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PRINCIPAL CONTENTS

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Brassfoundry Report

With the issue of "The Brassfoundry" the title of a Report* made by a team of men from the brassfoundry industry after a tour of inspection of foundries in the United States, the trilogy is now completed. The earlier ones emanated from the steelfounders and jobbing ironfounders, and the three together make a fascinating series of manuals as to what should be done in this country. They all insist on better incentives for everybody in industry: easy conditions for the acquisition of new buildings and plant, and on a lowered level of taxation. This latest Report has rightly taken cognisance of what has previously been published, and has stressed not mechanisation, but motorisation of the industry. This starts with a knock-out in a set position, followed by a simple sand-preparing unit. Then by the use of portable moulding machines and generally mobile plant, plus a few lengths of roller conveyor, the foundry is converted from a workshop to a manufacturing plant.

This is, of course, the material aspect, for on the human side stress is laid on incentives, and to be candid, it is here that Government help is needed for implementation. The present rate of taxation is such as to take off not merely the cream of the reward for extra effort, but the major part of the milk, too, for if one really does well, all that is left is a paltry sixpence of every pound earned. Though working men do not pay at this high rate, they are very heavily hit. It has been stated in the Report that it may be that the British prefer security and leisure to a higher standard of living, yet is it pleasant to take a holiday with scarcely the price of a "bitter" in one's pocket? The Report stresses the need for mechanisation, but we fear the wrong word has been used, and, as we indicated earlier, "motorisation" is more apt. "Safety first" comes in for consideration, and the attitude is very different in America from this country. There is recognition that, no matter what is done, factories are still potentially dangerous. Instead of making machinery "foolproof," they endeavour, and no doubt with outstanding success, to remove the stigma of "fool" from the mental make-up of their staff, by deeply inculcating a sense of "safety first" into everybody.

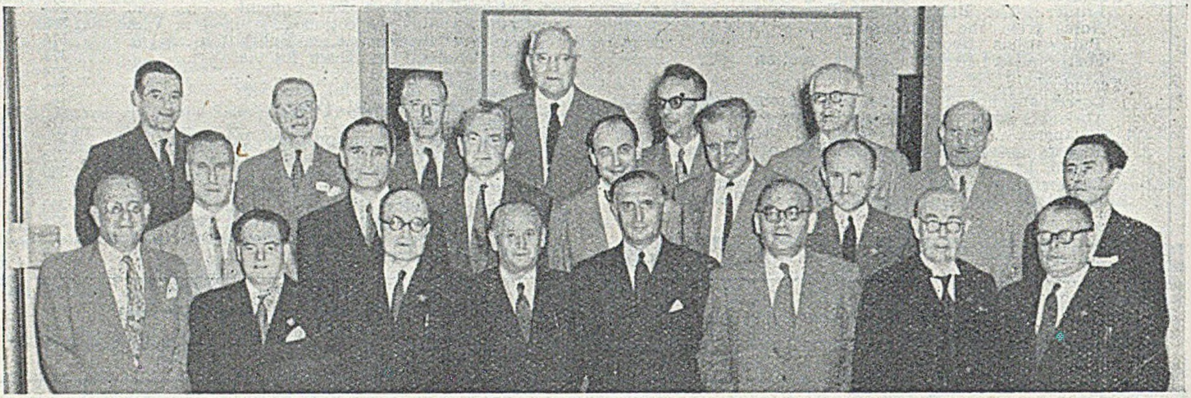
This Report, like others in their respective spheres, needs to be implemented by the brassfoundry industry in general, but the truth is that communal activities are shouldered by quite a small percentage of firms engaged in this industry. It is high time that *all* manufacturers of non-ferrous castings added to every invoice they send out a fraction of one per cent. for co-operative interests such as research and development, thus acting along lines parallel to those in vogue in France. The Report is excellent and every bronze and brass foundry should procure a copy and act on the precepts enunciated. Mr. Frank Hudson and his team are to be congratulated on the high standard of reporting they have achieved.

* Published by the Anglo-American Council on Productivity, 21, Tothill Street, London, S.W.1. Price 7s. 6d. (post free).

International Committee of Foundry Technical Associations

Members of the International Committee of Foundry Technical Associations photographed at the Brussels Conference. Reading from left to right :—

Front row :—Mr. W. L. Seelbach (U.S.A.), Commendatore M. Olivo (Italy), Mr. T. Makemson, M.B.E. (U.K.), Mr. J. Küster (Germany), Dr. G. Vanzetti (Italy), Mr. F. W. E. Spies (Holland), Mr. V. C. Faulkner (U.K.), Mr. M. Borgerhoff (Belgium).
Middle row :—Dr. P. W. Muller (Switzerland), Mr. J. Sissener (Norway), Mr. Colin Gresty (U.K.), Mr. E. O. Lissell (Sweden), Mr. J. Drachmann (Sweden), Mr. R. Reitsema (Holland), Dr. E. Hugo Germany), Mr. J. Foulon (Belgium).
Back row :—Mr. G. Lambert (U.K.), Mr. A. Brizon (France), Mr. V. Delport (Rep. U.S.A.), Mr. M. Vuilleumier (Switzerland), Mr. J. Goffart (Belgium), Mr. O. Hoff (Denmark).



Correspondence

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

PATTERNMAKERS' ASSOCIATION

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—I was particularly interested in your Editorial in which you refer to the non-existence of a master patternmakers' association, as "almost incomprehensible." It was obviously impossible for you to discuss at any length in your article the pros and cons of such a move. I would like, however, to comment upon two factors you mention.

Dealing first with the "widespread growth of employers' organisations since the war," surely you will agree that many of these organisations are typical of trade prosperity, just as unemployment and bankruptcy are typical of trade depression, and at the first chill wind of economic stress they will disappear overnight.

Regarding your second point, namely the necessity for an association in order to co-operate on technical training, I would like to say this. I am still in my forties, and from the days of my apprenticeship I have never at any time noticed any lack of facilities for those persons who were prepared to take advantage of such facilities.

It does, therefore, appear to one to be difficult to argue the case for an association based upon these points, and as I have often thought about the possibilities of such an organisation, the more I have been confronted with the many difficulties due to the economic relationship of the master patternmaker to the whole framework of the engineering and foundry industry. I write this letter not as one opposed to the views you express, but rather as one favourably disposed but unable to see the possibilities.

Yours, etc.,

J. BAILEY
(for Cooke Bailey, Limited).

September 18, 1951.

[We think all industries should have an employers' organisation in order that they may negotiate with Government departments—in the case of master patternmakers the supply of adequate quantities of suitable timber in times of shortages. Again, there is the question of representation on bodies which adjust the wages paid to skilled labourers or arrange teaching courses. Then, there are such questions as the poaching of labour. This is minimised when the various employers not merely know one another but actually become friends. Questions of apprenticeship conditions sometimes need discussion. So one could continue.—EDITOR.]

Notes from the Branches

Wales and Monmouth

On August 17, 40 members of the Wales and Monmouth branch of the Institute of British Foundrymen visited the Stanton Ironworks Company Limited, Nr. Nottingham. The six-hour journey by coach from Cardiff necessitated an early departure. On arrival at Stanton, Mr. P. H. Wilson, O.B.E., past-president of the Institute, presided at luncheon kindly provided by the Company. Mr. Harold Davies, branch president, expressed the thanks of members for the invitation to visit Stanton Works, and Mr. P. H. Wilson, in welcoming the party, gave a brief outline of the tour of the works which included the spun-pipe plant, mechanised foundry and the apprentices' training centre. The last was an established department in the company's organisation where apprentices were encouraged to make the most of opportunities in their early years, thus assisting their future progress in the industry.

Returning to the canteen for tea before departure, Mr. Davies briefly thanked Mr. Watson who represented the Company on this occasion for the many courtesies afforded the party on this memorable visit.

Abstracts from the Brussels Conference Technical Papers

The following abstracts have been taken from the technical contributions to the International Foundry Congress held in Brussels from September 9 to 14, when the whole range of subjects from pure theory to floor practice was dealt with in upwards of forty Papers. The contributions may be said to reflect to some extent the opinions held and degree of development in the countries of the Authors and the special value of such a meeting is derived from this free interchange. The full Papers have been printed and bound in a single volume by the organisers of the Congress but if any reader specially wishes to consult an individual item it is suggested he should write first to the Editor of this JOURNAL, *when an effort will be made to supply the one required. All the Papers are printed in French or English. From the necessity for space economy, many of the following abstracts record only the main conclusions drawn from the mass of experimental data presented.*

Dimensioning Risers and Feeding Heads

By J. S. Abcouwer (Werkspoor, Holland)

Conclusions

(1) For the same superheat, mould and metal, Chworinov's claims are in accord with the end of freeze times of the "Heat and Mass Flow Analyser Laboratory."

(2) Superheat is of paramount importance on start of freeze time, and in a lesser degree on end of freeze times and feeding.

(3) Risers and heads can be calculated mathematically somewhat more simply as with Caine's equation by:—

$$\frac{V_n}{S_n} : \frac{V_r}{S_r} = 1 - A\frac{V_c}{V_r}$$

(4) For the relation volume of casting divided by surface of casting has to be taken the maximum value $\frac{V_n}{V_n}$ and the riser or head has to be put on that place.

(5) Whether feeding proceeds as anticipated depends largely upon the hydrodynamics of the case (ferro-static and atmospheric pressure, time available and distance to flow), the thermal gradient in the direction of flow and the influence of this gradient on fluidity.

(6) In metals with a solidification range, freezing proceeds through the whole mass simultaneously, obstructing at least part of the feeding.

(7) It is of little use to calculate riser or head for a whole casting that only partly can be fed. The principles of how to feed a casting first have to be solved.

(8) It is good practice to dispense with risers and heads as far as possible, wall thicknesses, height and kind of metal and mould being the limiting factors.

Nodule Genesis and Growth in Magnesium-treated Hypoeutectic Irons

By R. P. Dunphy and W. S. Pellini (Naval Research Laboratory, Washington, D.C.)

It is tentatively concluded that the sequence of events occurring during the solidification of hypoeutectic cast iron properly treated with magnesium can be outlined as follows:—

Stage 1: The solidification of dendrites of austenite beginning at the liquidus temperature and continuing to the temperature at which the normal eutectic consisting of flake graphite and austenite would occur.

Stage 2: Suppression of the normal flake graphite eutectic during which interval graphite precipitates from localised regions of supersaturated interdendritic liquid in a spherulitic crystallisation mode.

Stage 3: Solidification of the remaining eutectic liquid as an austenite-iron carbide complex and rapid malleablisation of the structure resulting in growth of the graphite particles.

Quantity Production of Spheroidal-graphite Cast Iron

By N. Croft, Lloyds (Burton) Limited

Spheroidal-graphite cast iron has passed the laboratory stage and even that of the pilot plant. It is now exploited on a commercial scale. The techniques of both melting and processing have been established and their application has been more or less standardised according to each case. Though for the moulding and coring of the castings in nodular cast iron no special precautions are necessary, the layout of the runners and risers require special attention. Only the cleanest possible metal should enter the moulds, and that with a minimum of turbulence. Cleanliness and especially the elimination of the sulphurous slag must be rigorously controlled.

Shrinkage is much the same as for steel castings, and thus the feeding heads must be of the same type as in steelfoundry practice. The "life" of the metal is less than that of the base iron. So far as fettling is concerned, normal practice is followed. However, it is recommended that risers should not be broken off with a sledge unless the riser has been well notched, as there is a tendency for the heads to break into the casting. The better method is to use the oxy-acetylene flame cutter as in steel practice.

Nodular cast iron can be submitted to various heat-treatments. For a ferritic structure, it is obviously necessary to take the thickness of the section

Abstracts from the Brussels Conference Papers

into consideration. Heavy sections are naturally strongly ferritic. It is possible in such cases to change the structure into pearlitic by a treatment carried out above the critical temperature. The Author advises, on the other hand, that all castings not calling for heat-treatment should at least be reheated to about 500 deg. C. to remove internal stresses. In conclusion, a system of manufacturing control for normal production is given.

Study of the Design and Performance of Mould- and Core-drying Stoves

By E. O. Lissell, S. Førslund and S. Ryden (Sweden)

The design and operation of drying stoves are discussed on the basis of replies to a questionnaire and experiments in an electrically-heated foundry drying stove with recirculation. The drying cycle for sands bonded with different main types of core binders are touched upon:—

Three stages are distinguished in drying:—

First stage: Bringing the charge up to about 100 deg. C.

Second stage: Evaporation at constant temperature.

Third stage: Bringing charges up to drying temperature.

In the first two stages, heat input and temperature are probably less important, while these factors should be well controlled in the third stage.

Stove temperature should be kept within narrow limits when completing the drying cycle. Forced draft, with recirculation, is to be preferred to attain this.

High combustion efficiency, low amount of excess air and fuels that give a minimum amount of combustion products are to be preferred in drying. Heat losses through walls, floor and doors should be kept low through good design and efficient operation. Means of conveyance and reinforcement such as racks, boxes, plates, driers, etc., should be kept at a minimum. A minimum gas velocity is necessary to obtain efficient heat transfer.

The stove ought to be loaded with as many cores or moulds as possible (high load factor) if good fuel economy is desired. This will, however, increase the drying time. Maximum thermal efficiency seems to correspond with a definite rate of recirculation at a given load factor. Certain characteristic data, *i.e.*, rate of recirculation, load factor, iron quotient and specific fuel consumption are quite helpful when studying the performance of foundry drying stoves.

Gases in Bronze

By W. T. Pell-Walpole, D.Sc. (Tin Research Institute and Birmingham University)

Amongst the gases which can be introduced into bronze, some are simply dissolved, but others can combine with the constituents. After having studied the reaction of the gas with the metal in the liquid state, the Author examines the influence of the products of these reactions during the solidification. The main gases (hydrogen, oxygen, sulphur (SO_2) and water vapour) as well as gas brought in by the turbulence of the casting process are separately studied. These gases and the products of their reactions with the metal are the causes of the following defects:—(1) Internal gas porosity; (2) segregation of the weak constituent [$(\alpha+\delta)$ or $(\alpha+\delta+Cu_3P)$]; (3) inclusion of sulphide or oxide, and (4) superficial porosity and a superficial film of oxide.

The chief sources of contamination are:—(1) Gases introduced with the initial charge of metals; (2) gases present in the furnace atmosphere, and (3) gases absorbed during casting. With a knowledge of these three sources of gas, it is possible to find means to eliminate them, and the Author sets out the precautions to take and the treatment to give to the metal to ensure a minimum of contamination.

Surface Treating Grey Iron to Meet Specific Industrial Applications

By C. O. Burgess (Technical Director, Gray Iron Founders' Society, U.S.A.)

An attempt has been made in this Paper to outline briefly coating processes by which grey iron can be made to meet exacting corrosion, wear, oxidation or appearance standards. It should be noted that whilst grey iron is in some cases especially adapted to such treatments, the preparation of the surface for coating may differ from that used in the case of steel or non-graphitic materials. This is particularly true in surface preparation for tinning and for electroplating.

Possibility of adapting a readily-available material, such as grey iron, to meet rigorous industrial applications is of immediate importance in recurring periods of metal and alloy shortages. Use of coated materials as substitutes for highly-alloyed metals is naturally of maximum interest to design engineers when surface characteristics are of primary influence in determining whether a material is suitable for a given application. Before replacement or substitution, it is assumed that the substituted material will have been examined as to whether it will meet mechanical requirements.

Technical Education in the Danish Foundry Industry

By Ove Hoff (Denmark)

The Author describes the current position of the organisation for the training of apprentices, foremen and executives in Denmark. The principle of this education is the simultaneous holding of the theoretical courses at school with practical apprenticeship in the foundry. It has to be noted that the number of students for the foremanship grade is limited by the possibilities of employment in the industry.

Belgian Contribution to a Tentative Standard for Foundry Patterns

By Professor P. Houzea de Lehaie (Mons)

Under the auspices of Fabrimetal during the year 1949 and 1950 a commission comprising members of the *Association Technique de Fonderie de Belgique* and of the *Société Belge des Mécaniciens* have co-operated to establish the basis of what could be called a "Tentative standard for Foundry patterns."

This tentative standard not only classifies the raw materials and construction of patterns, but still gives very valuable recommendations to the patternmaker, the customer, technician, and foundryman to ensure maximum efficiency.

The report particularly insists on a co-operative spirit between the patternmaker, the designer, and the foundryman.

Utilisation of the Microscope in the Non-ferrous Foundry

By P. Mathy (Belgium)

The Author gives a few applications of the microscope in the copper-base foundry. The samples are polished either by abrasives or electrolytically. If chemical analysis be the usual means of control for the non-ferrous foundry, the examination of sample under the microscope can give very valuable informations in less time. In some cases it is possible through a micro-examination to adjust the mix from one melt to another. Macrography techniques—still simpler—are also very reliable for the detection of certain defects.

Grain Refinement in Magnesium Foundry Alloys

By J. Gris (France)

There are three processes for refining the grain of magnesium alloys:—(1) Superheating; (2) physico-chemical reactions, and (3) metallic additions.

(1) Superheating can only be used for alloys where the basic addition is aluminium. Experience has established a few practical rules applying to superheating.

(2) As to the use of physico-chemical reactions, the Author has experimented with the following agents:—Chlorine, iron chloride, magnesium carbonate (giobertite), the hexachlorethane (CCl_3-CCl_3) and the hexachlorocyclohexane ($C_6H_6Cl_6$). The alloy on which the tests were conducted was G-A9 (Al = 8.3 per cent.; Zn = 0.5 per cent.; Mn = 0.35 per cent.).

(3) Fig. 7 gives the structure of the Z5Z (Zn 4 per cent., Zr 0.7 per cent.) alloy of Magnesium Elektron, Limited (England), which has been treated by the metallic-addition process (in this case zirconium).

As-cast Structure of Ca/Mg-treated Nodular Cast Iron with and without Secondary Inoculation

By A. L. De Sy, J. Vidts and R. Collette (University of Ghent)

A comparative study of the Ca/Mg nodular iron process, *with* and *without* secondary inoculation, is made in relation to the three important variables:—(1) Final composition of the iron; (2) cooling rate, and (3) type of nodulising alloy.

Comparison of the results from three series of heats produced *without* secondary inoculation and three series of heats of almost identical composition produced *with* secondary inoculation shows very definitely that secondary inoculation is at least unnecessary; indeed, the mechanical properties of the nodular irons produced without secondary inoculation are generally better.

It is also stated that low-carbon irons and definitely hypo-eutectic compositions are less favourable than nearly eutectic irons. The effect of cooling rate on the structure of the matrix is studied by varying the section thickness of the castings.

Concerning the nodularising alloys, two types are considered: the Ca/Cu/Si type, with 1.5 to 2 per cent. Mg, and the Ca/Cu type with 1.5 to 2 per cent. Mg.

Control of Light-alloy Castings for Jet Engines

By J. Ophoven (Belgium)

The control for the production of jet-engine castings made in the Fabrique Nationale des Armes de Guerre light-alloy foundry consists of the following operations, both before and after pouring:—(1) Chemical control of raw materials; (2) temperature control during the melt; (3) de-gassing of metal; (4) study of the de-gassing stage; (5) chemical analysis of the tensile test-bar; (6) surface preparation; (7) talc examination of the surfaces; (8) milling test with flexible milling machines, and (9) X-ray examination of specimens (gas-holes, porosity, shrinkage, segregation, etc.).

An example of application of these controls on a casting illustrates the proposed process and gives the different steps carried before obtaining a practically perfect casting.

Possibilities of the Combined Treatment (Ca/Mg) for Nodular Iron

By A. L. De Sy, R. Collette and J. Vidts (University of Ghent)

The combined Ca/Mg process for the production of nodular iron is compared to the straight Mg process on the base of their respective advantages and inconvenients. A brief description is given of some 300 experimental heats treated by the Ca/Mg process, without secondary inoculation. The mechanical properties of the obtained nodular irons are studied in relationship to the structure either as-cast or after complete annealing.

According to the structure of the matrix, four classes are considered:—(1) Pearlitic nodular irons; (2) nodular irons with a continuous pearlitic network; (3) nodular irons with a continuous ferritic network, and (4) ferritic nodular irons.

By plotting mechanical properties against structure of the matrix, very regular curves are obtained for tensile strength and elongation.

Finally, the possibilities of the industrial application of the relatively-new combined Ca/Mg process are discussed.

Abstracts from the Brussels Conference Papers

Effect of Burn-out on Melting Conditions with Special Reference to the Water-cooled Cupola

By J. L. Jones and Fr. v. Bergen (International Meehanite Metal Company and the Globe Foundry, Holland)

There are two possible methods of reducing to a minimum the cupola lining wastage:—(1) Improving the refractory quality of the lining, and (2) improving the working conditions of the furnace. For this second case, it would be possible to cool down the lining to a sufficiently low temperature as to decrease and eventually suppress any burning back. After having defined the average burning back (arithmetical average of the attacked area above each tuyere), the Authors give the results of three series of tests carried out with a cupola the melting zone of which is cooled by a water coil. These tests have demonstrated that by water cooling of the melting zone it is possible to obtain a minimum burn-out of the lining and perform longer melts with all the economical and metallurgical advantages resulting from a constant inside cupola diameter.

The Authors are now carrying out tests on a small cupola cooled on all its height with the hope of obtaining still better results.

Ductile Iron—Its Significance to the Foundry Industry

By Albert Gagnebin (International Nickel Company, New York)

An industry such as a mining operation located in an area remote from the normal supply of replacement parts should find it useful to operate a foundry for the manufacture of ductile iron. By this means such an industry could go a long way towards becoming self-sufficient. Inventory costs of spare parts would be reduced and time lost waiting for deliveries circumvented. The broad range of utility of ductile iron and its inherent advantages in manufacture as compared to other ferrous materials are clearly evident under such circumstances. Malleable iron is primarily useful in light castings manufactured in large quantities. Cast steel has a much broader range of utility than malleable iron, but because of its lesser fluidity, is better adapted to medium and heavy sections not too intricate in design. The manufacture of either of these materials is best accomplished in a reverberatory or in an electric furnace and both types of installation require considerable capital investment. Furthermore, neither is completely flexible for an operation which may require a small amount of metal one day for light castings or a very large quantity of metal at another time for a single large casting. Ductile iron, on the other hand, because it can be produced in the cupola and because of its fluidity, has wide flexibility with respect to the size, intricacy and number of castings that can be produced at any given time. For example, one foundry operated by a manufacturing concern in the United States processed 120 tons of ductile iron during the month of April, 1951. Of this, 90 tons of good castings were obtained and 415 individual parts were made, ranging in weight from 5 lb. to 3½ tons. It is possible with a cupola operation to meet a greatly varied demand with respect to the type of castings produced. Furthermore, less skill is required for the manufacture of ductile iron than some of the other foundry alloys. Its compositional limits are broad and not critical, a wide variety of materials can be used for the base iron, and castings which may not meet specifications in the as-cast condition can be very simply heat-treated to harmonise with the requirements. It should not be inferred from this statement that technical control is not required. However, the control is simpler and the foundry problems less than with many other materials. It is, for example, easier to manufacture ductile iron than it is to manufacture high-strength, acicular grey iron. Its fluidity, its suitability for pressure castings, and its freedom from hot-tearing all contribute to the facility of its production. Although ductile iron would not completely fulfil the requirements of an isolated mining operation, since such items as crusher jaws and other parts requiring highly-specialised properties would be required from outside sources, it is evident that a large degree of self-sufficiency would be achieved and that the industry could perhaps produce in its own foundry 90 per cent. of its replacement parts.

For many of the same reasons, ductile iron should be extremely useful to those countries which are not yet fully industrialised. The capital investment can be considerably lower than that for the manufacture of other materials. This permits a larger number of units and a larger output for the same investment. With the development of the basic cupola, of which there are now a number operating in the United States producing a base iron with a sulphur content of 0.02 per cent., no critical or expensive materials are required. Furthermore, in an expanding industrial economy where requirements cannot be accurately forecast, the broad scope of properties available in ductile iron should be advantageous and will allow maximum realisation of new design concepts. Typical castings being produced in ductile iron range from light-iron castings, thousands of which are manufactured each week, to an anvil block, which weighs roughly 50 tons. A ductile-iron foundry could usefully serve a wide variety of industries, including the agricultural, manufacturing, transportation, mining and petroleum fields.

In a highly industrialised country like the United States, ductile iron permits the decentralisation of production, which is desirable from many viewpoints. It multiplies the available sources of supply, reduces transportation costs, and in many cases reduces manufacturing costs. Greater flexibility is achieved with a number of small units as compared to a large single one and the industrial economy as a whole can accommodate greater fluctuations in the size and the nature of the demands made on it.

It is generally more readily possible to make rapid changes in small operations than in large ones. Furthermore, many industries in the United States have found that there is an optimum size for many operations and that efficiency is sacrificed when the individual units are too large. In addition, it is always advantageous to have the manufacturing unit located close to the market being served. The low capital investment required for ductile iron makes it possible for certain industries to add a foundry to their facilities, thereby achieving greater self-sufficiency and economy. When materials are purchased from many sources in a complex operation, the uniform flow of these materials can only be accomplished through the considerable expenditure of time and money.

The invention of ductile iron provides a new method for utilising iron, one of the oldest and most useful metals known to man. The Author is confident that it is destined to become the second ranking casting material and that it will create new and broad markets for the foundry.

(*Further abstracts from these Congress Papers will appear shortly.*)

Institute of Metals

Discussion on "Metals Economics"

As previously announced, a general discussion on "Metal Economics" will be held, beginning at 10 a.m., at the Park Lane Hotel, Piccadilly, London, W.1, on October 17. The president, Prof. A. J. Murphy, M.Sc., will occupy the chair. The meeting will be divided into two half-day sessions. At each session several short Papers will be presented, after which there will be a discussion restricted to the subject of the session. Visitors will be welcome at the meeting and, in view of the importance of the subject, it is hoped that there will be a large attendance.

The programme includes Papers from Mr. R. Lewis Stubbs (British Non-Ferrous Smelters' Association), "World Supply of Non-ferrous Metals, including the Light Metals"; Prof. S. Zuckerman, C.B., F.R.S. (Birmingham University), "Metals as Natural Resources"; Dr. T. P. Colclough, C.B.E. (British Iron and Steel Federation), "Iron Ore: World Demand and Resources"; Mr. C. A. Bristow, Mr. A. J. Sidery and Dr. H. Sutton (Ministry of Supply), "Scope for Conservation of Metals, Ferrous and Non-ferrous"; Mr. C. Dinsdale (British Railways), "Economy by Standardisation of Alloys and of the Method of Reclamation of Scrap Metals"; Mr. F. Hudson (Mond Nickel Company, Limited), "Influence of Specifications on Productivity and the Economic Utilisation of Ferrous and Non-ferrous Metals"; Mr. E. H. Jones (Capper, Pass & Son, Limited), "Secondary Heavy Metals," and Colonel W. C. Devereux, C.B.E. (Almin, Limited), "Secondary Aluminium and Magnesium."

In the evening (8.0 to 11.0 p.m.) there will be an informal conversazione at the Institute's headquarters, 4, Grosvenor Gardens, London, S.W.1, at which there will be a small exhibition of apparatus, equipment, specimens and recent books. A charge of 3s. 6d. will be made to cover the cost of light refreshments.

On the following day, Thursday, October 18, there are to be several visits to works. A charge of 5s. will be made to cover transport and administrative expenses,

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

Publication Received

Gibbons Post-war Report. Issued by Gibbons Brothers, Limited, Dibdale Works, Dudley, Worcester.

This is an example of publicity at its highest level It is dignified, beautifully and clearly illustrated, splendidly bound in green, with the title set out in raised lettering. There are 47 illustrations—in fact, it is mainly a book of illustrations—yet in all these there are but two human figures. It appears to be a good policy. The make-up of this brochure is to take a type of plant, say gas works plant, then list the post-war installations, followed by a few pages of typical illustrations. The final pages illustrate the extensions carried out to their own works. The reviewer compliments the publicity department on having made such a handsome contribution to the field of trade literature.

F. Perkins "At Home"

Last week, the well-known firm of Diesel-engine builders, F. Perkins & Company, Limited, of Peterborough, entertained two parties each numbering 250 of their suppliers. To-day conditions are such that one cannot give service to customers unless one is well supplied with raw material and by showing the suppliers the factory, they obtained a much better understanding of the firm's requirements. Over an excellent luncheon, the chairman of the company, Mr. F. Perkins, related how the firm, now ranking amongst the largest makers of Diesel engines in the world, was only 18 years old. He stated that recently they had acquired a supply of French castings to alleviate the current pressure, for the factory is being doubled in size. For the equipment of the new extension, German machinery is being imported on a considerable scale. The factory, which is located in a splendid garden, is well equipped both as to machinery and handling. There is no foundry, but it would not surprise the writer if plans were on the drawing board for such a development.

I.B.F. Gardom Students' Fund

This fund was provided by J. W. Gardom, President 1945-46, in order to enable young foundrymen, usually within the range of 20 to 25 years, to have the opportunity of participating in the various sub-committee meetings of the Technical Council of the Institute of British Founders. Selected students are allocated to an appropriate sub-committee, and the expenses of attending meetings are met from the fund. If necessary, the Institute is prepared to approach employers with regard to the required leave of absence. Since the fund was inaugurated, a number of selected students have been attached to various sub-committees, and the scheme has been exceedingly successful.

It has now been decided to invite further applications from young foundrymen to participate in the fund. Those who are interested are requested to apply to the secretary of the Institute for an application form, which should be returned not later than October 13.

and tickets must be obtained from the secretary in advance. These visits are restricted to members of the Institute. Transport will leave 4, Grosvenor Gardens, London, S.W.1, at 9.30 a.m., and the works to be visited include Enfield Rolling Mills, Limited, and Enfield Cables, Limited, Brimsdown, Middx; High Duty Alloys, Limited, Slough, and Telegraph Construction & Maintenance Company, Limited, Greenwich.

Industry and Design

The Design Congress which was held at the Royal College of Art in London last week attended by chairmen, directors, and managers of many leading firms from this country and overseas, revealed similarities and conflicting methods of treating the increasingly important question of design in industry. Papers prepared by 23 industrialists explained the character of their companies' design policy, how it was devised and executed, and its commercial importance. The Papers read by Dr. Harold Hartley, chairman of Radiation, Limited, and Mr. W. T. Wren, who is a director of Allied Ironfounders, Limited, and managing director of Aga Heat, Limited, both stressed the necessity for design policy in industry to be the responsibility of management.

Sir Harold Hartley said that a design team should include an " artist-technician " who appreciated the function of artist, craftsman, and engineer. " In the team," he added, " some are concerned primarily with the way things look, some with the way they work, and others with the manner in which they are built. Industrial design must incorporate all three facets." With changes in construction and design, and with the increasingly important part played by the Radiation group's central research and development section, more and more specialist technologists were engaged. As their influence grew, that of the patternmakers diminished. The customer, representing the majority taste, he said, was the final arbiter of good design. There seemed to be a need for education and industry had a rôle to play in the process. Production and sales sections of an organisation must exercise forbearance and understanding, lest a good design be condemned because it was possibly more difficult to make or to sell.

Courage to begin and to know when, how, and where to stop were put forward by Mr. Wren as the important points to remember in the framing and operation of a design policy. Mr. Wren is also a believer in the individual flair. If the ideas and instincts of a designer, especially an outside consultant, were probed too closely by too many insensitive minds, they lost their " glorious spontaneity and therefore a great deal of their value," he said. On the question of public taste, Mr. Wren said he did not think public taste was in general ahead of the average manufacturer. It was passively receptive, with a few preferences and prejudices which research disclosed.

I.E.E. Scottish Centre's Chairman

The designer of many large high-voltage transformers for the grid system, rectifier installations for railway electrification, and transformers for hydro-electric schemes at home and overseas, Mr. P. Butler, who is manager of the transformer and rectifier departments of Bruce Peebles & Company, Limited, Edinburgh, has been elected chairman of the Scottish centre of the Institution of Electrical Engineers.

National Research Development

Three new appointments to the membership of the National Research Development Corporation have been announced by the President of the Board of Trade. One of the new members is Mr. J. F. Lockwood, managing director of Henry Simon, Limited, manufacturers of storage silos and handling plant, etc., of Cheadle Heath, Stockport (Ches). Sir Rowland Smith, chairman of the Ford Motor Company, Limited, and Sir Henry Tizard, F.R.S., are the other two new members.

The members of the corporation whose initial periods of service recently expired have been reappointed, Sir Percy Mills, who is managing director of W. & T. Avery, Limited, weighing machine manufacturers, etc., of Birmingham, continuing as chairman. Lord Halsbury remains managing director, the other members of the corporation being Sir John Duncanson, chairman of Daniel Varney, Limited, engineers, of Glasgow, and a director of other companies, Sir Edward H. Hodgson, Mr. W. E. P. Johnson, Sir Edward De Stein, Prof. P. M. S. Blackett, and Prof. E. C. Dodds.

Radiographic Inspection

The use of radiography as a method of inspection in industry was referred to by Dr. Edwin Gregory, a director and chief inspector of Edgar Allen & Company, Limited, the Sheffield steelmakers, when he delivered a Paper at the opening session of the convention of the Institution of Engineering Inspection in Glasgow. He estimated that 20 per cent. of British steel foundries were making frequent use of radiographic facilities, both in the improvement of foundry technique and in the final inspection of certain castings.

Explaining the value of engineering inspectors, Brigadier E. M. Ransford, a chief inspector of armaments, told a Press conference held in connection with the convention that whereas in the old days the craftsman was his own inspector, with the increasing use of mechanised tools more and more unskilled labour was being used, and it therefore became increasingly necessary to take the critical function of inspection out of the hands of the workman and apply it from outside. A standard of inspection should be aimed at that would make the acceptance of the finished product automatic.

Principal representative of Metropolitan-Vickers Electrical Export Company, Limited, since 1948, Mr. F. R. Mason has been appointed a director of the company. After completing his course as a college apprentice with Metropolitan-Vickers Electrical Company, Limited, in 1928, he spent several years on power engineering work, and during that time he won the graduates' prize of the Institution of Mechanical Engineers, and spent a year with A.E.I. (India), Limited, as technical representative. In 1938 he became engineer-in-charge of the paper-mill section of the general engineering department, and he held this position until 1948.

Factors Affecting the Solubility of Carbon in Iron*

By R. V. Riley, Ph.D., B.Sc., A.I.M.

(*Continued from page* 339.)

Metallographic Examination

Specimens from the interesting series of experiments described in part IV were mounted for metallographic examination.

(a) *Vacuum Melted Series*

The irons melted *in vacuo* were all high in carbon content and under the microscope showed hyper-eutectic graphite flakes. Some of these flakes were exceedingly large, as in Fig. 5. The matrix was ferrite and pearlite in approximately equal proportions. There were no important differences between the specimens melted without and with lime and calcium carbide additions.

(b) *Hydrogen Atmospheres at* 10-*mm. Pressure*

The general structure of irons in this series was mainly pearlitic. The amount of ferrite was very small and was largely confined to the specimen melted in contact with lime. A most interesting feature in the specimen which had been melted in contact with calcium carbide was the well-formed graphite nodules which may be seen in Fig. 6. The presence of the nodules was not altogether unexpected as calcium carbide is known to be a nodulariser[40] and the composition of this iron at the conclusion of the experiment was suitable for nodularising:—T.C, 4.35; Si, 2.20; Mn, 0.63; S, 0.008 and P, 0.37.

It is of interest to record that this was the only example of a nodular graphite structure found in the experiments carried out in Part IV. In a number of instances the composition of the iron after melting in the manner described was just as suitable from the point of view of sulphur (see Table VIII), carbon and silicon contents. The working temperature in these experiments was not, however, quite as high as that recommended for the production of nodular iron with calcium additions.[40]

FIG. 5.—*Coarse Hyper-eutectic Flake Graphite in a Matrix of Mixed Ferrite and Pearlite; Vacuum-melted Iron.* × 600 *mags.*

(c) *Hydrogen Atmospheres at* 750 *mm. Pressure*

These specimens showed a completely pearlitic structure with medium to fine flake graphite. Hyper-eutectic graphite was absent (Fig. 7).

(d) *Nitrogen Atmospheres at* 10 *mm. Pressure*

The irons melted in low pressure nitrogen were of mixed pearlite-graphite structure. The specimen melted in contact with graphite only had a normal

* Paper presented at the Annual Conference of the Institute of British Foundrymen at Newcastle-upon-Tyne, Mr. C. Gresty presiding. The Author is manager of the Research Department, Staveley Iron & Chemical Company, Limited.

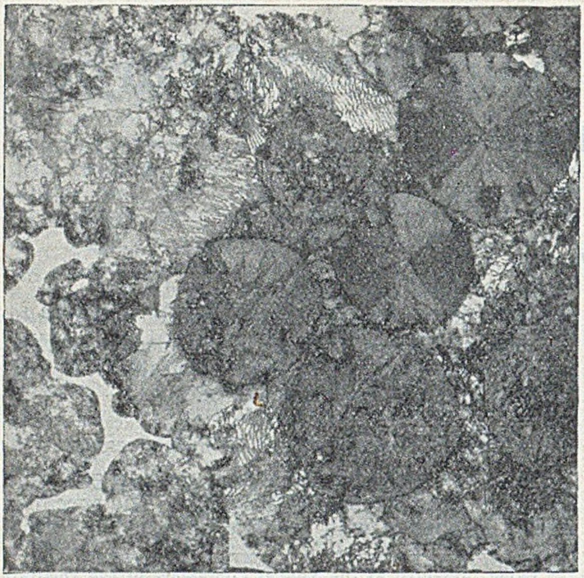


FIG. 6.—*Well-formed Graphite Nodules found in Specimen Melted in Hydrogen at 10 mm. in contact with Calcium Carbide × 600 mags.*

FIG. 8.—*Grey-iron Structure of Specimen Melted in contact with Graphite in an Atmosphere of 10 mm. Nitrogen. × 600 mags.*

grey iron structure as shown in Fig. 8. The specimens melted with lime and with calcium carbide both had supercooled graphite structures with rather more ferrite areas (Fig. 9).

(e) *Oxygen at 10 mm. Pressure*

The characteristic structure was a very fine mixed pearlite and ferrite matrix with fine flake and supercooled types of graphite (Fig. 10). The specimen melted in contact with graphite only also had a small central zone of internal chill as shown in Fig. 11.

(f) *Air at 750 mm. Pressure*

All the specimens had a largely pearlitic matrix with flake graphite and some ferrite near to some of the flakes. The general structure of the iron melted in contact with lime is shown in Fig. 12.

(g) *Relationship between sulphur and carbon contents*

Owing to the smallness of the specimens of iron used in the experiments described in Part IV, it was

FIG. 7.—*Medium-flake Graphite in Pearlite. Specimen Melted in Hydrogen Atmosphere at 750 mm. in contact with Calcium Carbide. × 600 mags.*

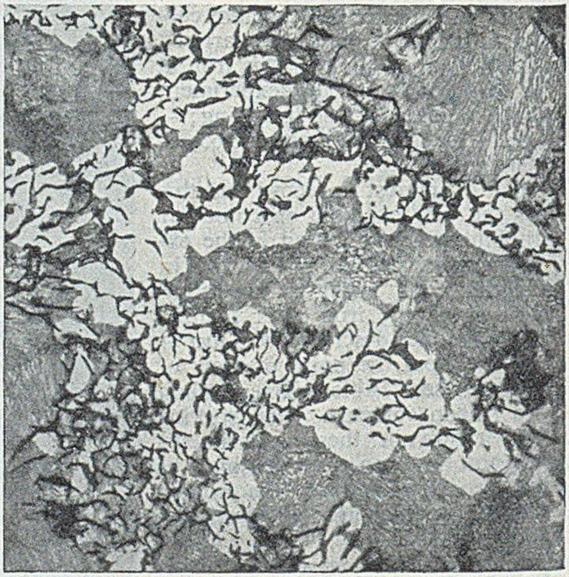


FIG. 9.—*Supercooled Graphite and Ferrite in Pearlite Matrix. Specimen Melted in Nitrogen at 10 mm. in contact with Calcium Carbide. × 600 mags.*

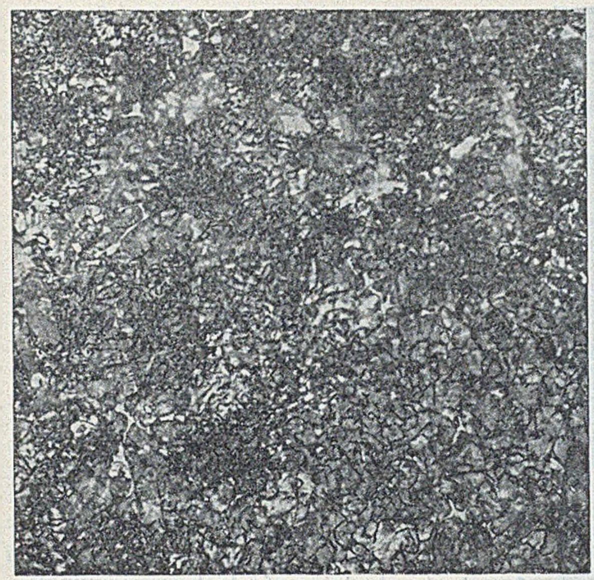


FIG. 10.—*Fine Mixed Structure of Specimen Melted in contact with Graphite only in Oxygen Atmosphere at* 10 *mm. pressure.* × 100 *mags.*

FIG. 11.—*Central Zone of "Internal Chill" found in same Specimen as in Fig.* 10. × 600 *mags.*

not possible to analyse all for sulphur content. The results which are available are given in Table VIII.

Some loss of sulphur occurred in all the experiments. The experiments carried out *in vacuo* and in gases at low pressure gave iron of very low sulphur content. Lime and calcium carbide in contact with the iron brought down the sulphur as might be expected.

Although some of the specimens with very low sulphur contents gave high carbon figures, the percentage of carbon found appeared to bear no direct relationship to the amount of sulphur present. For example, the iron melted in low pressure nitrogen, whilst having a low sulphur content, did not have a very high carbon content. It is of some interest to observe that if the melting of iron could be carried out in the cupola at lower gas pressures, or in a more reducing atmosphere, the sulphur content of the iron might be substantially reduced.

TABLE VIII.—*Sulphur Content of Iron under various Atmospheres after* 1 *hour at* 1,500 *deg. C.*

No.	Experimental conditions.	Graphite only. Percentage of sulphur.	Graphite + lime. Percentage of sulphur.	Graphite + calcium carbide. Percentage of sulphur.
1	Vacuum	Trace	0.005	0.009
2	Hydrogen 10 mm.	0.012	0.002	—
3	,, 750 ,,	0.032	0.010	0.008
4	Nitrogen 10 mm.	0.013	—	—
5	Oxygen 10 mm. ..	—	0.017	0.004
6	Air 750 mm.	0.066	0.020	0.024

Base iron compositions are as listed under Table VII.

DISCUSSION OF RESULTS

The main result of the experimental work is that the solution of carbon in molten cast iron appears to be essentially an example of a solid dissolving in a liquid. It appears that direct solution may occur without the assistance of a gaseous phase or gaseous reactions. The highest rate of solution and the maximum carbon content obtained at 1,500 deg. C. was found when graphite was allowed to dissolve in molten iron *in vacuo*. This result is based upon the work carried out *in vacuo* which is reported in Part IV. If it be accepted as a premise that molten cast iron picks up its carbon mainly from the solid carbonaceous materials with which it comes into contact then the whole of the results obtained in this experimental work can be explained fairly satisfactorily. In the treatment of the results in the following text we are dealing only with a molten iron of already substantial carbon content

TABLE VII.—*Percentage Carbon Solubility in Iron under Various Atmospheres after* 1 *hr. at* 1,500 *deg. C.*

No.	Experimental Conditions.	Graphite only. Actual carbon.	Graphite only. Carbon equivalent.	Graphite + lime. Actual carbon.	Graphite + lime. Carbon equivalent.	Graphite + calcium carbide. Actual carbon.	Graphite + calcium carbide. Carbon equivalent.
1	Vacuum	4.95	5.73	4.55	5.33	4.02	4.80
2	Hydrogen 10 mm.	4.67	5.45	4.98	5.76	4.37	5.15
3	,, 750 mm.	3.34	4.12	3.23	4.01	3.09	3.87
4	Nitrogen 10 mm. ..	3.84	4.62	3.42	4.20	3.32	4.10
5	Oxygen 10 mm. ..	4.32	5.10	4.72	5.50	4.08	4.86
6	Air 750 mm. ..	2.76	4.20	3.54	4.98	4.07	5.51

Base iron compositions in Expts. 1 to 5, inclusive : T.C., 3.08 ; Si, 1.98 ; Mn, 0.63 ; P., 0.37 and S., 0.133 ; per cent.
Base iron composition in Expt. 6 : T.C., 2.60 ; Si, 3.44 ; Mn, 0.48 ; P, 0.88 ; and S, 0.124 per cent.

FIG. 12.—*Largely Pearlitic Structure of Specimen Melted in Air at 750 mm. in contact with Lime.* × 600 *mags.*

and the explanations of the solubility mechanism put forward would not be expected to apply to low carbon iron and steel In the latter case gaseous reactions may and do play an important part.

The rate of solubility of a solid in a liquid and the percentage which dissolves depends upon a number of factors:—

(1) *Temperature of the liquid.*—Most liquids dissolve the solute more readily at higher temperatures.

(2) *Concentration of the Solute in the Solvent.*—The higher the concentration of a solid vent action take place until saturation occurs. which is in solution the slower will further sol-

(3) *Agitation of Solvent Liquid.*—The surface film of solvent adjacent to the dissolving solid must be continually removed to ensure rapid solution.

(4) *Surface Characteristics of the Solid.*—Granular solids, having a larger surface area to weight ratio dissolve more readily than compact lumps. Some surfaces are more active than others.

These general laws of solid solubility in liquids apply with equal force to the specific problem of carbon in molten cast iron. In the light of the experimental results it is of interest to study in detail the comparison between the solubility of carbon in molten cast iron and the general case of the solution of a solid in a liquid. An attempt is also made to interpret some of the practical points of interest which are often found during the melting of cast iron, especially in the cupola.

(1) *Effect of temperature upon Carbon Solubility in Molten Iron*

The results put forward by Ruer and Birens which have been checked substantially by the present Author's own experiments, and also by the theoretical work of Chipman, show conclusively that in the solution of carbon in iron, temperature plays the normal rôle. The carbon solubility increases steadily with increased temperature. A prime necessity, therefore, in the obtaining of a high-carbon cupola-melted iron, is to ensure a high furnace temperature.

Furthermore, since carbon is thrown out of solution as the temperature is lowered, provision must be made either to retain the metal at a high temperature or to tap hot and use at once if a high carbon iron is required.

(2) *Effect of Type of Carbonaceous Material*

The rate of solubility of carbon in molten iron depends to a large extent upon the type of carbon which is offered for solution. Coke has proved to be amongst the least soluble forms of carbon. The best form of carbon was electrode graphite which was low in ash Steam coal gave a good rate of carbon pick-up possibly due to the scavenging effect of the volatile matter which it evolved. For effective solution of carbon in iron the surface of the carbonaceous material must be kept clean and free from ash. The experimental work upon fluxes showed that if the ash in the coke was constantly slagged away then the rate of carbon solution was greater, due presumably to the larger area of carbon surface available.

On the other hand, when acetylene black was tested, which is a pure form of carbon with a very large surface/weight ratio, the rate of carbon solution was poor. This result is thought to be due to the fact that the fine powdered acetylene black did not penetrate the surface of the molten iron. There is perhaps an optimum size of particle which secures the maximum area of contact between itself and the molten iron.

(3) *Effect of Agitation of Molten Iron upon rate of Carbon Solubility*

The prevention of the surface of the carbon from clogging by ash was important to secure maximum rate of carbon solution. This could be achieved by either (*a*) working with carbons of low ash content, (*b*) removing the ash by slagging or other means. It was also important to prevent the formation of any inert film over the surface of the carbon. This inert film might be ash or it might be gases preventing contact with the molten iron or it might be a stagnant layer of molten iron saturated with carbon. For this reason the agitation of the molten iron in contact with the solid carbon was found to speed up the rate of carbon solution. The interesting results of the experiments carried out in controlled atmospheres may be explained by assuming that the molecules of nitrogen, oxygen, hydrogen, etc., prevent to some extent the free interchange of carbon with iron at the boundary of the solid and liquid phases. Anything which screens the solid carbon from the liquid iron such as ash, slag, oxide, general impurities either in the carbon or the iron, gaseous films, stagnant high-carbon films of molten iron, etc., all tend to reduce the rate of solubility. Mechanical or thermal agitation is effective in reducing the degree of such interference.

(4) *Effect of Ambient Atmosphere upon Carbon Solubility*

The experiments described in Part IV demonstrate the importance of the ambient atmosphere upon the degree of carbon solution in molten iron. It seems probable that the effect of gases upon the system is indirect. The molecules of gas exert a masking effect, preventing intimate contact between solid carbon and liquid iron. This was shown quite clearly in the two experiments with high and low pressure hydrogen. It may be that certain gases have also a selective effect upon carbon solubility rate. Nitrogen even at only 10 mm. pressure appears to slow down the solubility rate and perhaps limit the amount of carbon which will go into solution at a given temperature. Much more experimental work is required to clear up this point. Recorded knowledge upon the complex systems of C:Fe (molten):Gases, at high temperature, is almost non-existent.

(5) *Effect of Specific Additions upon Carbon Solubility*

The improvement in carbon content which accrues from the addition of calcium carbide to the cupola charge during the melting of iron in a basic cupola is now recognised and the method is in current use.[41] This effect of calcium carbide appears to be specific and not capable of explanation in the way already outlined. It is of great interest to observe that calcium carbide was only effective in an atmosphere derived from the products of combustion of air at substantially atmospheric pressure. Calcium carbide added to molten iron and carbon in the presence of hydrogen, nitrogen and oxygen atmospheres had a negative effect upon carbon absorption. In these latter cases it behaved as though it exerted a masking effect upon the free solution of carbon.

Lime in the presence of molten iron and carbon at 1,500 deg. C. in an atmosphere based upon air at normal pressure also tended to increase the degree of solubility of carbon. When the crucible and contents were examined after the experiment it was noted that some calcium carbide had been formed. This calcium carbide produced during the experiment was probably largely responsible for the observed improvement in carbon content. On the other hand, this might not be the complete answer since in the oxygen atmosphere at 10 mm. pressure the carbon content of the iron in the presence of lime was slightly higher than in the experiment where calcium carbide was the addition.

From these experiments it is clear that calcium carbide is some sort of " carrier " for carbon under certain conditions of melting as in cupola atmospheres. It is unlikely that this is the entire reason for its striking success in the cupola. One other important factor is the increase in furnace temperature brought about in the melting process by its use which cannot be entirely ignored.

Sulphur in the iron did not show a direct relationship with the amount of carbon which dissolved, although conditions conductive to low sulphurs often resulted in high carbons.

Concluding Remarks

The programme of experimental work described in this Paper has produced results which suggest that the iron-carbon system above 4.5 per cent. carbon still requires much further work for its complete understanding. It has shown that with the high-carbon cast iron alloys, carbon solution rates depend largely upon the general laws governing the solution of solids in liquids. The effect of ambient atmosphere during the melting has an important effect upon carbon solution rates and in this respect the atmosphere present in the cupola is not conducive to the production of high carbon iron. The action of calcium carbide is specific and is only effective in raising the carbon content of iron under certain cupola melting conditions.

Acknowledgment

The author is indebted to Dr. J. E. Hurst. director of research, for his keen interest and encouragement throughout the course of the investigation and also to the directors of the Staveley Iron & Chemical Company, Limited, Chesterfield, and Bradley & Foster, Limited, Darlaston, for permission to publish the results of this research which was carried out in their research departments.

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DISCUSSION

Opening the discussion, MR. H. MORROGH congratulated Dr. Riley on an excellent effort in dealing with a very difficult subject. The ironfoundry industry was particularly concerned, as Dr. Riley had said, in increasing the carbon content of iron. There was one point he would like to emphasise and it was not always appreciated by the foundryman; that was, in dealing with any given iron at any given temperature, there was a limit to the amount of carbon which could be dissolved. In some cases the ironfoundry industry was working very close to that limit and, unless it could raise the temperature of the iron, it could not expect to increase the carbon content.

There were one or two points in the Paper to which he would like to refer. For Table II, the experiments were carried out in a high-frequency furnace and presumably the carbon was also heated by the high-frequency current. However, the carbon addition, depending on its form, would be heated to a different extent. At a guess, he would expect electrode carbon to be heated rather more effectively in the high-frequency field than some of the other materials. That could perhaps explain the higher carbon pick-up obtained with electrode carbon. That led to another point. The temperature of the carbon itself was important. In his own rather scattered experiments, he had found that when an electrode was used to strike the arc on the surface of a metal and so produced very hot carbon on the tip of the electrode, on immersing it a very rapid solution of carbon was obtained. The use of an electric-arc or an arc-furnace for carburisation was a possibility, and it led to a further suggestion, *viz.*, it might be possible to introduce carbon into the molten metal under the influence of an electric current direct, because carbon would diffuse in molten iron under an electric potential.

DR. RILEY agreed that Mr. Morrogh had stated something which was quite correct. In the experiments, different forms of carbon would be expected to be at different temperatures on the surface of the molten iron because of the different heating effects of the high-frequency current. With very finely-divided graphite, he did on one occasion obtain a lower rate of carbon solubility. With this finely-divided material one would expect less intrinsic heat in the carbon added than with solid electrode carbon. That would indicate that Mr. Morrogh's contention was correct. He did not agree, however, that the different rates of carbon solubility obtained in these experiments were entirely due to this cause and he did not think Mr. Morrogh had intended this.

As to the idea of using a carbon electrode and passing current through it as in an arc furnace, he would point out that that was often done in the ordinary three-phase arc furnace, and he had never there seen a very spectacular increase in carbon in the melt of iron carried out on a practical scale.

Effect of Ash

MR. J. L. FRANCIS found the statement at the bottom of page six of the preprint of the Paper very interesting:—"This experiment was interpreted as demonstrating the retarding influence of ash remaining on the surface of the coke and the possibility of improving the solubility of coke in iron by the provision of suitable cleansing material to remove the ash and keep the carbon surface active."

It was realised that many foundrymen to-day were interested in obtaining a high carbon pick-up, particularly in view of difficulty of obtaining hematite, which in former years was relatively easily purchased. Any means by which carbon absorption could be increased during the cupola melting operation was of special importance to foundrymen producing textile and thin-section castings for vitreous enamelling. In this respect, claims made for the basic-lined cupola were also of interest.

The Author mentioned a temperature of 1,500 deg. C. as being developed in the melting zone of the cupola; in well-operated furnaces it might well go higher. Thus there was superheated iron and incandescent carbon in close contact with each other. Furthermore, the molten iron was formed in droplets which offered large surface areas for contact with the coke. It would seem, therefore, that ideal conditions existed for the picking up of carbon, although admittedly these obtained only for a relatively short time during which the iron passed through the melting zone. Apart from the time factor, it appeared that the ash formed from the combustion of the coke formed an insulating layer on the coke surface, thereby preventing coke-to-metal contact and thus restricted the carbon pick-up that might otherwise be achieved. That this retardation of carburisation could be ameliorated by using a more basic fluxing technique was of considerable importance.

It was known that slag conditions which tended to give a lower sulphur pick-up also encouraged higher levels of carbon absorption. In other words, the more-basic flux attacked the film of coke-ash and gave better coke-to-metal contact; again, the experience with basic-lined cupolas came to mind.

Dr. Riley mentioned that, when discussing recently that matter with Mr. Renshaw (who had much experience of basic cupola operation), the point had been raised. He had felt that the action of the basic-lined cupola, or one action of it, was to afford a means of fluxing the oxides present in the ash, and he attributed the higher carbon pick-up in the basic-lined cupola, partly at any rate, to that cause.

Mr. T. R. Twigger cited experiences on two points which were relevant to the Paper. One concerned the use of soda ash in the cupola for the purpose of varying slightly the hardness characteristics of the material. Although he could not offer scientific evidence on the point, there seemed no doubt that the use of soda ash did have a bearing on the total-carbon content of the material, and it might easily be that this had something to do with the fluxing of the coke ash.

Pick-up from Electrodes

The other point concerned the treatment of metal in a rocking arc-furnace. It was common experience that metal having a known chilling propensity regularly showed considerably less chill (on a chill test sample or a casting) following upon rather than before treatment in the arc furnace. This appeared to be due to the absorption of small particles of graphite detached from electrodes, and while there was undoubtedly a small carbon increase, this was hardly detectable on analysis, particularly in view of the analytical error usual in total carbon estimations. In any case, it was clear that the inoculating effect of the carbon was quite disproportionate to the amount of carbon actually introduced into the metal.

Dr. Riley said the fact of the resistor furnace giving a higher carbon content or at any rate an inoculation effect, was within his experience.

Mr. Twigger interjected to add that he had figures which he could quote. Generally speaking he thought there was a slight carbon increase, but the result was out of all proportion to the increase in carbon, and must be due to the inoculation effect.

Mr. Hallett agreed with Mr. Twigger and Dr. Riley that melting in a rocking resistor furnace caused a difference in the chilling characteristics. He also thought this was not due to a change in the carbon content, but to an inoculation effect. From the practical point of view, there was no doubt that an increase in temperature was the most important factor in promoting pick-up of carbon. Pick-up could be effected quite easily in the arc furnace by dipping the electrodes, or by adding lumps of electrode carbon. It was difficult, however, to apply that type of process to the cupola.

The effect of ash in shielding the surface of burning coke made one wonder whether it was possible to develop self-fluxing cokes. That investigation might be commended to a coke research association!

Importance of Atmosphere

He would like to ask the Author for his views on the importance of the atmosphere in influencing carburisation. It had been suggested that when melting borings in an arc furnace it was important that the carbon should be present throughout the melting. Personally he found that rather difficult to believe because the rate of solution of carbon was so much higher in the liquid state than in the solid state that it did not matter when the carbon was added, provided that some was present while the metal was at a high temperature. There might, of course, be some point in maintaining a reducing atmosphere around the metal charge during the melting-down stage, in order to prevent oxidation.

Dr. Riley thought the diffusion of carbon into hot iron whilst still solid was a slow process and was probably not important in the cupola melting of cast iron. It was pretty certain that there would be some surface take-up of carbon during the melting-down process, but that was probably only a surface effect and was unlikely to result in a very large increase in the speed of carbon solubility throughout the mass.

With regard to the effect of atmosphere, the stage that had been reached with that work made it difficult for him to give a very definite answer. So far, it appeared that any atmosphere at all surrounding the carbon was detrimental. The ideal way would be to melt in a vacuum and then there would be no trouble in getting carbon solubility. He was not certain, but on the whole he would say that oxidising gases were worse and reducing gases probably better in obtaining carbon solubility.

When is Carbon Pick-up Required?

The Chairman, Mr. Colin Gresty, said he would

Solubility of Carbon in Iron—Discussion

like to ask one question: Who wanted all this pick-up?

On heavy casting work, such as they carried out in the Tyneside area, they were in the reverse position, and wished to keep their carbon content down. He presumed, therefore, he was right in saying that on light-casting work, the reverse was the case. He was, however, rather worried by Mr. Hallett's suggestion of self-fluxing coke to improve carbon pick-up, but, as long as it was not universally recommended, he did not mind!

DR. RILEY thought that the thing that worried metallurgists was that they could not control carbon sufficiently. They wanted to be able to make a high or low carbon at will without having limitations imposed by the melting furnace. For the nodular irons, he felt that they would probably like to work with carbon content fairly high, near to the eutectic. For the recovery of steel scrap and steel turnings and that sort of operation and in the production of refined iron, the control of carbon was of much importance. Generally the need for a method of increasing carbon was recognised.

MR. W. J. COLTON said he was very interested in what Dr. Riley had said in his Paper about the alkali fluxing of coke to remove the ash. Other members had mentioned the electric-furnace-melting question and it was on that he would like to comment.

He had found it was possible to increase the carbon in an electric-arc furnace if desired, but it was not so easy to get substantial carbon pick-up. That led to the question which Mr. Hallett had asked about melting steel scrap in a furnace charge. He, himself, had found a benefit by mixing coke with the cold charge. It seemed to prevent that small loss of carbon, in amount of the order of perhaps 0.1 per cent., which was sufficient to make a difference on the final composition of the metal. Also, that slight loss of carbon was shown more with high-silicon content than with a low-silicon content. As to the forms of carbon for use in the charge make-up to keep carbon-content under control, coke was the best practical answer which he had found. Electrode carbon, both solid and ground, when added to the molten bath did not seem to him to be very effective. Coke in reasonably large particles mixed with the charge seemed to counteract that slight loss which was definitely experienced. The loss could be increased, if the furnace was tapped twice and the slag was removed and a second bath was not covered; there would then be a difference of carbon content between the first and second bath.

Pick-up Conditions

DR. RILEY, dealing with the last point first, agreed that the amount of carbon picked-up from electrode graphite which was put on to the surface of iron was negligible; it was a useless procedure. As an example, he knew of a 12-ton receiver into which was introduced 1 cwt. of graphite. The receiver was used all day, in the course of which over 100 tons of metal went through it. The electrodes were fished out at the end of the day and they had lost precisely one and a half pounds; so there was little carbon pick-up that way!

Treatment in the furnace gave one the best hope of improving carbon content and in that connection ash-free coke was obviously desirable. It tended to produce a higher temperature and provided a greater active-surface of carbon in the cupola. It was probably the experience of many, that the first charge from a cupola tended to be higher in carbon than later charges. That fact again indicated that the new coke bed was in a reactive form and dissolved in molten iron more readily than subsequently when the surface became fouled with ash and slag.

Other Methods

MR. MORROGH asked if Dr. Riley had used or considered the use of silicon carbide as a source of free carbon and what his experiences had been with carbon pick-up in the direct-arc furnace.

In some countries which were not so unfortunate as to have to use coke, and where the electric furnace was the usual medium for melting, he knew that it was the standard practice to melt a steel charge and carburise it partly from the electrodes, and partly from scrap electrode additions. He had seen a bath carburised up to 4 per cent. carbon by that method.

In the United States, he had noted that a good many foundries charged scrap electrodes into the cupolas. They claimed that their carbon contents were higher as a result of that procedure and he knew there were a number of foundries which were continuing with this practice after some years, so there must be some good reason.

In Italy, a furnace had been developed in which it was claimed the carburisation of molten iron was particularly easy. The furnace comprised a deep layer of slag which could be either acid or basic, and electrodes were dipped into the slag which was used as a resistance element. Electrode carbon could be charged through that slag layer and it was claimed that very good carbon pick-up was obtained.

DR. RILEY said silicon-carbide additions had been tried out, but with negative results. The method was merely to put silicon-carbide granules on the surface of the molten iron in much the same way as the method described in Part I of the Paper. When that was done the silicon-carbide formed a kind of refractory surface, due he thought to oxidisation, and there was no indication that there was any carbon solubility. That did not mean that silicon carbide could not be used for the purpose of raising carbon content. It might be quite satisfactory if charged into the cupola furnace or some other type of furnace in which one could exclude oxidising gases.

Quite possibly, the reason for the success claimed for the Italian furnace was that it had a very deep layer of slag excluding all oxidising gases from the surface of the metal and had provision for introducing hot carbon into the molten iron and keeping it active below the slag. He agreed the use of electrode carbon was practised in the States in cupola working, and it must be that it was an advantage, if the people concerned continued to use it. However, all the times he had tried the method, the carbon dissolved was so small that its general use in ordinary cupola working conditions seemed to be hardly worthwhile.

Another question concerned the electric furnace for use with steel melting. He thought that went back to a point made earlier that one could choose suitable conditions in an electric-arc furnace to give a carbon pick-up. He accepted the statement that Mr. Morrogh had made in that connection: but reiterated that under the normal melting conditions which his investigators had experienced with three-phase arc-furnaces they had not succeeded in increasing the carbon substantially.

MR. W. W. BRAIDWOOD said he had seen in operation the Italian furnace quoted. The foundry concerned made use of poor-quality scrap, including turnings, borings, etc., usually heavily rusted, to produce iron of good quality and certainly sufficiently high in carbon.

He had also seen in operation in Italy a direct-arc furnace which used a carbon hearth. In that case also, use was made of charge materials of the type already described and final carbon content was controlled by holding time and, apparently of more importance, by temperature. He thought these observations from practice confirmed what Dr. Riley reported in his Paper.

Written Contribution

At the end of the verbal contributions, the CHAIRMAN mentioned that a written contribution had been received from Mr. E. S. Renshaw dealing with the mechanism and chemistry of carbon absorption by molten iron in cupola melting.

MR. E. S. RENSHAW (Ford Motor Company, Limited) wrote that Dr. Riley's Paper went a considerable way towards elucidating the mechanism and chemistry of carbon absorption by molten iron when applied to cupola practice. It also further revealed the important function of slag in the cupola furnace, in this case in relation to carbon pick-up.

Some time ago, his firm had carried out experiments on similar lines to those described by Dr. Riley but in his case molten steel at 1,700 deg. C. was poured into a ladle of red-hot coke, flotation of the latter being prevented by tightly clamping a lid on the surface of the ladle, leaving a slot for entry of the molten steel. It was found that the carbon in the steel was raised from 0.10 per cent. to 3.40 per cent. in 9 min. being a greater pick-up rate than that obtained by Dr. Riley's method. Conditions in this experiment more nearly simulated those which existed in the cupola furnace and it was believed that this was a method used in Italy for the manufacture of cast iron.

Importance of Atmosphere

Dr. Riley's remarks on the effect of calcium carbide on carbon pick-up were extremely interesting in view of the results obtained by Carter in America. He would like to ask Dr. Riley if he would consider the following as a possible explanation for the high carbon pick-up, high tapping temperatures and desulphurisation obtained by Carter when using calcium carbide as an additive to the cupola coke bed:—

It was well known that when calcium carbide is heated in a stream of nitrogen, calcium cyanamide is formed with the liberation of free carbon, according to the equation:—

$$Ca\,C_2 + N_2 = Ca\,N\,CN + C$$

The reaction is also an exothermic one and the carbon released may be in a form easily soluble in molten iron.

Similarly, calcium carbide may dissociate when heated in a stream of CO and CO_2 to give calcium oxide and carbon, *viz.*:—

$$Ca\,C_2 + CO = CaO + 3C$$
$$2Ca\,C_2 + CO_2 = 2CaO + 5C$$

The specific action of calcium carbide referred to by Dr. Riley might, perhaps, be explained by considering these reactions.

DR. RILEY, in reply, thanked Mr. Renshaw for his kind remarks. The experimental evidence which Mr. Renshaw brought forward relating to the solubility of carbon in iron might be taken as reinforcing the findings given in Part III of his Paper, namely, that the rate of carbon solubility was dependent primarily upon the temperature of the molten iron. The greater rate of solubility found in the new experiments was obviously due to the higher temperature of working.

He was obliged to Mr. Renshaw for the suggested mechanism of carbon-solubility when using calcium carbide. He was familiar with the reaction for the production of calcium cyanamide, but believed that this usually occurred at lower temperatures than was thought to exist in the cupola melting-zone and since the reaction was exothermic, it was to be expected that, at high temperatures, a reversal would take place, increasing the stability of calcium carbide. The suggested reactions between calcium carbide and carbon monoxide and carbon dioxide, appeared to be far more likely to be the ones concerned in cupola operation. However, it was clear that much further work would be necessary to explain the mechanism of the apparently catalytic behaviour of calcium carbide.

Summing up the discussion, Dr. Riley said he thought that carbon control was a real problem and his Paper was an attempt to find out why they could not solve the problem, it seemed to be so simple and yet had proved to be very difficult. If the Paper had stimulated further consideration, then it had served its purpose.

Hot-metal Machining

Certain of the high-temperature alloys that are supposed to be difficult to machine are readily machined by heating the stock at the time, taking advantage of certain metallurgical properties that exist at the elevated temperatures of the metals. Thus a steel containing about 42 per cent. Co, 19 per cent. Cr, 19 per cent. Ni, 4 per cent. W was machined at a rate of 270 cub. in. per hr., compared with the usually recommended metal removal rate of 2.1 cub. in. per hr. This was achieved by heating it to 1,500 F. (815 deg. C.) and machining it as rapidly as it was heated.

Blast-furnace Industry in Great Britain

Census-of-Production Details for 1948

Particulars of the British blast-furnace industry, compared in certain cases with 1937 and 1935, are contained in the "Final Report on the Census of Production for 1948, Vol. 3, Trade A: Blast Furnaces," published by H.M. Stationery Office (price 1s. 6d.). Some introductory and explanatory notes recall that the 1948 census was the first full census of production taken since the war. Five full censuses of production were taken under the Census of Production Act, 1906, for the years 1907, 1912, 1924, 1930, and 1935. In addition to the census of production, surveys with a more limited industrial coverage were taken in respect of 1933, 1934, 1937, and 1938 under the Import Duties Act, 1932, which conferred somewhat different powers from those of the Census of Production Act. For the survey of industrial production taken in respect of 1935, the powers conferred by both the Census of Production Act and the Import Duties Act were used. In June, 1945, the President of the Board of Trade appointed a Census of Production Committee under the chairmanship of Sir George Nelson to consider and report upon what additional information should be collected at future censuses of production and to recommend what amendments should be made to the Census of Production Act. The report of the Committee was presented to Parliament and its recommendations found expression in the Statistics of Trade Act, 1947, which laid down that the Board of Trade shall, for the purpose of providing general surveys of the state of trade and business, take a census of production in respect of the year 1948 and of every subsequent year. Accordingly, for 1948 a census was taken and compulsory questions were asked about wages and salaries, capital expenditure, and other matters not hitherto covered in a full census of production. These and other subjects were covered after consultation, as provided for in the Act, with the Census of Production Advisory Committee.

Explanatory

Tables I to III give information relating to the blast-furnace industry, and in this connection it should be noted that "gross output" is the total value of goods made and other work done during the year. For 1948 (and 1946) this is derived by subtracting from the value of sales and work done the value of stocks at the beginning of the year and adding the value at the end of the year. A deduction is then made for any payments made to other firms for transport outwards to offset a similar sum included in the recorded value of goods sold. For 1935 and 1937, however, the values of individual items related to output in the year, allowances having already been made by firms for changes in stocks between the beginning and the end of the year, and for payments made to other firms for transport outwards; it was unnecessary, therefore, to make any adjustments for these factors. The "net output" is defined, as in previous censuses, as the amount left after deducting from the value of the gross output the aggregate of the cost of materials and fuel used and the amount paid for work given out. This residual figure represents the value added to materials by the process of production and constitutes the fund from which wages, salaries, rents, rates and taxes, advertising and other selling expenses, and all other similar charges have to be met, as well as depreciation and profits.

TABLE I.—*Summary of Operations at Larger Blast-furnace Establishments in Great Britain in* 1948.

	1948.	1937.	1935.
Number of establishments ..	51	—	48
Average number of persons employed	27,257	19,565	15,815
	£'000.	£'000.	£'000.
Gross output (production) ..	91,906	35,914	21,047
Cost of materials and fuel used ..	72,878	29,129	16,964
Payment for work done on materials given out	70	—	—
Net output	18,958	6,785	4,083
Wages and salaries of persons employed	10,596	—	—
Net output per person employed ..	696	347	258

TABLE II.—*Larger Blast-furnace Establishments in Great Britain Analysed by Size*, 1948.

Average number employed.	Establishments.	Gross output.	Net output.	Persons employed.	Net output per person.
	No.	£'000.	£'000.	No.	£
11–49 ..	5	314	93	137	681
50–99 ..	3	500	144	200	720
100–199	9	5,409	1,564	1,480	1,057
200–399	7	6,130	1,229	2,220	554
400–499	4	7,627	1,466	1,885	778
500–749	13	28,946	5,257	8,161	644
750–999	6	19,315	3,902	5,242	744
1,000 and over	4	23,665	5,302	7,932	668
Total ..	51	91,906	18,958	27,257	696

TABLE III.—*Larger Establishments in Blast-furnace Industry Analysed by Standard Region*, 1948.

Region.	Establishments.	Gross output.	Net output.	Person employed.	Wages	Salaries
	No.	£'000.	£'000.	No.	£'000.	£'000.
England and Wales:						
Northern ..	11	30,063	5,944	9,294	3,165	354
North Midland	14	28,680	6,619	9,264	2,848	734
North Western	6	5,120	980	1,434	464	103
Other regions ..	16	20,655	3,926	5,358	1,898	335
Total England and Wales ..	47	84,518	17,469	25,350	8,375	1,520
Scotland ..	4	7,388	1,489	1,907	619	75
Great Britain ..	51	91,906	18,958	27,257	8,994	1,602

JOHN HARPER & COMPANY, LIMITED, will change their London office to Seaforth Place, 57, Buckingham Gate, S.W.1, on October 1. The telephone number will be TATE gallery 0286.

Plaster in the Patternshop

By " Checker "

Plaster can on some occasions be a better substance than wood for the patternmaker to work with. When its use is confined to certain kinds of work, it has the advantages of saving time and reproducing, more accurately, complicated shapes.

Plaster Patterns for Chills

Plaster can be a time-saver when making patterns for chills, especially when their shape is so irregular that a large amount of fitting would be necessary if wood were used. Fig. 1 illustrates a pattern part for which chills are required round the boss, the required chill position being shown by broken lines. First, a frame comprising two ends and a side are cut to fit round the pattern shape, nailed together, and the inside part coated with shellac varnish. Then it is placed in position on the pattern as shown in Fig. 2. Nails partially driven through this frame into the pattern at each end hold it securely, and the protruding nail heads allows them easily to be withdrawn after the plaster has set and is to be removed.

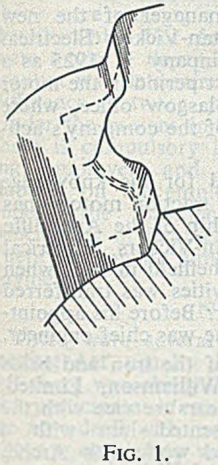

FIG. 1.

FIG. 1.—*Pattern Part for which a Chill is Required.*

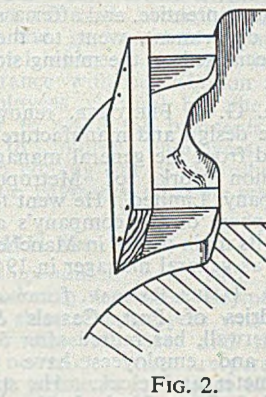

FIG. 2.

FIG. 2.—*Wooden Frame fitted around the Part.*

It is advisable to run wax or other suitable material around the outer frame edge where it makes contact with the pattern. This ensures that no plaster can escape through any slight crevice when pouring. Next, the inside of the frame and pattern shape it encloses, should be oiled or greased to ensure that it can easily be removed from around the plaster after it has set. When the plaster has been poured in, it is left for a short time for setting, then the nails are withdrawn, and both frame and plaster removed.

This way of using plaster for chills ensures an exact replica of the pattern shape being reproduced. For when the plaster powder has been well mixed with water until it is of a creamy consistence, it must, when poured into the frame take the exact pattern shapes. This ensures that when metal chills have been cast from the plaster pattern, and are correctly positioned in the moulds, no bad marks or wrong shapes are left on castings. When frames cannot be made to produce the exact outside chill shape required, they are made larger and then cut down to size before the material gets too hard. After cutting to shape, the plaster, when thoroughly dry, should be given a coat of shellac varnish. Contraction which takes place when the chill castings are made does not usually effect those of small size. In some circumstances, however, it may be found advantageous to ease the plaster pattern slightly in some places to counteract contraction.

Plaster Pattern for a Metal Corebox

When plaster patterns have to be made for castings required for producing metal coreboxes, a wooden model of the core shape must be produced first. This should be made to sizes allowing for any machining which may be required by the metal patternmaker on ends, joints, etc., and, of course, using the correct contraction rule. Fig. 3 shows a wooden core-shape made in halves, from which plaster patterns are to be made. These are produced in the following way:—First one-half of the wood core-shape is placed on a flat board. A frame is made with depth and inside dimensions corresponding to those of the finished corebox. This frame is then placed in position on the base-board and lightly nailed on the outside. It is best always to give the inside parts which come into contact with plaster a coat of shellac varnish, and, when dry, to sandpaper them smooth. Before the plaster is poured into the frame, the interior should be well greased or oiled, to prevent wood and plaster sticking together. Fig. 4 illustrates the frame and half core-shape in position ready for making the plaster mould.

When there is a possibility of a core-shape being lifted from the bottom when plaster is being poured in, it can be held in position by a screw through its

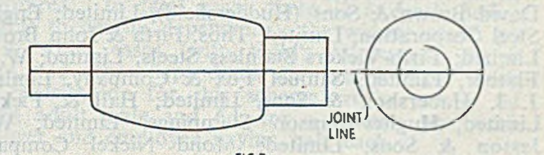

FIG 3

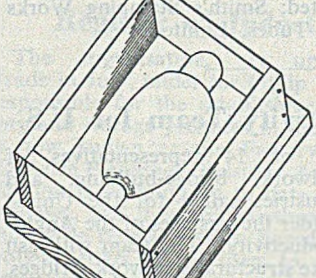

FIG 4

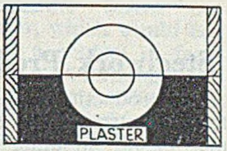

FIG 5

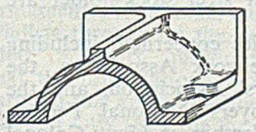

FIG6

FIGS. 3 TO 5.—*Preparation of a Plaster Pattern for a Metal Corebox. Fig. 3, Wooden Core Shape;* FIG. 4, *Frame and First Half-core, and Fig. 5, Assembly for Second Half-core.*

FIG. 6. — *Provision for Dowell Bosses and Ribs in a Plaster Corebox Pattern.*

Plaster in the Patternshop

base. Having filled the frame, sufficient time should be given to allow it to set. Then any surplus should be strickled from the frame top, the frame turned over, and the wooden core removed. This plaster joint and shape are then varnished and the complete core-shape (both halves) is set in position. Next, another frame is added, and varnished inside, to complete the full corebox. The whole interior is then oiled or greased ready for receiving the plaster.

Fig. 5 shows everything ready for pouring the plaster for the second half-corebox. After this has set, both frames are taken apart, and the wooden core-shape and frames removed. Lightening out at the back of plaster coreboxes can either be done by hand or by using cutters in a wood-milling machine. Provision must be made for dowel bosses, usually in the corners, and also for strengthening of ribs when necessary. These are illustrated in the corebox section shown in Fig. 6.

Steel Producers at S.B.A.C. Exhibition

A spectacular flying display backed by an interesting static exhibition organised by the Society of British Aircraft Constructors, was held from September 11 to 16 at Farnborough, to help promote the export trade of member companies and demonstrate the quality of British aeronautical products. Only materials of the highest quality may be permitted to be used as components for such engines as the record-breaking Sapphire. The engine has about the same power as the four engines of a Super Fortress, and the alloys therein are the result of years of intensive research by British metallurgists. Steelmakers and producers of bars, forgings, stampings, castings, sheet, strip and tube, who exhibited in the "static" section included the following:—Accles & Pollock, Limited; Aircraft Materials, Limited; Brown Brothers (Aircraft), Limited; David Brown & Sons (Huddersfield), Limited; English Steel Corporation, Limited; Thos. Firth & John Brown, Limited; Firth-Vickers Stainless Steels, Limited; W. T. Flather, Limited; Samuel Fox & Company, Limited; J. J. Habershon & Sons, Limited; Hall & Pickles, Limited; Hughes-Johnson Stampings, Limited; Wm. Jessop & Sons, Limited; Mond Nickel Company, Limited; Reynolds Tube Company, Limited; Rubery Owen & Company, Limited; Smith's Stamping Works (Coventry), Limited; and Tubes, Limited.

Steelwork Productivity Team for U.S.

A productivity team of 14 representatives of the constructional steelwork, bridge-building, and mechanical handling industries sailed for the United States on September 21 under the auspices of the Anglo-American Council on Productivity. The team will visit American firms which make structural steelwork, bridges, and oil tanks, specialise in power-line transmission towers, and manufacture structural steelwork accessories, such as gutters and doors. Visits to an ore-storage and handling installation and a steel stock-holder are also included in the itinerary.

Sponsored by the trade bodies concerned, including the British Constructional Steelwork Association, the Mechanical Handling Engineers' Association, and the Engineering and Allied Employers' National Federation, the team is under the leadership of Lieut.-Colonel H. B. DENTON, chairman of Joseph Parks & Son, Northwich (Ches).

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Industrial Injuries Scheme

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Both the old Compensation Acts, and the present Industrial Injuries Scheme, provide for compensation to employees in respect of injuries (the contracting of certain industrial diseases included in the term) arising out of and in the course of their employment, but there are contrasting differences. Under the old Acts, the employer was called upon to make these compensation payments and even if he did not insure with ordinary insurance companies, the obligation to pay was always present. There was no Government scheme of insurance, no compulsion to insure, and no contributions were payable. The compensation was based on pre-accident earnings so the compensation worked out differently for different employees, and there were varying amounts for total and for partial disablement. For fatal injuries, lump-sum payments were made to dependants; for partial disablement, the amount was determined on a formula according to the difference between pre- and post-accident earnings. Under the present Industrial Injuries Scheme, however, there is compulsory insurance with contribution paying (employers and employees sharing) but the old liability on the employer to make the payments has ended, the payments to injured employees (or dependants in fatal cases) coming out of the scheme. There are now no lump-sum payments, all being weekly payments.

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By this new Act, also, the pre-January 1, 1924, cases are now also to be given allowances under the Industrial Injuries Scheme, so that with their Workmen's Compensation Acts payments and the allowances now to be given, the amounts will be as follow. If married, even if married after the injury, (it was limited to a pre-accident wife under the old Compensation Acts) and the person is residing with or wholly maintaining the wife, the amount in full will be 56s. (40s. man plus 16s. for wife), the sum arising out of the new scheme, however, being the excess over the previous payment. In other cases (*e.g.* single men), the full amount is 40s., the new scheme paying any excess over the old compensation as just mentioned. Under the previous Acts, the amount was determined according to pre-accident earnings, but this new Act provides that in cases of partial disablement, if the wage rates in the persons pre-accident occupation have increased, the scheme will provide an allowance to bring the amount up to two thirds of the loss of earnings, provided that compensation and the new allowance do not exceed the basic 40s.

It should be noted that nothing in this new Act alters in the slightest degree the existing rights and obligations of workers and employers (or insurance companies) under the Workmen's Compensation Acts, the extra cost only coming out of the Industrial Injuries Fund; this fund on March 31, 1950, (the latest available figures) had a balance of £39,165,003. The Act provides for a special scheme to operate these new provisions under which there is a special Board to administer the scheme; the overriding authority being the Ministry of National Insurance. The scheme came into operation on July 11, 1951, from which date the payments began to accrue.

Main Scheme

The chief benefit under the Industrial Injuries Scheme is injury benefit, 45s. plus 16s. for an adult dependant, 10s. for first or only child, other children 2s. 6d. added to the family-allowances scheme. This can be drawn for six months or longer if pending an assessment of the injury. Then there is disablement benefit which is dependent on the degree of disablement as assessed, as for example it may be only 9s. if 20 per cent. disablement or 45s. if 100 per cent is adjudged. It should be noted that if an assessment is made of 20 per cent. or more it may become a disablement pension. Such a pension may be increased by 20s. weekly if a pensioner is incapable of work and likely to remain permanently unemployable. If this is not payable, but special hardship is proved, the pension may be plus 20s. on this account. Furthermore, pensions assessed at 100 per cent. disability, may be increased by 20s. (or even 40s.) if constant attendance is required. In fatal cases, there is a death benefit (payable to certain dependants); the widow would get 30s. in some cases (with child's allowance), 20s. in others, and other dependants may get 20s. per week. The contribution for this scheme works out at 8d. for an adult male and 6d. for a woman per week, employer and employee paying half each.

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Plaster in the Patternshop

base. Having filled the frame, sufficient time should be given to allow it to set. Then any surplus should be strickled from the frame top, the frame turned over, and the wooden core removed. This plaster joint and shape are then varnished and the complete core-shape (both halves) is set in position. Next, another frame is added, and varnished inside, to complete the full corebox. The whole interior is then oiled or greased ready for receiving the plaster.

Fig. 5 shows everything ready for pouring the plaster for the second half-corebox. After this has set, both frames are taken apart, and the wooden core-shape and frames removed. Lightening out at the back of plaster coreboxes can either be done by hand or by using cutters in a wood-milling machine. Provision must be made for dowel bosses, usually in the corners, and also for strengthening of ribs when necessary. These are illustrated in the corebox section shown in Fig. 6.

Steel Producers at S.B.A.C. Exhibition

A spectacular flying display backed by an interesting static exhibition organised by the Society of British Aircraft Constructors, was held from September 11 to 16 at Farnborough, to help promote the export trade of member companies and demonstrate the quality of British aeronautical products. Only materials of the highest quality may be permitted to be used as components for such engines as the record-breaking Sapphire. The engine has about the same power as the four engines of a Super Fortress, and the alloys therein are the result of years of intensive research by British metallurgists. Steelmakers and producers of bars, forgings, stampings, castings, sheet, strip and tube, who exhibited in the "static" section included the following:—Accles & Pollock, Limited; Aircraft Materials, Limited; Brown Brothers (Aircraft), Limited; David Brown & Sons (Huddersfield), Limited; English Steel Corporation, Limited; Thos. Firth & John Brown, Limited; Firth-Vickers Stainless Steels, Limited; W. T. Flather, Limited; Samuel Fox & Company, Limited; J. J. Habershon & Sons, Limited; Hall & Pickles, Limited; Hughes-Johnson Stampings, Limited; Wm. Jessop & Sons, Limited; Mond Nickel Company, Limited; Reynolds Tube Company, Limited; Rubery Owen & Company, Limited; Smith's Stamping Works (Coventry), Limited; and Tubes, Limited.

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World Metallurgical Congress

Fourteen British scientists from the metal industry are to attend the first World Metallurgical Congress in Detroit, Michigan, October 14 to 19, sponsored by the American Society for Metals. The visitors from overseas countries are expected to bring to the attention of the Congress such aspects of metallurgical practice in their own countries as they feel would enable the world to produce more and better metal products, better conserve and utilise available resources, or provide substitutes for metals and alloys in short supply.

Foreign delegates will be assembled into eight specialist groups. each of which will make a three-week guided tour to major American industries and government, private and university research laboratories. The study tours have been organised to cover the chief topics of the Congress: (1) Steel making and refining; (2) rolling and manufacture of copper, aluminium, magnesium and their alloys; (3) metal fabrication; (4) heat-treatment; (5) welding and joining; (6) inspection and testing; (7) engineering and metallurgical education; (8) research. The British representatives to the Congress are:—W. A. Baker, research manager, British Non-Ferrous Metals Research Association; K. C. Barraclough, research metallurgist, Brown-Firth Research Laboratories; R. Blount, inspector, Ministry of Education, K. M. Entwistle, lecturer in metallurgy, University of Manchester; P. F. Hancock, chief metallurgist, Birlec, Limited; E. Ineson, Metallurgy (General) Division, British Iron and Steel Research Association; A. H. Leckie, Steelmaking Division, British Iron and Steel Research Association; E. Mills, general manager and director, Mills Engineering Products, Limited; J. G. Pearce, director, British Cast Iron Research Association; J. Pearson, Chemistry Department, British Iron and Steel Research Association; C. E. Phillips, Mechanical Engineering Research Organisation, Department of Scientific and Industrial Research; W. P. Rees, senior principal scientific officer, National Physical Laboratory, Teddington; H. G. Ridge, technical officer, Zinc Development Association, Oxford; and H. Sutton, director, Materials Research and Development (Air), Ministry of Supply.

New Conveyor Company, Ltd., Acquired by T.I.

Agreement has been reached, subject to the completion of legal arrangements, for the acquisition by Tube Investments, Limited, of the New Conveyor Company, Limited, of Smethwick. The New Conveyor Company, with works at Brook Street, Smethwick, and Grice Street, West Bromwich, and branch offices in London, Manchester and Glasgow, specialises in the production of all types of mechanical handling equipment, both bulk and industrial, including the full mechanisation of foundries, and it manufactures a wide range of "Newcon" standard components. The company has built up a large home and overseas business for these components over a period of sixty years. The New Conveyor Company will continue to operate as a separate entity. Its policy, trading activities, the constitution of the board, and its personnel, will not be changed, but Mr. W. R. Purnell, the present vice-chairman, who has been acting chairman, will become chairman, in addition to continuing as managing director.

NORTH BRITISH LOCOMOTIVE COMPANY, LIMITED—Mr. T. A. Crowe has joined the board as chief managing director.

I.M.M. President

At the annual general meeting, on May 15 next, MR. VERNON HARBORD will take office as president of the Institution of Mining and Metallurgy. A partner in Riley, Harbord & Law, metallurgical chemists, of London, he has served on the council of the institution since 1940, holding the office of vice-president from 1947 to 1950. Educated at Tonbridge School, he entered King's College, Cambridge, in 1913, being commissioned in the Royal Engineers in 1914 and serving in France until April, 1918, when he was wounded. He was then seconded for duty with the metallurgical research department at Woolwich and, on demobilisation, he went to the Royal School of Mines, obtaining his A.R.S.M. in metallurgy and the Bessemer Medal in 1920.

From 1921 to 1926, Mr. Harbord was with the South Durham Steel & Iron Company, Limited, for the first three years as metallurgist and technical assistant to the general manager of the Cargo Fleet works, and for the remainder of the time he was in charge of special work at the Ormesby ironworks—the foundry department of the company—and acted as general metallurgical adviser on foundry work.

In 1926 he joined Riley, Harbord & Law, which was founded by his father and the late Mr. Edward Riley in 1905. Mr. Harbord was engaged for the last 18 months of the 1939-45 war as metallurgical adviser to the armament research department. A fellow of the Royal Institute of Chemistry and the Institution of Metallurgists, he is a member of the Iron and Steel Institute and the Institute of Metals.

Power-gas Corporation Ltd., New Chairman

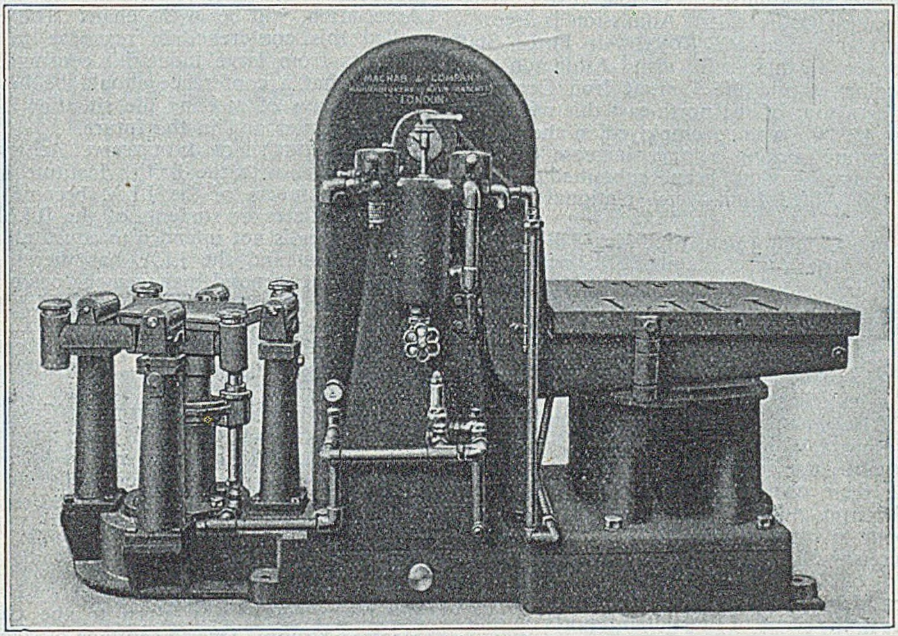
At a meeting of the board of the Power-Gas Corporation, Limited, held in London on September 19, it was announced that the managing director and vice-chairman, Dr. N. E. Rambush, D.Sc.(Hon.), M.I.Chem.E., had been elected chairman of the company. The vacancy was caused by the retirement of Mr. Wilfred Beswick, who had been chairman since 1939.

Dr. Rambush joined the Power-Gas Corporation, Limited, in 1918 as chief engineer. Nine years later he became technical manager, and in 1931 was appointed general manager to the Power-Gas group. He became a director of Ashmore, Benson, Pease & Company, Limited, in 1933, and in 1939 was appointed managing director of Power-Gas and its subsidiaries, having been joint managing director with Mr. Beswick during the preceding year. Dr. Rambush has been vice-chairman since 1947.

His book "Modern Gas Producers," published in 1923, still has worldwide recognition as one of the major works on the subject and in June, 1948, in recognition of the distinction of his work in the application of science to the gas industry, he was awarded the degree of D.Sc. (Honoris Causa) of Durham University. In the foundry sphere, the experiment in which he co-operated with Mr. Taylor in quenching the contents of a cupola remains a classic piece of research.

Although the head office of the Corporation is at Stockton-on-Tees, the group have a controlling interest in the well-known firm of Rose, Downs & Thompson, Limited, of Hull, and own overseas subsidiaries in South Africa, Australia, France, and Canada.

MR. LEONARD SLATER, chairman and managing director of George Slater, Limited, scrap iron merchants, of Sheffield, has died at the age of 77.



News in Brief

THE SUTTON-IN-ASHFIELD (Notts) "Festival of Industry" will be opened on October 6 by Sir Hubert Houldsworth.

THE DIRECTORS of A. Reyrolle & Company, Limited, electrical engineers, of Hebburn (Co. Durham), propose an increase in the authorised capital from £2,000,000 to £3,000,000.

TREASURY PERMISSION has been given for a capital bonus distribution by A. A. Jones & Shipman, Limited, machine tool makers, of Leicester, of four 5s. ordinary shares for each share held.

"Manpower," an exhibition on the human factor in industry, in the Safety, Health and Welfare Museum, Horseferry Road, Westminster, London, S.W.1, is remaining open until October 19. Admission is free.

FORTY STUDENTS from the Royal Air Force Staff College, Andover (Hants), will visit Ashington and Lynemouth collieries and the Consett Iron Company, Limited, during a tour of the north-east this week.

MORE than 400,000 women employed in the engineering industry are seeking a wage increase of £1 a week, their claim having been submitted to the Engineering and Allied Employers' National Federation.

A 61-YEAR-OLD Catcliffe man, Frederick Tillison, sustained severe injuries on September 18, when there was a sudden explosion in a cylinder he was cutting up for scrap. He was dead on arrival at Rotherham Hospital.

NORTHERN ALUMINIUM COMPANY, LIMITED, announce that from October 1 the address of their head office and London-area sales office will be Bush House, Aldwych, London, W.C.2 (telephone: TEMple Bar 8430; telegrams: Noraluco Estrand, London).

BECAUSE TRADESMEN from the industry were taking work outside their own trade at higher wages, employers in the iron industry in Falkirk cannot obtain sufficient labour to carry out contracts, said Mr. T. M. Monteith, secretary of Falkirk and District Employment Committee.

THE OFFICE MANAGEMENT ASSOCIATION has published a new booklet in the series of illustrated reports on office systems and methods entitled "Filing and Indexing." Copies of the report (price 5s.) may be obtained on application to the Association at 8, Hill Street, London, W.1.

A SURVEY of tin resources is being carried out by the Chamber of Mines in Malaya, circulars having been sent to over 700 mines asking for details of ore reserves and the expected duration of mine-life. Because of the bandit menace it is expected that the results will not be collated for some time.

A NEW 400-ft. long construction bay, equipped with two 100-ton cranes, at the Heaton works of C. A. Parsons & Company, Limited, Newcastle-upon-Tyne, is expected to be completed this month. In the new section work will begin on 275,000-volt transformers for the British Electricity Authority.

THE FRENCH FIRM of Prat-Daniel, 64, rue Miromesnil, Paris, 8, who for many years have specialised in dust-removal and ventilation plant for foundries, are to open a branch establishment in this country. The name of the new company, which will differ from the parent company, will be announced on its registration.

ACCORDING TO Mr. W. S. Shirra, chairman of the Distributors of Builders' Supplies Joint Council, the "fire-buying season," has started at least a month earlier than usual, and offers convincing evidence that housewives are determined to make the most and the best of the little fuel they have been warned is all they can expect this winter.

JOSEPH LUCAS, LIMITED, which employs more than 35,000 people at 18 factories throughout Great Britain, is conducting an experiment to solve one of industry's biggest problems—the shortage of women workers—in their Birmingham works at Great King Street. An appeal has been made to mothers of not-so-young families and those whose children have passed school age to undertake part-time work for four hours a day, either in the morning or the afternoon. A scheme whereby groups of friends or neighbours can work together is proving popular.

THE COMBUSTION ENGINEERING ASSOCIATION has decided to hold a conference on the subject of "Meeting the Fuel and Power Shortage," on October 9 and 10, in the ballroom of the Dorchester Hotel, Park Lane, London, W.1. Mr. P. A. Sanders, president of the Association, will be in the chair. The Association has called this conference in response to a number of requests from large industrial consumers of fuel and power, that a conference should be held forthwith to discuss ways of meeting the situation both during the coming winter and in the future.

THE INSTITUTE OF INDUSTRIAL ADMINISTRATION has been merged with the British Institute of Management and all members of the I.I.A. become founder members, associates or students of the B.I.M. Membership of the latter is not intended to constitute a professional qualification and the I.I.A. has therefore been incorporated as a general management professional institute within the framework of the B.I.M., its membership being open only to members of the B.I.M. The Institute of Industrial Administration in effect thus becomes the professional wing of the British Institute of Management.

NORTH BRITISH LOCOMOTIVE COMPANY, LIMITED, which has already supplied more than 2,000 locomotives to South Africa, may open a loco-assembly plant in the Union to meet large demands for steam-powered engines in that country. As reported recently, the company received two contracts worth £3,711,000 to supply the South African Railways with 60 of the most modern types of locomotives and 18 heavy shunting locomotives. Another order, worth nearly £2,000,000 for 100 shunting engines, was given to the German firm of Siegfred Krupp. Due to shortage of steel and increased costs in Germany, it is understood that Krupps may seek release from the contract, in which case the British firm's competitive tender would be the only one acceptable. This would fulfil requirements contained in a provisional offer by the North British, to set up a South African plant.

MR. E. W. L. FIELD, chairman of the Glasgow district committee of the Scottish Board for Industry, told trade union organisers in Glasgow on September 10 that there would be a particularly difficult winter with almost certain power cuts, possibly of unusual severity, in November. Mr. Field met the trade unionists to inform them of the electricity supply position and the need for load spreading so as to ensure that through them workers in the industry could be fully acquainted with the facts of the situation. After taking available plant into account, he said, the gap between demand and supply in November was 198,000 kw. It was estimated that if industry could reduce the demand by 20 per cent., 60,000 kw. would be saved, but that still left a gap. The board had decided to spread the load with the co-operation of industry. In their notice to consumers the board had emphasised the need for employers to consult with the trade unions concerned before presenting a scheme to the board where such schemes affected working hours. They also emphasised the need for consultation with transport services and, where necessary, with the H.M. Factory Inspectorate.

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

(Delivered, unless otherwise stated)

September 26, 1951

PIG-IRON

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

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

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

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

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £15 17s.; South Zone, £15 19s. 6d.

Cold Blast.—South Staffs, £17 5s. 6d.

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

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

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

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered.)

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

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

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

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

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

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

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

Ferro-chrome (6-ton lots).—4/6 per cent C, £74, basis 60% Cr, scale 24s. 6d. per unit; 6/8 per cent. C, £70, basis 60% Cr, scale 23s. 3d. per unit; max. 2 per cent. C, 1s. 8½d. per lb. Cr; max. 1 per cent. C, 1s. 8¾d. per lb. Cr; max. 0.15 per cent. C, 1s. 9½d. per lb. Cr.; max. 0.10 per cent. C, 1s. 9¾d. per lb. Cr.

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

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

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

Ferro-manganese (blast-furnace). — 78 per cent., £39 17s. 1d.

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

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

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—Basic: Soft, u.t., £21 11s. 6d.; tested, 0.08 to 0.25 per cent. C (100-ton lots), £22 1s. 6d.; hard (0.42 to 0.60 per cent. C), £23 19s.; silico-manganese, £29 15s.; free-cutting, £24 15s. 6d. Siemens Martin Acid: Up to 0.25 per cent. C, £27 16s.; case-hardening, £28 4s.; silico-manganese, £30 16s. 6d.

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

Sheet and Tinplate Bars.—£21 16s.

FINISHED STEEL

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

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

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

Tinplates.—54s. 8½d. per basis box.

NON-FERROUS METALS

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

Tin.—Cash, £960 to £965; three months, £905 to £910; settlement, £960.

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

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

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

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

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

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

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £270 to £280; BS. 1400—LG3—1 (86/7/5/2), £280 to £300; BS. 1400—G1—1 (88/10/2), £330 to £360; Admiralty GM (88/10/2), virgin quality, £330 to £360 per ton, delivered.

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

Phosphor Bronze.—Strip, 38d. per lb.; sheets to 10 w.g., 40½d.; wire, 42¼d.; rods, 38d.; tubes, 36½d.; chill cast bars: solids 3s. 11d., cored, 4s. (C. Clifford & Son, Limited.)

Nickel Silver, etc.—Ingots for raising, 2s. 7d. per lb. (7%) to 3s. 6¾d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 3s. 1d. (7%) to 4s. 0¾d. (30%); to 12 in. wide × .056, 3s. 1¼d. to 4s. 1d.; to 25 in. wide × .056, 3s. 3½d. to 4s. 3d. Spoon and fork metal, unsheared, 2s. 10d. to 3s. 9¾d. Wire, 10g., in coils, 3s. 6¾d. (10%) to 4s. 6½d. (30%). Special quality turning rod, 10%, 3s. 5⅝d.; 15%, 3s. 10½d.; 18%, 4s. 2¼d. All prices are net.

Forthcoming Events

[Secretaries are invited to send in notices of meetings, etc., for inclusion in this column]

OCTOBER 1

Institute of British Foundrymen

Sheffield branch:—Presidential Address, "The Training of Foundry Technicians," by W. J. Colton, followed by a film, 7.30 p.m., at the Royal Victoria Station Hotel, Sheffield.

OCTOBER 2

Incorporated Plant Engineers

London branch:—"Planned Maintenance," by J. T. Bromley, 7 p.m., at E.L.M.A., Savoy Hill, London.

Institution of Works Managers

Leicester branch:—Annual dinner and discussion: "Restrictive Practices," by R. Siddall, 7 p.m., at the Bell Hotel, Leicester.

Sheffield branch:—"Some Aspects of Motion and Time Study," by D. D. W. Usalis, 7.30 p.m., at the Grand Hotel, Sheffield.

OCTOBER 3

Institute of British Foundrymen

Sheffield branch:—"Casting Design in Relation to Production," by J. H. Pearce and G. D. Whitehouse, 7.30 p.m., at the Technical College, Doncaster.

North-east Scottish section:—"Cast Iron as an Engineering Material," by Dr. H. T. Angus, 7.30 p.m., at the Imperial Hotel, Keptie Street, Arbroath. (Joint meeting with the Institution of Production Engineers, Dundee section.)

Institution of Production Engineers

Nottingham section:—"The Fatigue of Metals," by Prof. J. A. Pope, 7 p.m., at the Victoria Station Hotel, Nottingham.

OCTOBER 3 to 6

Institute of Vitreous Enamellers

Annual Conference at the Grand Hotel, Birmingham. Further details were printed in this JOURNAL on September 6, page 270.

OCTOBER 4

Institution of Mechanical Engineers

North-western branch:—"Industrial Design and its Relation to Machine Design," by H. G. Conway, at 6.45 p.m., in the Engineer's Club, Albert Square, Manchester.

Institution of Production Engineers

London section:—"Increased Productivity by the Use of Compressed Air," by N. P. Watts, 7 p.m., at the Royal Empire Society, Northumberland Avenue, London, W.C.2.

Institute of Metals

Leeds Metallurgical Society:—"Statistical Control in the Steel Industry," by N. H. Bacon, at 7 p.m., in the Chemistry Department, The University, Leeds, 2.

OCTOBER 5

Institution of Mechanical Engineers

North-Eastern branch (Graduates' Section):—"Materials Testing," by M. Milne, at 7 p.m., in the Lecture Theatre of the Northern Gas Board Showrooms, Grainger Street, Newcastle-upon-Tyne.

OCTOBER 6

Institute of British Foundrymen

Wales and Monmouth branch:—Film display, including illustrations of Non-Ferrous Productivity Team's Visit and Report, 6 p.m., at the Engineer's Institute, Cardiff.

Obituary

WE REGRET to learn of the deaths in the recent train disaster at Weedon of MR. C. C. HOWIS and MR. F. WALKER. Both men were engaged on important research work at the Kirkby Laboratories of British Insulated Callender's Cables Limited, Mr. Howis being the Company's chemical research laboratory manager and Mr. Walker a research metallurgist.

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.

SITUATION WANTED

METALLURGIST. — Foundry Technician, B.Sc. (25), requires post as ASSISTANT MANAGER and METALLURGIST, 5 years apprenticed, 5 years industry cast iron, malleable, etc. Experienced in all departments, practical, theory and laboratory. Responsible, progressive post required.—Box 1271, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

NON-FERROUS and CAST IRON MOULDERS required. Good rates. Canteen, etc.—Write Box 302, W.B.G., 39, Cheapside, London, E.C.2.

METALLURGICAL CHEMIST required for Grey Iron Foundry of modern light engineering factory near Leeds. Practical experience in the control of metal mixtures an advantage. Assistance with housing accommodation may be given. Apply stating age, experience, qualifications and salary required to Box 1228, FOUNDRY TRADE JOURNAL.

METALLURGICAL LABORATORY ASSISTANT required, chiefly for Microscope and related work, on a large variety of engineering materials. Ability to correlate with production problems essential. Degree or L.I.M. preferred, but not essential. Age up to 35.—Replies, quoting Lab.(1), to SENIOR PERSONNEL OFFICER, Vickers-Armstrongs, Ltd., Barrow-in-Furness.

FOUNDRY MANAGER required for modern well-equipped Machine Tool Foundry (West Riding of Yorkshire); excellent prospects and permanency. Successful applicant to take complete control of Foundry, having monthly production approximately 120 tons. Vacancy caused by retirement of present Manager.—Box 1258, FOUNDRY TRADE JOURNAL.

ASSISTANT ANALYST required; experienced in analysis of cast iron and non-ferrous alloys. Hartlepools district. State age, experience, training, and salary required.—Box 1261, FOUNDRY TRADE JOURNAL.

WORKING FOREMAN required for small Non-ferrous Foundry, North London. Experience in brass and gunmetal valve castings. Preferably practical moulder, with good knowledge of plaster oddsides, coremaking (inc. blowing) and furnace work. Must be able to organise and take charge.—Write full details of experience and salary required, Box 1262, FOUNDRY TRADE JOURNAL.

LEADING MOULDER required for North London Foundry. Brass and gunmetal pressure castings. Knowledge of coremaking beneficial. Regular position for right man, with prospects of taking charge.—Write full details of experience and salary required, Box 1263, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

FOUNDRY MANAGER required for small Malleable Foundry (Midland area). Exceptional opportunity for sound practical man, with knowledge of stump and machine moulding.—Box 1254, FOUNDRY TRADE JOURNAL.

REQUIRED. — FOUNDRY TECHNICIAN. Capable of starting up own laboratory. Routine analysis of all materials and sand control, with sufficient practical knowledge to apply results to casting production. House available. Commencing salary £520 per annum.—Box 1265, FOUNDRY TRADE JOURNAL.

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

FOREMAN or MANAGER required for Small Sand Foundry in South Birmingham, employing 10-15 moulders. Aluminium alloys and yellow metals, prototype and production work. Opportunity for good man to take full control.—Box 1222, FOUNDRY TRADE JOURNAL.

PATTERNMAKER required, able to design, lay-out, make master patterns, and complete plated metal patterns. Excellent opportunity for absolutely first-class man. Yeadon area. Write stating age, experience, salary required.—Box 1226, FOUNDRY TRADE JOURNAL.

WANTED.—Man to take charge of small, but rapidly expanding, Aluminium Gravity Die Foundry in the Midland area. Applicant must be good organiser with ability to control labour and production efficiently. Please state age, experience and salary required to Box 1230, FOUNDRY TRADE JOURNAL.

CAST Iron and Non-ferrous working CHARGEHAND required for small East London Foundry. Good weekly wage, plus bonus and overtime paid.—Write Box 1232, FOUNDRY TRADE JOURNAL.

FOREMAN required for Jobbing Foundry on N.E. Coast. Castings up to 15 tons, weekly output 100 tons. House available.—Write, giving full details of experience and salary required, Box 1252, FOUNDRY TRADE JOURNAL.

SENIOR executive (Foundry Manager) requires personal ASSISTANT, Dudley area. Some metallurgical knowledge necessary. Experience in non-ferrous founding and scrap metal trade desirable but not essential. Main requirements are enthusiasm, energy and initiative. Excellent prospects for right man. Age preferably not over 30 years.—Full details of experience to date, salary expected, and appropriate references, to Box 1246, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

WANTED.—ASSISTANT FOUNDRY MANAGER, for Jobbing Foundry, both Ferrous and Non-Ferrous. Rapid promotion is offered to successful applicant, who must be fully experienced to carry out re-organisation.—Box 1274, FOUNDRY TRADE JOURNAL.

RATEFIXER required for modern special Steel Foundry in N. Notts area. Machine shop experience preferable, but not essential. Permanent expanding position, with good prospects.—Write, stating age, experience, and salary required, to Personnel Manager, Box 1272, FOUNDRY TRADE JOURNAL.

WANTED.—SALES MANAGER, for Mechanised and High Duty Jobbing Foundry. Applicant must be fully experienced in these branches of foundry work and be capable of making accurate estimates. He must be of pleasing personality and fully capable of dealing with after sales service. Salary in line with qualifications.—Box 1273, FOUNDRY TRADE JOURNAL.

FOUNDRY SUPERINTENDENT.—An expanding foundry on the outskirts of London, producing both ferrous and non-ferrous castings (by a precision process as well as by normal sand foundry methods), wishes to engage an experienced man to take full charge of production and administration. Salary dependent on experience, but not less than £700 p.a.—Reply, giving details of experience in chronological order, to Box No. 3138, MASON-PEACOCK, LTD., 184, Strand, W.C.2.

CHARGEHAND COREMAKER required by large engineering firm in the West of England. Must have knowledge of modern coremaking methods on large and small cores, ability to introduce them on semi-skilled labour. Experience of coreblowing essential. Progressive outlook for young man. Previous executive position not essential—State past experience and salary required to Box 1266, FOUNDRY TRADE JOURNAL.

FOREMAN required for Chill Cast Bar Foundry, Dudley area. Experience in quality control of Chill Cast Brass and Bronze essential. Excellent prospects for experienced man.—Full details of age, experience, etc., to Box 1245, FOUNDRY TRADE JOURNAL.

JUNIOR METALLURGISTS required, age 21-25, for control work in Iron and Steel Foundry. Good opportunity to gain practical experience. Write stating age, experience, training and salary required.—Box 1213, FOUNDRY TRADE JOURNAL.

FACTORY PREMISES WANTED

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

PLANTS FOR SALE

3 ELECTRIC FURNACES in good condition, suitable for vitreous enamelling, 140 kW., size 9 ft. by 13½ ft. high, complete with equipment. — Apply Buyer, Platers & Stampers Ltd., Burnley.

1 CUPOLETTE, by Geo. Green, size No. 2. 15 cwt. per hour. Complete with motorised blower, 400 volts, 3-phase, 50 cycle.—Particulars, J. CROLLIE & SON, LTD., Wantz Road, Dagenham.

FINANCIAL

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

WANTED to purchase, controlling interest in Iron Foundry mechanised by firm with speciality castings, approximately 28 lbs. weight or would buy outright, state all particulars of price, etc.—Box 1215, FOUNDRY TRADE JOURNAL.

WANTED.—Iron Foundry to manufacture speciality castings about 28 lbs. weight or would buy controlling interest, state full particulars and price, etc.—Box 1216, FOUNDRY TRADE JOURNAL.

MACHINERY WANTED

5-TON CAPACITY CUPOLA REQUIRED, COMPLETE WITH STAGING, BLOWER, ETC.—Box 1264, FOUNDRY TRADE JOURNAL.

WANTED.—Core Sand Mixing Machine, about 2 cwt. mixing capacity.—State maker, age, price, and where seen.—Box 1240, FOUNDRY TRADE JOURNAL.

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MACHINERY FOR SALE

ABRASIVE DISC CUT OFF MACHINE by Coleman for sale. Price £250.—1219, FOUNDRY TRADE JOURNAL.

COCHRANE VERTICAL BOILER for sale, 8 ft. 6 in. dia. by 17 ft. height, 4,950 lbs./hr., 100 lbs. with Weir Pump. Price £400.—Box 1220, FOUNDRY TRADE JOURNAL.

SAND MIXERS and DISINTEGRATORS for Foundry and Quarry; capacities from 10 cwts. to 10 tons per hr.—W. & A. E. BRELEY (MACHINERY), LTD., Station Works, Ecclesfield, Sheffield.

FOR SALE.—McNab Roll Over Moulding Machine, 40 in. by 50 in. plate. Three B.M. straight lift Moulding Machines. These machines are in good order and may be seen working.—Box 1256, FOUNDRY TRADE JOURNAL.

MACHINERY FOR SALE—*Contd.*

FOR SALE.—One 5 ft. 6 in. dia. edge-running Mortar Mill, complete with countershaft and 10 h.p. motor and starter.—Can be viewed at H. & E. LINTOTT, LTD., Engineering Works, Horsham.

MACHINERY FOR SALE.—ONE 54 in. shell dia. Cupola. Modern type, 55 ft. high. Absolutely new condition. Available 2/3 weeks.

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SEVERAL NEW KEITH BLACKMAN BLOWING FANS. 10,000 c.f.m., 13 in. w.g. 1 h.p. Motor, 400/3/50. Blast gate and starters.

MOTOR DRIVEN BLOWING FAN, Keith Blackman. 150 c.f.m., 10 in. w.g. 1 h.p. S.C. Motor, 400/3/50.

NEW SIZE 20 MULTIVANE STEEL-PLATE PRESSURE FAN. 1,500 c.f.m. against 18 in. w.g. 10 h.p. S.C. Motor, 400/3/50.

MOTOR DRIVEN BLOWING FAN, Sturtevant, No. 6. 14 in. inlet, 12 in. outlet. 10 h.p. Crompton Parkinson S.C. Motor, 400/3/50. 1,440 r.p.m., with starter.

TWO KEITH BLACKMAN NARROW PATTERN MOTOR DRIVEN BLOWING FANS. 10 in. inlet, 6 in. by 2 in. outlet. 10 h.p. Brook S.C. Motor, 400/3/50. Oil Immersed Starter.

NEW SIZE 24 MULTIVANE STEEL PLATE PRESSURE FAN. 2,820 c.f.m. against 22 in. w.g., to 20 b.h.p. S.C. Motor, 400/3/50.

MUSGRAVE MULTIVANE MOTOR DRIVEN BLOWING FAN. 25,000 c.f.m., ⅜ in. w.g. 10 h.p. S.R. Motor, 400/3/50. 1,400 r.p.m. Ellison O.I. Starter.

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