the year, the first a Conference on Foundry Sands in September, 1949, and the second a general Foundry Conference at the end of March, 1950. Both were well attended, and the papers presented have been published, or will shortly be published, in the *Journal*.

The work of the department is in charge of Mr. G. R. Woodward as manager, with Miss D. Drake as librarian.

### Operational Research

Reference was made in the last annual report to a decision to set up an operational research team for the purpose of visiting foundries by invitation to examine their equipment and methods, and to advise confidentially on the steps required if any, to raise their technical and productive efficiency. The council appointed an Operational Research Team Committee to consider and advise on the team's work, under the chairmanship of Mr. Arthur Watson, and eight meetings have been held during the year. Two appointments of the three envisaged have been made to the team, but the appointment of the leader of the team has still to be made. The first appointment was that of Mr. J. Hunter, until recently manager of the foundry equipment department of Stone-Wallwork, Ltd., as engineer to the team, and the second that of Mr. J. A. Ballard, who took the diploma of the National Foundry College in 1948, and as the holder of a fellowship of the Worshipful Company of Founders has since pursued a course of training in foundries, admirably calculated to prepare him for the work of the team. Active work has already been begun, and a number of visits to foundries have been made.

### Foundry Atmospheres

The Association has always been considerably interested in and concerned with the technical aspects of foundry working conditions, and with the methods to be adopted to implement the 1947 report of the Joint Advisory Committee of the Ministry of Labour and National Service on conditions in ironfoundries. In close collaboration with the Factory Department of the Ministry, some extra-mural work was planned in 1948 on the nature and effect of fume from corebinders used in ironfoundries. This work began in the chemical department of Loughborough College in close contact with the Association's staff. It was evident that this work would be of considerable magnitude and after a year the College authorities found it increasingly difficult, and ultimately impossible, to staff the investigation on the lines originally planned. As a result, the work was reluctantly abandoned. In co-operation with the Joint Iron Council, the council has since set up a Foundry Atmospheres Committee for the purpose of providing a fresh approach to the subject and steps have been taken to consider it from the aspects of both research and development. For the development approach it has been decided to appoint a suitably qualified engineer to be attached to the staff of the development department, and advise foundries on the steps required to provide the best working conditions. The question of research is more complicated and it is hoped to arrange discussions both with the Factory Department of the Ministry of Labour and with the Medical Research Council.

### Finance and Membership

Since the arrangement with respect to industrial income with the Joint Iron Council, opportunity has been taken on two occasions to circularise all non-member ironfoundries in the United Kingdom, inviting them to apply for membership, for which no formality is required beyond signing an application form. The membership of the Association has thus markedly increased and the number of ironfoundry members as at June 30, 1950, was 986, and the number of other ordinary and trade members, including overseas members, 128. Since the total number of ironfoundries in the country is of the order of 1,800, it is clear that many eligible firms do not yet appreciate that the opportunity of membership is open to them. While no specific subscription is stipulated, member-firms may contribute voluntarily at their discretion and the council is greatly indebted to those who do so. As grant is received on these contributions, they are of great value to the Association and they also rank as business expenses for tax purposes to the firms concerned. The total income for the year exceeded £86,000.

### Relations with Other Bodies

In July, 1949, the Association welcomed Sir Ben Lockspeiser, K.C.B., who succeeded Sir Edward Appleton as secretary to the D.S.I.R., and who visited the Association officially with Mr. C. A. Spencer, M.Sc., C.B.E., and Commander R. G. A. Jackson. In April, 1950, the D.S.I.R. visitors, Professor H. O'Neill, D.Sc., and Mr. W. Barr, paid an official visit to Alvechurch, during which an inspection of equipment and work is progress took place, and discussions were held with the scientific staff. In June, the recently appointed managing director of the National Research Development Corporation, Lord Halsbury, visited the Association and discussed a number of matters of mutual interest.

*This Report is signed by:—*

MR. PERCY H. WILSON, *President.*
DR. J. E. HURST, *Chairman of Council.*
and DR. J. G. PEARCE, *Director and Secretary.*

The Report was presented at the Annual General Meeting of the Association, held in London on November 15. At this meeting Dr. J. E. Hurst, J.P., was elected as president and the retiring president, Mr. P. H. Wilson, O.B.E., was made an honorary member.

## APPENDIX

### Research Programme

*Graphite Formation.*—To continue the study of factors affecting the formation of graphite during the solidification process of cast iron.

*Gases in Cast Iron.*—To study the vacuum fusion method for the determination of gases in cast iron and to apply the method to the study of the effects of gases in cast iron.

*Spectrochemical Analysis.*—To investigate source characteristics with the object of improving methods of spectrochemical analysis, involving the construction and development of direct-reading attachments. To continue the application of spectrochemical methods for determining the composition of cast irons.

*Chemical Analytical Methods.*—To investigate methods for the determination of calcium in cast iron and to study the application of spectrophotometer and polarographic methods to chemical analysis.

*Isolation of Phases.* — To attempt to develop electrolytic extraction methods for the isolation of the microstructural phases in cast iron, and to determine the distribution of elements present between the phases.

*Malleable Cast Iron.*—To continue the study of factors influencing the annealability of malleable cast iron.

*Fluidity.*—To complete the study of factors influencing the fluidity of molten cast iron.

*Moulding Sands.*—(i) To study the effects of wood flour as an addition to moulding sands; (ii) To study the factors influencing stress-strain properties of sand compacts.

*Fatigue.*—To construct machines and then to investigate the influence of notches, under-stressing and over-stressing on the fatigue properties of cast irons.

*Impact.*—To begin a study of the factors affecting shock-resistance, nature of impact failure, and development of impact testing methods for cast irons.

*Soundness of Castings.*—To begin a study of factors influencing the soundness of iron castings.

*Cavitation and Corrosion.*—To complete the study of factors influencing the cavitation erosion of cast-iron ship propellers, in conjunction with the British Shipbuilding Research Association.

## *Hot-Dip Tinning of Cast Iron*

(*Continued from page* 414.)

over it for one minute before an appropriate quantity of molten tin is poured on and wiped over the surface by means of a steel-wire brush or scraper. More tin and flux may be added if required and when tinning is complete excess is drained off in the case of bearing shells, or the surface is wiped smooth with soft tow in the case of pans or vessels. The flux residues are removed by thorough washing.

The wipe-tinning procedure briefly described above is particularly useful for very large shells and vessels, but with smaller work, where heating and fluxing can be under closer control, the use of tinning pastes is found convenient. These pastes are mixtures of powdered pure tin and chloride flux and when used on well-cleaned and shot-blasted cast iron are very effective tinning media.

### Conclusions

In laying down procedures for tinning cast iron two basic principles must be kept in mind. First, the surfaces to be tinned should be brought to as clean a condition as possible by mechanical means and, second, aqueous acid pickling should be kept to a minimum or avoided altogether. Iron plating prior to tinning and the "chloride" process are

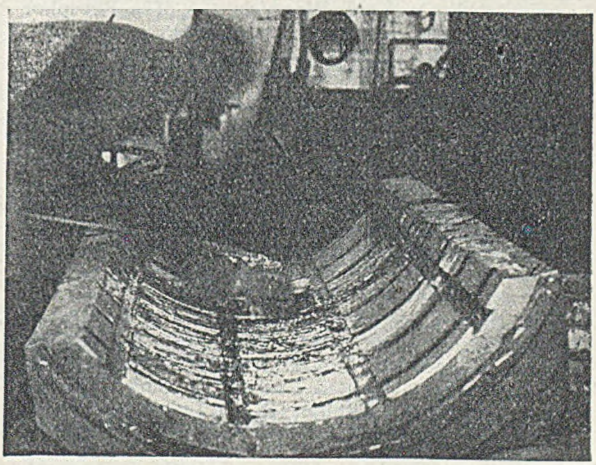

FIG. 5.—*Tinning Cast Iron by Wiping, using Zinc-sodium-chloride Eutectic as Flux.*

eminently suitable for small-article tinning; chemical oxidation methods are well-applied in cases where high adhesion strengths are required. Homogeneous metal, free from porosity or blow-holes, makes the task of the tinner easier and contributes very largely to the appearance and corrosion resistance of the finished work.

REFERENCES

"Hot-Tinning." W. E. Hoare. Published by The Tin Research Institute.

"The Tinning of Cast-Iron." R. A. Cresswell, J.I.S.I., 1945 (II), p. 157.

"Metallic Surface Finishes applicable to Gray Iron." Gray Iron Founders' Soc. Inc., Tech. Bull. No. 7. March, 1950 (adv. copy).

# Institute Elects New Members

AT A MEETING of the Council of the Institute of British Foundrymen, held in Glasgow on October 21, 1950, the following were admitted to the various grades of membership:—

## As Subscribing Firm Members

British Industrial Plastics, Limited, Oldbury (*representative*: R. S. Bushnell); Clay Cross Company, Limited, Chesterfield (*representative*: Wm. Bradley); Institute del Hierro Y del Acero, Madrid, Spain; A. Reyrolle & Company, Limited, Hebburn (*representative*: D. Walker); School of Engineering, County of Lanark Education Committee, Burnbank, Hamilton (*representative*: R. H. Garner).

## As Members

H. Bancroft (Taylor & Wilson, Limited, Clayton le Moors, Lancs); R. H. Bromley (Goodwin Barsby & Company, Limited, Leicester); W. J. Crockett (Crockett Lowe, Limited, Birmingham); R. H. Garner (School of Engineering, Burnbank, Hamilton); W. M. Gunn (Lawside Engineering & Foundry Company, Limited, Scotland); A. Harrison (Firth-Vickers, Limited, Sheffield); R. W. P. Holt (Widnes Foundry & Engineering Company, Limited, Widnes, Lancs); E. W. Karoly ("Fermet" Steel & Metal Works, Haifa, Israel); P. G. Pentz (Leicester, Lovell & Company, Limited, Southampton); H. H. Sivyer (Morgan Crucible Company, Limited, London, S.W.11); H. van Maurik (Koper-en Metaalgietery, Breda, Holland); D. Waters (Hargreaves (Leeds), Limited, London, S.W.1); R. I. Whitlock (Ford Motor Company, Leamington Spa); A. N. Wormleighton (The Phosphor Bronze Company, Limited, Birmingham).

## Transfer from Associate Member to Member

R. R. Caizley (Enfield Rolling Mills (Aluminium), Limited, Enfield); R. M. Cleaver (Kelly & Cleaver, Limited, London, S.E.17); W. J. Colton (Newton Chambers & Company, Limited, Sheffield); G. H. Davison (United Steel Companies, Limited, Stocksbridge, near Sheffield); D. Macbeth (T. J. Priestman, Limited, Birmingham); J. R. Stayt (African Malleable Foundries, Limited, Transvaal, South Africa).

## As Associate Members

J. A. Ballard (B.C.I.R.A., Birmingham); J. C. Bennett (Massey-Harris, Limited, Manchester); S. D. Bhagwat (Cooper Engineering, Limited, India); J. Boon (Platt Bros. & Company, Limited, Oldham); J. Burkitt (British Railways, Glasgow); J. Butler (British Industrial Plastics, Limited, Oldbury); A. B. Christie (Glenfield & Kennedy, Limited, Kilmarnock); J. W. Davison (British Railways, Doncaster, Yorks); C. Dempster (African Malleable Foundries, Transvaal, South Africa); G. V. Dipple (Patternmakers, Limited, Coventry); T. Erskine (Beeston Boiler Company, Beeston, Notts); W. D. Ford (Morris Motors, Limited, Wellingborough); L. B. Gabb (Brecknell, Munro & Rogers, Limited, Bristol); N. K. Ghosh (India Electric Works, Calcutta, India); M. Godfrey (Beyer, Peacock & Company, Limited, Gorton, Manchester); J. Gray (British Railways, Glasgow); H. T. Haigh (H. Burnley (Brassfounders), Limited, Bradford); J. S. Haigh (S. Russell & Sons, Limited, Leicester); G. Hallanell (Garside & Derrington, Halifax); L. Hankart (African Malleable Foundries, Transvaal, South Africa); K. Hardy (International Harvester Company of Great Britain, Limited, Doncaster); F. A. Hargreaves (Entwisle & Kenyon, Limited, Accrington); J. G. Harris (Geo. Waller & Son, Stroud, Glos); R. G. Hunt (F. Godwin, London, E.15); P. H. Jackson (David Brown Foundries Company, Penistone, near Sheffield); G. L. Jarvie (Lion Foundry Company, Limited, Kirkintilloch); L. L. Johnson (Bayliss Rolls, Limited, Wolverhampton); R. Kennedy (Foundry Plant & Machinery, Limited, Glasgow, C.2); C. D. M. Kruger (African Malleable Foundries, Limited, Transvaal, South Africa); J. M. Lawson (A. F. Craig & Company, Limited, Paisley, Renfrews); E. J. Lowndes (E. W. Wynn, Limited, Cannock, Staffs); D. de Waal Marais (Vanderbijl Engineering Corporation, Transvaal, South Africa); G. B. Matthews (African Malleable Foundries, Transvaal, South Africa); R. Mercer (Enfield Rolling Mills, Limited, Bradford); J. Mitchell (Corporation of Dundee (Education Committee); W. Owens (J. Varley & Sons, Limited, St. Helens, Lancs); B. R. Pearson (Coventry Technical College, Coventry); A. Petrie (Gearing & Jameson, Limited, Cape Town, South Africa); H. Pollitt (Ideal Boilers & Radiators, Limited, Hull); J. L. Rawlinson (British Insulated Callenders' Cables, Limited, Prescot); J. Royales (Platt Bros., Limited, Oldham, Lancs); G. J. Schwartz (African Malleable Foundries, Transvaal, South Africa); R. Staveley (Ideal Boilers & Radiators, Limited, Hull); J. Stewart (Corporation of Dundee, Education Committee); D. L. Taylor (The Harland Engineering Company, Limited, Scotland); W. H. Taylor (F. H. Lloyd & Company, Limited, Wednesbury); N. White (British Railways, Glasgow); A. Wigton (J. Broadfoot & Company, Whiteinch, Glasgow); J. R. W. Williams (R. Threlfall, Limited, Bolton, Lancs); J. R. Worswick (Entwisle & Kenyon, Limited, Accrington); H. W. Zimnawoda (National Engineering Company, Illinois, U.S.A.).

## Transfers from Associate to Associate Member

W. H. Barraclough (Marshall Sons & Company, Limited, Gainsborough, Lincs); F. Machin (Vickers-Armstrongs, Limited, Barrow-in-Furness).

## As Associates (over 21)

T. C. Andrews (Bryan Donkin & Company, Limited, Chesterfield); R. W. Archibald (Enamelled Metal Products Corporation, Limited, Leven); T. M. Barson (Morris Motors, Limited, Coventry); D. M. G. Bisset (The Argus Foundry, Thornliebank, Glasgow); C. E. Booth (F. W. Birkett, Cleckheaton); R. S. Gangwar (student: Mechanical Engineering Diploma Course, India); W. W. Glick (Richard Thomas & Baldwins, Limited, Swansea); G. Gray (Ley's Malleable Castings, Limited, Derby); M. H. Hillman (B.C.I.R.A., Birmingham); Wm. Hunter (Clyde Alloy Steel Company, Limited, Motherwell); G. E. Leach (African Malleable Foundries, Transvaal, South Africa); P. S. Miles (Bengal Ingot Company, Limited, Calcutta, India); A. M. Morrison (Sterling Metals, Limited, Coventry); A. K. Munshi (Birla Engineering College, India); F. Sanders (W. Wadsworth & Sons, Bolton, Lancs); N. Smith (Moorland Engineering Company, Leek, Staffs); G. R. Staples (International Harvester Company of Great Britain, Limited, Doncaster); J. M. Tasker (Darby & Company, Birmingham); D. W. Taylor (J. Stone & Company, Limited, London, S.E.7); H. E. Williams (J. Williams & Sons, Limited, Cardiff).

## As Associates (under 21)

I. Blane (W. MacFarlane, Glasgow, N.); A. C. Bowen (Worthington-Simpson, Limited, Newark, Notts); C. W. Brookshaw (W. & T. Avery, Limited, Smethwick); A. D. Davis (John Harper & Company, Limited, Willenhall, Staffs); N. Gadsby (Stanton Ironworks Company, Limited, near Ilkeston); C. J. W. Hayhurst (The Butterley Company, Limited, Keighley); J. F. Haywood (Morris Motors, Limited, Coventry); C. T. Hudghton (Beyer, Peacock & Company, Limited, Gorton, Manchester); W. F. Liebenberg (African Malleable Foundries, Transvaal, South Africa); D. S. Morley (Stanton Ironworks

(*Continued on page* 432.)

## New Engineering Material

The Morgan Crucible Company, Limited, have for some time been actively engaged in the development of metal ceramic materials, and have registered the trade mark "Metamic" to cover their products of this type.

Modern methods and techniques have created a growing, and as yet unfulfilled, demand for materials which will operate satisfactorily at temperatures above those at which the present high-temperature alloys may be used. Under these severe thermal conditions the conventional ceramics generally fail to combine all the desirable properties such as high strength and resistance to creep and thermal shock. The ideal may be to combine the better features of both metals and ceramics. Considerable interest is therefore being shown in bodies in which metals and ceramics are intimately associated so as to constitute what is virtually a new class of materials.

The research laboratories of the Morgan Crucible Company, Limited, are developing "Metamic" materials to cover a wide range of applications. The use of this material for turbine blades is one example of the many possible applications for this material, and may enable turbine operating temperatures to be raised to such a degree as to effect a considerable fuel economy.

It must be understood that the numerous combinations of metal, ceramic, and methods of manufacture will permit a wide variation in the properties and fields of use of this new material; thus, for particular uses, one may desire resistance to oxidation, corrosion, erosion, or creep, the formulation being varied to meet these requirements.

## Department of Scientific and Industrial Research

The D.S.I.R. Annual Report* for 1948-49, was published recently. It begins with the report of the advisory council which states the broad lines of policy and contains a mass of information on researches in progress and completed at all the D.S.I.R. stations and also from the research associations.

Last year, the council drew attention to a lack of balance in the programmes of research, stating that not enough time and effort was being devoted to basic research. This year the council repeats its warning and, while admitting the difficulties that are upsetting the balance, calls bluntly for more research of this nature.

* Cmd. 8045, from H.M. Stationery Office. Price 5s. 6d.

## *Luncheon*

### *British Engineers' Association*

At the May Fair Hotel, London, on November 9, under the chairmanship of the president, Mr. Keith Fraser, the Association entertained the Resident Minister in London of the Commonwealth of Australia, the Hon. Eric J. Harrison; those present included: Mr. H. W. Bosworth; Sir Eric Bowyer, K.B.E., C.B.; Mr. C. E. Critchley; Mr. W. T. Gill; Sir James Helmore, K.C.M.G.; Sir Norman Kipping, J.P.; Mr. Arthur R. Knowles, C.B.E.; Sir Alexander Ramsay, O.B.E.; Sir Archibald Rowlands, G.C.B., M.B.E.; and Sir Robert Sinclair, K.C.B., K.B.E.

## Wood Flour in Foundries

The Productivity Team's Report has revived interest in the potentialities of wood flour as an ingredient in moulding sands. Earlier, the JOURNAL carried a report that a French foundry was using sodium silicate for bonding cores and here, too, wood flour was being used. It is interesting to learn that this material is now being marketed by a London firm of foundry supply merchants. A circular letter sent out by this firm makes the following observations and includes a number of claims.

In America, hardwood is often used, but we have found that the higher resin content of soft wood gives a better finish. The benefits from the use of wood flour in foundry sands may be summarised as follows:—(*a*) Marked improvement in surface finish; (*b*) reduced fettling and cleaning costs; (*c*) in some cases, in ferrous casting, it can entirely replace coal dust, hence greater cleanliness; (*d*) it gives better knock-out properties; (*e*) increases the flowability of sand; (*f*) gives a reducing atmosphere in the mould cavity and so decreases turbulence on the mould metal interface; (*g*) facilitates harder ramming of the mould where desired, with a reduced risk of mould expansion and so eliminates scabs, rat-tails, buckling, etc., and (*h*) prevents a too rapid burn-out in high-temperature thin-section work.

For good results a material of fine mesh is essential with reasonably high alcohol-solution present (patternshop saw dust will not produce the required results). A maximum of 2 per cent. should be added to the sand and often less is sufficient. Moisture must be increased ½ per cent. for every 1 per cent. of wood flour added. If coal dust is displaced this should be by volume. Wood flour weighs about one-third of an equal volume of coal dust. Precautions should be taken against fire when storing the material; though the risk of spontaneous combustion is not as great as with coal dust, the carelessly discarded cigarette must be avoided at all cost.

The following observations are called for: (1) The use of wood flour may inherently carry a higher percentage of moisture into the sand; (2) for continuous use, it can be presumed that some charcoal would be formed, which happens to be black (!) but which can absorb quite large quantities of gas; (3) wood flour is being used for the large-scale production of a light-iron domestic casting with success. Sawdust has, of course, for many years been replacing horse-manure in loam moulding in some foundries.

## International Welding Congress

An International Welding Congress is meeting in London and Oxford from July 14 to 21, 1951. The Congress will include the annual meeting of the International Institute of Welding and its various commissions, and is being sponsored in this country by the five British member societies, namely, the Institute of Welding, British Welding Research Association, British Acetylene Association, the welding sections of the British Electrical and Allied Manufacturers' Association and the Sheet and Strip Metal Users' Technical Association. The president of the Reception Committee is Sir William Larke, K.B.E. The Congress will open in London on Saturday, July 14, and will be transferred on the following day to Oxford, where three colleges, Christ Church, Oriel and Somerville, will accommodate the visitors, who are expected to number between four and five hundred.

The secretary of the Congress is Mr. G. Parsloe, at 2, Buckingham Palace Gardens, Buckingham Palace Road, London, S.W.1.

# British Blast Furnaces in the September Quarter, 1950

*These tables are published through the courtesy of the British Iron and Steel Federation.*

*Derbyshire, Leicestershire, Notts, Northants, and Essex.*

| Name of firm. | In blast at end of third quarter, 1950. Hematite. | Basic. | Foundry and forge. | Ferro-alloys. | Total. | Weekly average in blast. | Total existing at end of quarter. |
|---|---|---|---|---|---|---|---|
| Clay Cross .. | — | — | 1 | — | 1 | 1 | 2 |
| Ford Motor | — | — | 1 | — | 1 | 0.9 | 1 |
| Holwell Iron | — | 1 | 2 | — | 3 | 3 | 4 |
| Kettering Iron & Coal | — | — | 1 | — | 1 | 1 | 2 |
| New Cransley Iron & Steel | — | — | 1 | — | 1 | 1 | 2 |
| Renishaw Iron | — | — | 2 | — | 2 | 2 | 2 |
| Sheepbridge | — | — | 1 | — | 1 | 1 | 1 |
| Stanton Ironworks : Stanton-by-Dale | — | — | 5 | — | 5 | 5 | 5 |
| Staveley Iron & Chemical | — | — | 4 | — | 4 | 4 | 4 |
| Stewarts and Lloyds : Corby | — | 4 | — | — | 4 | 3·5 | 4 |
| Wellingboro' Iron .. | — | 2 | — | — | 2 | 2 | 3 |
| Total | — | 7 | 18 | — | 25 | 24·4 | 30 |

*Lancashire (excl. N.-W. Coast), Denbighshire, Flintshire, and Cheshire.*

| Name of firm. | Hematite. | Basic. | Foundry and forge. | Ferro-alloys. | Total. | Weekly average in blast. | Total existing at end of quarter. |
|---|---|---|---|---|---|---|---|
| Brymbo Steel | — | — | — | — | — | 0·2 | 1 |
| Darwen & Mostyn.. | — | — | — | 1 | 1 | 1 | 2 |
| Lancashire Steel Corp'n .. | — | 2 | — | 1 | 3 | 3 | 4 |
| Total | — | 2 | — | 2 | 4 | 4·2 | 7 |

*North-West Coast.*

| Name of firm. | Hematite. | Basic. | Foundry and forge. | Ferro-alloys. | Total. | Weekly average in blast. | Total existing at end of quarter. |
|---|---|---|---|---|---|---|---|
| Barrow Ironworks.. | 2 | — | — | — | 2 | 2 | 2 |
| Charcoal Iron | — | — | 1 | — | 1 | 0·5 | 1 |
| Millom & Askam | 2 | — | — | — | 2 | 2 | 3 |
| United Steel : Workington | 2 | — | — | — | 2 | 1·9 | 3 |
| Total | 6 | — | 1 | — | 7 | 6·4 | 9 |

*Lincolnshire.*

| Name of firm. | Hematite. | Basic. | Foundry and forge. | Ferro-alloys. | Total. | Weekly average in blast. | Total existing at end of quarter. |
|---|---|---|---|---|---|---|---|
| Appleby-Frodingham | — | 8 | — | — | 8 | 8 | 9 |
| Lysaght, J. : Scunthorpe | — | 4 | — | — | 4 | 3·8 | 4 |
| Thomas, R., & Baldwins : Redbourn .. | — | 2 | — | — | 2 | 2 | 2 |
| Total | — | 14 | — | — | 14 | 13·8 | 15 |

*North-East Coast.*

| Name of firm. | Hematite. | Basic. | Foundry and forge. | Ferro-alloys. | Total. | Weekly average in blast. | Total existing at end of quarter. |
|---|---|---|---|---|---|---|---|
| Cargo Fleet Iron .. | — | 2 | — | — | 2 | 2 | 2 |
| Consett Iron | 1 | 1 | — | — | 2 | 2.1 | 3 |
| Dorman, Long : Acklam .. | — | 3 | — | — | 3 | 3 | 4 |
| Redcar .. | — | 2 | — | — | 2 | 2 | 2 |
| Cleveland .. | — | 2 | — | — | 2 | 2 | 5 |
| Bessemer .. | — | 2 | — | — | 2 | 2 | 3 |
| South Bank .. | — | — | — | 2 | 2 | 2 | 4 |
| Grangetown .. | — | — | — | — | — | — | 2 |
| Gjers, Mills & Co. .. | 2 | — | — | — | 2 | 2 | 5 |
| Pease & Partners .. | 2 | — | — | — | 2 | 2 | 3 |
| Skinningrove Iron | — | 2 | — | — | 2 | 1.7 | 2 |
| South Durham Steel & Iron | — | 2 | — | — | 2 | 2 | 2 |
| Total | 5 | 16 | — | 2 | 23 | 22.8 | 37 |

*Scotland.*

| Name of firm. | Hematite. | Basic. | Foundry and forge. | Ferro-alloys. | Total. | Weekly average in blast. | Total existing at end of quarter. |
|---|---|---|---|---|---|---|---|
| Bairds & Scottish Steel : Gartsherrie .. | 1 | 1 | 1 | — | 3 | 3 | 5 |
| Carron | — | — | 1 | — | 1 | 1 | 4 |
| Colvilles | — | 3 | — | — | 3 | 2·7 | 3 |
| Dixon's | — | 1 | 1 | — | 2 | 2 | 6 |
| Total | 1 | 5 | 3 | — | 9 | 8·7 | 18 |

*South Wales and Monmouthshire.*

| Name of firm. | Hematite. | Basic. | Foundry and forge. | Ferro-alloys. | Total. | Weekly average in blast. | Total existing at end of quarter. |
|---|---|---|---|---|---|---|---|
| Briton Ferry Works | 1 | — | — | — | 1 | 1 | 1 |
| Guest Keen Baldwins : Cardiff .. | 1 | 2 | — | — | 3 | 2·7 | 4 |
| Thomas, R., & Baldwins : Ebbw Vale .. | — | 2 | — | — | 2 | 2 | 3 |
| Steel Co. of Wales : Margam | — | 2 | — | — | 2 | 2 | 2 |
| Total | 2 | 6 | — | — | 8 | 7·7 | 10 |

# Solvent Degreasing

### *Operational Risks*

The dangers to which operators are exposed when working with degreasing solvents such as chlorinated hydrocarbons, which include trichloroethylene, perchloroethylene, carbon tetrachloride and others, are referrred to in the course of an article on the subject of "Health Hazards in Metal Degreasing," by Paul W. McDaniel (senior industrial hygienist, Pennsylvania Department of Health) ("Metal Progress," July, 1950). The Author points out that all these solvents are poisonous to some extent. Their toxic effects depend on their vapour pressure, solubility, chemical activity and concentration. As a rule they show an affinity for the fats and lipoids in the body and chiefly affect those in the central nervous system. When inhaled, their vapours can cause irritation of the mucous membrane of the lungs, loss of consciousness and death by asphyxiation. In common with other degreasing agents, solvents cause varying degress of dermatitis, the skin then becoming more susceptible to further injury.

Volatile solvents, the Author explains, enter the body chiefly through the respiratory passages, although appreciable amounts may be absorbed through the skin. Inhaled vapours of a solvent pass directly into the general circulation and are distributed to the heart and the central nervous system. They may produce a general toxic effect without injuring the respiratory tract, or a mixed effect, including local irritation. It is important to resognise any signs of toxic reactions as early as possible, in order to take measures for their control. The effects of over-exposure to a solvent vapour are not always specific, especially in early stages or exposure to limited concentrations. Irritation or depression of the central nervous system may cause a diversity of symptoms which may lead to classifying an employee as neurasthenic, eccentric, intemperate or lazy. Gastro-intestinal irritation with nausea, vomiting and abdominal pain is frequently seen with different types of intoxication. Damage to liver, kidney, heart, blood and blood-generating organs, states the Author, are more specific, but are not typical of intoxication to any one solvent.

# British Blast Furnaces in the September Quarter, 1950—*continued*

*Staffordshire, Shropshire, Worcestershire, and Warwickshire.*

| Name of firm. | In blast at end of third quarter, 1950. | | | | | Weekly average in blast. | Total existing at end of quarter. |
|---|---|---|---|---|---|---|---|
| | Hematite. | Basic. | Foundry and forge. | Ferro-alloys. | Total. | | |
| Goldendale Iron .. .. .. .. | — | — | 1 | — | 1 | 1 | 2 |
| Lilleshall .. .. .. .. .. | — | — | 1 | — | 1 | 1 | 2 |
| Round Oak Steelworks .. .. .. | — | — | 1 | — | 1 | 1 | 3 |
| Shelton Iron, Steel & Coal .. .. | — | 3 | — | — | 3 | 3 | 3 |
| Stewarts and Lloyds: Bilston .. .. | — | 3 | — | — | 3 | 2·9 | 3 |
| Total .. .. .. .. | — | 6 | 3 | — | 9 | 8·9 | 13 |

*Sheffield.*

| Name of firm. | Hematite. | Basic. | Foundry and forge. | Ferro-alloys. | Total. | Weekly average in blast. | Total existing at end of quarter. |
|---|---|---|---|---|---|---|---|
| Park Gate Iron & Steel .. .. .. | — | 2 | — | — | 2 | 1.5 | 2 |
| GRAND TOTAL .. .. .. | 14 | 58 | 25 | 4 | 101 | 98.4 | 141 |

**Weekly Average Number of Furnaces in Blast during September Quarter, 1950, and Previous Four Quarters**

| District. | 1949. | | 1950. | | |
|---|---|---|---|---|---|
| | Sept. | Dec. | March. | June. | Sept. |
| Derby, Leics, Notts, Northants, and Essex .. | 25.3 | 25.4 | 26 | 24.6 | 24.4 |
| Lancs (excl. N.-W. Coast), Denbigh, Flint, and Ches .. .. .. .. .. .. | 5 | 5 | 5 | 4·5 | 4.2 |
| Lincolnshire .. .. .. .. .. | 14.6 | 14.8 | 13.7 | 14 | 3.8 |
| North-East Coast .. .. .. .. .. | 23 | 23 | 23 | 23 | 22 8 |
| Scotland .. .. .. .. .. .. | 9 | 8.7 | 7.5 | 8 | 8.7 |
| Staffs, Shrops, Worcs, and Warwicks .. .. | 8.4 | 9 | 9 | 8·4 | 8.9 |
| S. Wales and Monmouth .. .. .. .. | 7.9 | 8 | 8 | 8 | 7.7 |
| Sheffield .. .. .. .. .. .. | 1 | 1 | 1.5 | 1 | 1.5 |
| North-West Coast .. .. .. .. .. | 6.6 | 7 | 7 | 6·6 | 6.4 |
| TOTAL.. .. .. .. .. .. | 100.8 | 101.9 | 100.7 | 98·1 | 98 4 |

The following companies have furnaces in course of construction or rebuilding:—Barrow Ironworks; Cargo Fleet Iron; Lancashire Steel Corporation; J. Lysaght (Scunthorpe); R. Thomas & Baldwins (Redbourn); Sheepbridge; South Durham Steel & Iron; Skinningrove Iron, and Steel Co. of Wales.

## Unified Screw Threads

In December last it was announced that a Declaration of Accord had been signed in Washington between Great Britain, the U.S.A. and Canada regarding an agreement between these three countries on a unified screw thread system. Since then, the final technical details have been completed and the British and American Standards have recently been published; the Canadian Standard is to be expected shortly. The thread system is to be known in all three countries as the "Unified Screw Thread System" and common designations for the various threads have been agreed. The system at present relates to threads ¼ in. and larger for bolts, nuts, screws and engineering details; no common agreement has yet been reached regarding threads smaller than ¼ in. or pipe threads. The Standard (B.S.580:1949) now issued, includes all the technical data necessary to ensure the interchangeability of threaded products made to this standard and to the corresponding American and Canadian standards. It is issued at this stage as a provisional British Standard. It is intended that, at the end of six months, it shall be reviewed in order that it may be confirmed as one of the series of British Standards for screw threads. Comments on the standard will be welcomed and should be sent to the British Standards Institution by not later than December 31. Copies of the Standard may be obtained from the British Standards Institution, 24, Victoria Street, London, S.W.1. (Price 7s. 6d. by post.)

## *Film Review*

### STRENGTH WHERE YOU NEED IT

"Strength Where You Need It" is the title of a picture made by the Big-Six Film Unit (producer Mr. Edward Cook), for the New Insulation Company, Limited. Its object is to promote the sales of "Permali", a high-strength insulating material, based on laminated sheets of timber. It is a straightforward documentary inasmuch as the stages in the production of the material are clearly shown. Then follow its uses in service such as for insulating fishplates on the railway; as picking sticks in the textile industry and as various bits and pieces in electrical machinery. Compared with the films covering Lloyd's steel castings or the North British locomotives it may be felt that it lacks "pep" in the commentary—a feature at which the Americans excel. Beyond this criticism, the reviewer has nothing but praise for the balance of the production.

THE "CENTRE TECHNIQUE" have inaugurated a new regional laboratory at Lyons. It was opened recently by Mr. André Guillant, the Secretary of State for Industry and Commerce.

A SECOND French foundry productivity team has visited the United States. This time, the membership was drawn from the steel and malleable sections of the industry. Mr. Flour was the leader.

## News in Brief

It is proposed to erect a foundry in conjunction with a new paper mill for Brazil.

At the 4th Congress of the Scientific Film Association held in Florence, Great Britain contributed about 30 per cent. of the total of some 120 films shown.

The Manchester depot of Gandy Limited (formerly known as The Gandy Belt Manufacturing Company, Limited), has recently removed from 4, Wood Street, to larger premises at 19/23, York Street, off Charles Street, Manchester, 1.

The Engineers' Guild has removed to 213, Abbey House, 2, Victoria Street. Mr. Robert Chalmers, O.B.E., was recently elected president; Mr. Henry Nimmo, M.I.C.E., chairman of council, and Mr. W. S. Graff-Baker, B.SC., as vice-chairman.

The Metropolitan-Vickers Electrical Company, Limited, of Trafford Park, Manchester, 17, have designed and placed on the market the "Metrovick" vapour-tight gauge glass fittings, for the illumination of gauge glasses in oil refineries and for other special applications in fume-laden atmospheres.

As a result of the rearmament programme, a quarter of a million more men are wanted in the engineering industry within the next 12 months. This statement was made by Mr. Alex. Williamson, Scottish regional secretary of the Engineering Industries Association, at a meeting of Aberdeen and District group in Aberdeen held recently.

Mr. John T. W. Hobkirk, representing the third generation, has been appointed to the board of directors of J. Hobkirk, Sons, Limited, of Bedford. It is also announced that production at Hobkirk's has been stepped up to 150 tons of castings per month. The telephone number of this concern has been changed to Bedford 5451.

D. Mitchell & Company, Limited, manufacturers of lathes and drilling machines, Keighley, and Rushworth & Company, engineers and tool makers, Sowerby Bridge, near Halifax, have jointly taken over the machine-tool firm of Darling & Sellers, Limited, Airedale Works, Lawkholme Lane, Keighley, which was formed nearly a century ago.

The representatives of the Council of Ironfoundry Associations on the executive committee of the Joint Iron Council for the ensuing year are Mr. J. E. Bennett, Mr. J. D. Carmichael, Mr. Ambrose Firth, Mr. V. Jobson, Mr. F. D. Ley, Mr. N. P. Newman, Mr. A. E. Pearce, Mr. S. H. Russell, Mr. H. V. Shelton, and Mr. A. Watson.

Mr. Charles Connell, chairman of Chas. Connell & Company, Limited, Glasgow, was elected president by the Central Board of the Shipbuilding Employers' Federation at their annual general meeting in Edinburgh on November 17. Mr. A. Lewis Cochrane, chairman and managing director of Cochrane & Sons, Limited, Selby, was elected senior vice-president, and Mr. John G. Stephen, director of Alex. Stephen & Sons, Limited, Glasgow, and Mr. T. Eustace Smith, joint managing director of Smith's Dock Company, Limited, North Shields, vice-presidents.

The Manchester and District Ironfounders recently held a meeting, presided over by Mr. R. L. Handley, to discuss the report of the Ironfounders' Productivity Team. Representing the team were Mr. S. H. Russell (the leader), Mr. G. Judd, the secretary, and Mr. A. Kirkham. Mr. Russell pointed out that it costs £600 for each member of a team crossing the Atlantic and examined in some detail the question as to how they were to get a return on the money spent. One aspect was the practical application of the notions disclosed in the report.

## Mr. O. Smalley Honoured

Mr. Oliver Smalley, O.B.E., was recently honoured by the Gray Iron Founders' Society of America, when they bestowed upon him the Society's highest merit award, their Gold Medal, in token of the high esteem and grateful appreciation of the industry as a whole.

The award specifically cites:—

"Smalley's outstanding contributions to the scientific advancement of the industry; for his pioneering work as the first technical director of the Society, which he served for many years; for his brilliant work to enhance the quality of gray-iron castings and acquaint engineers with the intrinsic merits of the product; for his leadership of an organisation which has added great lustre and prestige to a group of foundries which have followed his sound leadership in bringing foundry procedures to a high state of excellence; and for his co-operation with the Society at all times for the mutual advancement and technical development of the industry as a whole.

"In recognition of his manifold contributions for the betterment of the industry and its products, we bestow upon him the Society's highest merit award, a gold medal, in token of our high esteem and grateful appreciation.

"Presented by order of the Board of Directors on October 13, 1950."

### *Institute Elects New Members*

(*Continued from page* 428.)

Company, Limited, near Nottingham); A. K. Moss (J. Harper & Company, Limited, Willenhall, Staffs); J. D. Noble (Noble & Lund, Limited, Felling-on-Tyne); A. W. Rollestone (S. Russell & Sons, Leicester); J. Shelley (John Harper & Company, Limited, Willenhall, Staffs); R. E. Shoesmith (Sterling Metals, Limited, Coventry); J. Somerfield (John Harper & Company, Limited, Willenhall, Staffs); G. M. Stinchcombe (Daimler Company, Limited, Coventry); P. W. Taylor (Hunt Bros., Oldbury, Worcs); E. Thompson (Sterling Metals, Limited, Coventry); J. N. Tierney (Sterling Metals, Limited, Coventry); C. Varley (Stanton Ironworks Company, Limited, near Nottingham).

**Transfer from Associate Member to Associate**

A. Lennox (Mirrlees Watson Company, Limited, Glasgow, C.5).

## Personal

Mr. R. C. Shepherd has been elected president of the North Midlands branch of the Ironfounders' National Confederation.

Dr. J. H. Andrew, Professor of Metallurgy and Dean of the Faculty of Metallurgy at Sheffield University from 1932 until last summer, has received the title of Emeritus Professor from the university.

Mr. H. B. Riggall, managing director of Ruston & Hornsby, Limited, engineers, ironfounders, and boilermakers, of Lincoln, is going to Australia and New Zealand next month to meet the firm's customers.

Mr. G. Keith Drew has resigned his position as general sales manager of Frigidaire Division of General Motors, Limited, to join the board of Turner & Company (Glasgow), Limited, as director and general manager.

Lt.-Col. H. T. Thornley, managing director of the Morton Machine Company, Limited, Wishaw, is relinquishing his position on December 1, to take up a board appointment with Petters, Limited, Diesel-engine manufacturers. Mr. W. Thomson, director and general manager of the Morton Machine Company, will take over full operation of the company.

Mr. L. C. Wallach, a director of Sterns, Limited, and Sternol, Limited, has celebrated his eightieth birthday. He joined the predecessor of these companies in 1890. At the age of three he suffered from infantile paralysis, but now enjoys the best of health. He is doubling a cash present which he has received from his colleagues for the benefit of research on infantile paralysis.

Qualcast, Limited, of Derby, announce that at the end of this year Mr. C. D. Pollard will retire from his executive post as general foundry manager, but will continue to serve the company on a part-time basis as a foundry consultant, retaining his present position on the boards of Qualcast (Wolverhampton), Limited, and Qualcast (Ealing Park), Limited. Mr. W. H. Pycroft, previously general manager, grey-iron division, has been appointed group foundry adviser and has also been appointed to the boards of Qualcast (Wolverhampton), Limited, and Qualcast (Ealing Park), Limited. Mr. M. A. Wardle, previously assistant general manager of the grey-iron division, has been appointed general manager of the division.

## Board Changes

Birfield Industries, Limited—Mr. Michael Brown has been appointed a director.

B. & S. Massey, Limited—Mr. H. G. Taylor and Mr. H. A. Wallace have been appointed directors.

Walmsleys (Bury), Limited—Mr. Percy Holland, a director, has been appointed managing director.

Foster, Yates & Thom, Limited—Mr. D. P. Welman has resigned as managing director. Mr. H. Dowell has been appointed a director.

Kayser, Ellison & Company, Limited—Mr. Noel F. Ibbotson, who has been employed by the company for 32 years, has been made a local director.

British Oxygen Company, Limited—Mr. S. J. L. Hardie has resigned as chairman and as a director, consequent upon his appointment as chairman of the Iron and Steel Corporation of Great Britain. Mr. J. S. Hutchison, the vice-chairman, has been elected chairman. Mr. F. C. S. L. Lewin-Harris and Mr. John L. Hardie have been appointed directors.

## Alldays & Onions Tercentenary

For a company to celebrate its tercentenary must be rare in the industrial life of any community, and this year marks that occasion in the history of the firm of Alldays & Onions, Limited, of Birmingham; it also constitutes the silver jubilee of the acquisition of the company by Mitchell Cots & Company, Limited, of London.

Unfortunately, not only records but also valuable examples of craftsmanship were destroyed during the period of hostilities, but it has been established that a member of the Onions family founded the business in the year 1650. The amalgamation with the firm of William Allday & Sons did not take place until later and subsequently the combined efforts were directed to the development and production of plant for the forge and the foundry. To-day, the company ranks as one of the foremost in this class of equipment.

In addition, fans of nearly every type and for every purpose are manufactured, whilst furnaces utilising gas, oil, or solid fuel are numbered among the products. Included in forge equipment is the well-known range of pneumatic forging hammers, both of the self-contained and of the compressed-air-operated types, in addition to which, steam hammers of the Rigby type are also manufactured.

During the last few decades, many businesses have been absorbed, including Thwaites Bros. of Bradford, Peter Pilkington, Limited, of Bamber Bridge, the Britannia Foundry Company of Coventry, and the Roots-blower portion of Samuelsons of Banbury.

The celebrations have taken the form of a tercentenary bonus based on years of service. Men and women of all grades who have completed over one and under five years' service, received a bonus of £2, and a further £1 bonus has been allotted for each completed five years' service; part-time employees, who qualify by length of service, receive half bonus. There are many long-service employees, several having between 30 and 60 years' service; indeed, 25 per cent. of the personnel have more than 30 years' service.

## Allied Ironfounders Apprentice School

The new apprentice training school established by Allied Ironfounders, Limited, in their Castle Laurie works, Falkirk, was open recently to parents and friends of the boys at present undergoing training there.

Mr. Hunter, general manager of M. Cockburn & Company, Limited, and a director of Allied Ironfounders, Limited, who has been responsible in a great measure for the successful establishment of the school, welcomed the parents and friends and gave them a brief outline of the scheme and of what was proposed for the programme. The party was then taken on a tour of the training school, visiting the showers, first-aid room and moulding shop. Members of the staff included Mr. Erskine, general manager of Castle Laurie Works, and Mr. Conry, apprentice supervisor, who explained to the visitors the details of the scheme and answered many questions. The visitors were shown the type of work carried out by the boys and all were impressed with the high standard of the working conditions.

The guests, on their return to the canteen, were shown a film relating to products of Allied Ironfounders, Limited, and were afterwards served with coffee. The arrangements for the evening-class studies available to the boys were described by Mr. Cranston, headmaster of Falkirk Technical School evening classes.

# *Raw Material Markets*

## Iron and Steel

Although the pig-iron supply position presents some problems, the engineering foundries are generally able to obtain sufficient supplies of the various grades available to continue production at capacity levels. The low- and medium-phosphorus grades are augmented with supplies of hematite and refined irons, and, when the necessity arises, deliveries of Scotch foundry medium-phosphorus iron are secured. The trades catered for by these foundries are specifying freely, particularly the motor, tractor, and allied trades which are busy on both home and export account. Castings for electrical and gas undertakings, and the agriculture and textile trades add appreciably to commitments, and there is also a good tonnage required in connection with plant and machinery for shipment.

Apart from the Northamptonshire grade of high-phosphorus iron, which is not in excessive demand, outputs of other grades of foundry iron, together with hematite and refined irons, are being fully absorbed by the foundries. There is no evidence that any foundry iron or hematite is being made available for export. Refined iron is being sent abroad in small quantities, but it can ill be spared. The light and jobbing foundries continue to register reasonable outputs. Scrap supplies are available, and there is no slackening in demand for parcels of cupola scrap in both cast iron and steel.

The coke ovens are sending forward regular supplies of foundry coke against allocations. It is essential that there should be no interference in deliveries, many foundries having little, if any, stock. Furnace coke for heating core ovens is being received in fairly satisfactory quantities. Little difficulty is experienced in securing ganister, limestone, and ferro-alloys, but it is now necessary to give notice for firebricks.

Substantial order-books are on hand at the re-rollers; they could increase these considerably if capacity permitted. Home consumers and stockists are requiring increased tonnages of all sizes of sections, bars, and strip, and buyers abroad cannot secure anything near their full requirements. The sheet re-rollers are very active. In most cases, re-rollers cannot consider new business until present commitments are reduced. There are increased demands from home steelmakers for steel semis, and the re-rollers are readily accepting arisings of defectives, crops, etc., to make good the deficiencies in supplies of prime material.

## Non-ferrous Metals

By last week-end the tin conference at Geneva was virtually over. The progress made at these talks seems to have been somewhat meagre and it is understood that the chief stumbling block proved to be the difficulty in agreeing upon minimum and maximum world prices. Import and export quotas are believed to have proved another thorny subject in the debates, and it looks as if the series of meetings will end without more than a moderate volume of agreement being achieved. At the present time, with new price records being set up due to the scarcity of tin, it must have been difficult to tackle the problem of setting up machinery to function during a period of over-supply. And yet there is no doubt that a serious change in the tin situation could occur at short notice and confront the industry with difficulties on a grand scale.

Apart from increases in antimony and mercury, there were no price changes to report for last week. However, the course of brass scrap values was upwards, although the rate of the climb seemed to have diminished. The firmness in secondary brass is, of course, due to keen demand from fabricators, who are desperately short of zinc. There is apparently no prospect of any improvement in supplies, and consumers are looking forward to 1951 with a good deal of misgiving. There has been a shortage of nickel for some time now, and this looks like continuing into the New Year, while it is known that the Government is unlikely to be able to find all the aluminium to satisfy the increased demand. Of copper there are somewhat vague hints of possible trouble, and it is, of course, a fact that Northern Rhodesian tonnage is falling behind somewhat owing to the enforced cut in output which came into force some weeks ago. Lead appears to be the only metal in reasonably good supply at present, and it seems likely that this fortunate state of affairs will continue.

London Metal Exchange official tin quotations were as follow:—

*Cash*—Thursday, £1,020 to £1,025; Friday, £995 to £1,000; Monday, £1,027 to £1,030; Tuesday, £1,125 to £1,130; Wednesday, £1,080 to £1,085.

*Three Months*—Thursday, £965 to £970; Friday, £940 to £945; Monday, £955 to £960; Tuesday, £1,055 to £1,060; Wednesday, £1,015 to £1,020.

# *Book Reviews*

**Statistical Year Book for 1948. Part II, Overseas Countries.** Published by the British Iron and Steel Federation, Steel House, Tothill Street, London, S.W.1. Price 15s.

This, it is thought, is the most comprehensive statistical guide to the iron and steel industries of the world at present available. Statistics are given for about 40 countries, and from their study a complete picture is given of the difficulties which beset the exporting countries, for gradually the various overseas markets are installing plants and increasing their home production. The book is profusely illustrated with maps showing the location of the metallurgical industries.

**Drop Forging.** By Henry Hayes. 2nd edition. Published by Sir Isaac Pitman & Sons, Limited, Parker Street, Kingsway, London, W.C.2. Price 6s. net.

This is an excellent elementary textbook. It was first published 27 years ago and perhaps a more thorough revision would have made the book more acceptable. Yet, as much old plant is still being used, perhaps the Author is justified in retaining illustrations. The Author's views on the ebb and flow of trade are really interesting. It seems that whilst the drop forger can on occasion wrest business from the founder, he may lose orders to the machine shop utilising automatics. However, where expensive alloyed steels are used, the tendency is to revert to the hammer to avoid raw material waste. It seems that the critical range where a drop-forging can compete with an iron casting is from 4 to 16 lb., but then only for plain jobs. So far as steel castings are concerned, the Author is obviously worried as to the progress being made by the founders through alloying and heat-treatment. There is also a weight limit as to the size of drop-forging that can be manufactured economically. In Chapter II there is a 25-line paragraph on furnaces. The fuel position to-day demands much more thought than the Author indicates. Chapter III is the longest and best; it deals with the actual process of drop-forging, both generally and as applied to the making of a number of standard components. In subsequent chapters, mechanical forging presses; the physical effects of drop-forging; heat-treatment, hammer treatment and metallurgy of forgings are dealt with and finally some consideration is given to drop-forging dies.

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

*(Delivered, unless otherwise stated)*

November 22, 1950

## PIG-IRON

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

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

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

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

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

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

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

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

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

## FERRO-ALLOYS

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

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

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

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

**Ferro-titanium.**—20/25 per cent., carbon-free, £100 per ton.

**Ferro-tungsten.**—80/85 per cent., 16s. 3d. per lb. of W.

**Tungsten Metal Powder.**—98/99 per cent., 17s. 9d. per lb. of W.

**Ferro-chrome.**—4/8 per cent. C, £60; max. 2 per cent. C, 1s. 5½d. lb.; max. 1 per cent. C, 1s. 6d. lb.; max. 0.15 per cent. C, 1s. 6¾d. lb.; max. 0.10 per cent. C, 1s. 7d. lb.

**Cobalt.**—98/99 per cent., 15s. 6d. per lb.

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

**Ferro-manganese** (blast-furnace). — 78 per cent., £30 5s. 11d.

**Metallic Manganese.**—96/98 per cent., carbon-free, 1s. 7d. to 1s. 9d. per lb.

## SEMI-FINISHED STEEL

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

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

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

## FINISHED STEEL

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

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

**Alloy Steel Bars.**—1-in. dia. and up: Nickel, £37 7s. 3d.; nickel-chrome, £55; nickel-chrome-molybdenum, £61 13s.

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

## NON-FERROUS METALS

**Copper.**—Electrolytic, £202; high-grade fire-refined, £201 10s.; fire-refined of not less than 99.7 per cent., £201; ditto, 99.2 per cent., £200 10s.; black hot-rolled wire rods, £211 12s. 6d.

**Tin.**—Cash, £1,080 to £1,085; three months, £1,015 to £1,020; settlement, £1,080.

**Zinc.**—G.O.B. (foreign) (duty paid), £151; ditto (domestic), £151; "Primo Western," £151; electrolytic, £155; not less than 99.99 per cent., £157.

**Lead.**—Good soft pig-lead (foreign) (duty paid), £136; ditto (Empire and domestic), £136; "English," £137 10s.

**Zinc Sheets, etc.**—Sheets, 10g. and thicker, all English destinations, £170 7s. 6d.; rolled zinc (boiler plates), all English destinations, £168 7s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £139 10s.

**Other Metals.**—Aluminium, ingots, £120; antimony, English, 99 per cent., £250; quicksilver, ex warehouse, £31 to £31 15s.; nickel, £386.

**Brass.**—Solid-drawn tubes, 21⅝d. per lb.; rods, drawn, 28¼d.; sheets to 10 w.g., 26d.; wire, 26⅜d.; rolled metal, 24¾d.

**Copper Tubes, etc.**—Solid-drawn tubes, 23¼d. per lb. wire, 226s. 6d. per cwt. basis; 20 s.w.g., 254s. per cwt.

**Gunmetal.**—Ingots to BS. 1400—LG2—1 (85/5/5/5), £190 to £220; BS. 1400—LG3—1 (86/7/5/2), £200 to £232; BS. 1400—G1—1 (88/10/2), £285 to £315; Admiralty GM (88/10/2), virgin quality, £290 to £320, per ton, delivered.

**Phosphor-bronze Ingots.**—P.Bl, £295 to £325; L.P.Bl £200 to £239 per ton.

**Phosphor Bronze.**—Strip, 34d. per lb.; sheets to 10 w.g., 35⅜d.; wire, 36d.; rods, 33½d.; tubes, 38¾d.; chill cast bars: solids, 34½d., cored, 35½d. (C. CLIFFORD & SON, LIMITED.)

**Nickel Silver, etc.**—Ingots for raising, 2s. 2¾d. per lb. (7%) to 3s. 1½d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 2s. 8¼d. (7%) to 3s. 7½d. (30%); to 12 in. wide × .056, 2s. 9d. to 3s. 7¾d.; to 25 in. wide × .056, 2s. 11d. to 3s. 9¾d. Spoon and fork metal, unsheared, 2s. 5¾d. to 3s. 4½d. Wire, 10g., in coils, 3s. 2¼d. (10%) to 4s. 1d. (30%). Special quality turning rod, 10%, 3s. 1¼d.; 15%, 3s. 5¾d.; 18%, 3s. 10d. All prices are net.

## Obituary

MR. J. T. CADMAN, formerly a director of Thomas Willett & Company, Limited, iron and brass founders, etc., of Burslem, Stoke-on-Trent, has died at the age of 73.

MR. ARTHUR KIRTON, formerly secretary and a directors of Gjers, Mills & Company, Limited, pig-iron manufacturers, of West Marsh, Middlesbrough, has died at the age of 77.

MR. RICHARD G. McELWELL, a well-known American metallurgist, died recently. For the last 15 years he had been head of the ironfoundry division of the Vanadium Corporation of America.

MR. JOHN BRACEWELL, secretary of Geo. Hattersley & Sons, Limited, textile machinists, ironfounders, etc., of Keighley (Yorks), with which firm he had worked for 50 years, died recently at the age of 67.

MR. ROBERT JOHN MILBOURNE, a former chairman and managing director of C. & W. Walker, Limited, gasworks engineers and ironfounders, of Donnington, near Wellington (Salop), has died at the age of 86. He was a director of the F.C. Construction Company, Limited, Derby.

PROF. RICHARD STANFIELD, F.R.S.E., Professor of Mechanical Engineering at the Heriot-Watt College, Edinburgh, from 1889 until 1929, died on October 19 at the age of 87. Educated at Manchester Grammar School and the Royal School of Mines, Prof. Stanfield was senior Whitworth Scholar in 1884, and gained the National Science Scholarship in 1886. The professor was at one time president of the Royal Scottish Society of Arts, and was consulting engineer to the Highland and Agricultural Society of Scotland.

## Forthcoming Events

NOVEMBER 28

**Institute of British Foundrymen.**

*Slough Section* :—" Results of Experimental Work on Oil-sand Practice in the Foundry," by D. T. Kershaw, B.SC., at High Duty Alloys, Limited, Buckingham Avenue, Trading Estate, Slough, at 7.30 p.m.

**Institution of Chemical Engineers.**

" Chemical Engineering Experiences in the Metallurgical and Chemical Industries," by S. Robson, at the Geological Society, Burlington House, Piccadilly, London, W.1, at 6 p.m.

NOVEMBER 29

**Institution of Production Engineers.**

*Glasgow Section* :—" Rust Prevention," by M. C. Timbury, at the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, C.2, at 8 p.m.

NOVEMBER 30

**Institute of Vitreous Enamellers.**

*Midland Section* :—" Metal Cleaning," by S. E. A. Ryder, at the Chamber of Commerce, New Street, Birmingham.

DECEMBER 1

**Institution of Mechanical Engineers.**

" Manufacture of Experimental Gas Turbines," by L. H. Leedham, M.I.MECH.E., at Storey's Gate, St. James's Park, London, S.W.1, at 5.30 p.m.

DECEMBER 2

**Institute of British Foundrymen.**

*Wales and Monmouth Branch* :—" Where is Cast Iron Going to?" by P. A. Russell, B.SC., F.I.M., at the Engineers' Institute, Cardiff, at 6 p.m.

THE FIRST CONFERENCE of the British manufacturers licensed for magnesium-treated spheroidal-graphite cast iron was held in Birmingham on Tuesday. Nineteen representatives of seven licensees joined in technical discussions, under the chairmanship of Dr. L. B. Pfeil, and afterwards visited the research laboratory of the Mond Nickel Company, Limited.

# 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

FOUNDRY MANAGER or SUPERINTENDENT seeks post. Not definite, but preferably Midlands area. Progressive, experienced in practical, technical and commercial spheres. General loose work and also mechanised plants with iron, and high duty mixes, also malleable and steel. Married, age 40, M.I.B.F.—Box 306, FOUNDRY TRADE JOURNAL.

## SITUATIONS VACANT

**CARMARTHENSHIRE EDUCATION COMMITTEE.**

**LLANELLY TECHNICAL COLLEGE.**

APPLICATIONS are invited for the post of FULL-TIME LECTURER IN FOUNDRY SUBJECTS.

Candidates should have up-to-date knowledge and experience of modern foundry practice and be capable of conducting practical and theoretical classes in foundry work and science in preparation for the Intermediate and Final Certificates of the City and Guilds of London Institute.

Ability to teach Drawing will be an advantage.

Salary in accordance with the provisions of the Burnham Scale of Salaries for Teachers in Technical Schools, with increments for previous teaching and/or industrial experience.

Application Forms, which must be returned within two weeks of the appearance of this advertisement, may be obtained from the undersigned on receipt of a stamped addressed foolscap envelope.

IORWERTH HOWELLS,
Director of Education.
Education Department,
County Hall, Carmarthen.

FOREMAN required for fully mechanised North Midlands Foundry. Knowledge of modern mass production methods essential also knowledge of Steel Foundry practice and practical experience of up-to-date Production Planning Methods would be very desirable qualifications. Must possess all the qualities for making successful foremanship.—Applicants must state full details of training, experience, position held, age, and salary required. Box No. 594, DORLAND ADVERTISING, 18/20, Regent Street, S.W.1.

POSITION of ASSISTANT FOUNDRY FOREMAN open to live man with intimate experience in administration of coremaking department employing mixed labour and sound knowledge also of green and dry sand moulding from moulding machines and skilled moulding. Foundry is situated in neighbourhood of London and offers excellent prospects to man of good experience who can improve existing conditions.—Apply Box 294, FOUNDRY TRADE JOURNAL, stating age, experience, etc.

FOREMAN required, age 30-40, for small Grey Iron Foundry approx. 45 tons per month. W. Riding of Yorks. Jobbing work predominant. Man with experience of rate fixing for piece work preferred.—Box 296, FOUNDRY TRADE JOURNAL.

## SITUATIONS VACANT—*Contd.*

FOUNDRY FOREMAN.—Young energetic Foundryman required as Assistant to Foreman. Must have some practical experience, especially of machine moulding methods, knowledge of sand control and cupola practice, and to be able to control labour. Permanent position for successful applicant.—Apply in the first instance in writing, stating age, details of previous position held, and salary required.—BILSTON FOUNDRIES, LTD., Highfields, Bilston.

REQUIRED IMMEDIATELY.—MOULDERS for H.W. Connections, and MOULDERS and MATES for 6 ft. and 9 ft. lengths of 4-in. hot water pipes. Piece work rates.—Apply C. P. KINNELL & COMPANY, LTD., Thornaby-on-Tees, Stockton-on-Tees, Co. Durham.

FERROUS and Non-Ferrous Foundry requires MOULDERS and TRIMMERS. Only skilled jobbing moulders need apply. — PLANT MACHINERY & ACCESSORIES, LTD., 136-140, Bramley Road, W.10. Ladbroke 3692.

MOULDERS.—Iron Foundry requires skilled jobbing Moulders. Piecework or bonus. Good wages can be earned by good workers.—HOLLAND FOUNDRY, 157, Clapham Road, S.W.9.

STEEL FOUNDRYMAN required, experienced in the production of heavy carbon and alloy steel castings. Knowledge of modern production planning methods an advantage. Progressive position for right man.—Applicants must state full details of training, experience, positions held, age and salary required, Box No. 595, DORLAND ADVERTISING, 18/20, Regent Street, S.W.1.

WANTED. — FOUNDRY SUPERINTENDENT / METALLURGIST, for a South Wales Foundry (Non-ferrous Metal). Experienced in sand control, and with knowledge of centrifugal casting.—Full particulars to Box 292, FOUNDRY TRADE JOURNAL.

WANTED.—WORKS MANAGER for Steel Foundry and Engineering Concern situated in the North-East Coast employing approximately 700. Present output of metal 100 tons per week from Basic Electric Furnaces. Large proportion of output finished machined castings. Every encouragement will be given to the right man.—Apply by letter, stating age, remuneration expected, and giving full details of past experience, with references, to Box 166, FOUNDRY TRADE JOURNAL.

ENAMELLING SUPERINTENDENT required for Vitreous Enamelling Plant in Central Scotland producing Domestic Cooking Appliances and General Enamelware. Applicants should have experience of both Cast and Sheet Iron enamelling and be capable of organising and controlling all stages of the process.—Applications, stating age, qualifications and previous experience, to 02N5, WM. PORTEOUS & Co., Glasgow.

## SITUATIONS VACANT—*Contd.*

FOUNDRY SUPERVISOR required, experienced in Machine Moulding Technique (Steel). North-West Area. Good salary and prospects to right type of applicant.—Full details to Box 244, FOUNDRY TRADE JOURNAL.

MOULDERS required for Iron Foundry experienced in jobbing work from 1 lb. to 1 ton. First-class men only need apply.—Apply H. & E. LINTOTT, LTD., Engineers, Horsham, Sussex.

TECHNICAL SERVICE AND SALES REPRESENTATIVES wanted to handle synthetic resin corebinders. Foundry experience preferred.—Apply DEVELOPMENT MANAGER, B.I.P., Ltd., Research Laboratories, Tat Bank Road, Oldbury, Worcs., stating age, qualifications, and giving references.

JUNIOR METALLURGISTS required for general control work in iron and steel foundry.—Write, stating age, training, experience, and salary required, to Box 194, FOUNDRY TRADE JOURNAL.

SENIOR COMMERCIAL ASSISTANT wanted for Steelworks Sales Dept. in N.E. Coast firm.—Applicants should state age and experience to Box 204, FOUNDRY TRADE JOURNAL.

FOUNDRY SUPERINTENDENT required in East Midlands Foundry making Grey Iron Castings for machine tools, large and small Diesel engines, and pump work.

Must be experienced in the above castings as general jobbing work up to 4 tons, and also experienced and able to economically control semi-mechanised plant consisting of Herman Pneulec Rollover and Jarr Squeeze Strip Machines.

Please send full particulars, which must include age, experience, details of metallurgical knowledge, and salary required, to Box 266, FOUNDRY TRADE JOURNAL.

APPLICATIONS are invited for the position of FOUNDRY CHEMIST, to control the production of high duty irons. Please give fullest details of experience and salary required.—TECHNALOY, LTD., Stocklake, Aylesbury.

A LARGE Company of Cooking Appliance Manufacturers have a vacancy for an ENAMEL DEPARTMENT SUPERINTENDENT, and invite applications from men who are energetic, capable production organisers with sound technical knowledge, plus the ability to maintain strict discipline. The scope of the appointment covers control of Mill Room, Laboratory, cast iron and sheet steel Enamel Shops. Experience of continuous furnace working would be an advantage. The position is permanent and pensionable and carries a generous salary.—Apply, giving full details of age, education, experience and salary required, to Box 270, FOUNDRY TRADE JOURNAL.

FOUNDRY TECHNICIAN required for modern progressive foundry, situated near London; must have good experience in non-ferrous and foundry processes, including melting, sand control, running and feeding practice. State standard of education, experience and salary required. —Write Box R.48, WILLINGS, 362, Grays Inn Road, London, W.C.1.