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PRINCIPAL CONTENTS

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Brussels Congress

An international foundry congress to-day is a vastly different affair from some of the earlier efforts, for in times past many of the British visitors disregarded the technical sessions, because of language difficulties. To-day, because of the increasing participation of the Scandinavians and Dutch, all of whom seem to speak excellent English, a pleasing equilibrium between that language and French has been established. This fact made the technical sessions of last week's Brussels International Foundry Congress more than usually interesting. The offices of Fabrimetal—the employers' federation for the Belgian metallurgical industries—make an ideal building for such a gathering. There is a large hall capable of seating several hundred people, whilst smaller rooms allow of three simultaneous sessions being held. These were sometimes filled almost to overflowing. A very agreeable feature was the use of the Fabrimetal Club, where, with the delegates seated on comfortable chairs, backs of envelopes could be used to elucidate the more complex problems arising from the sessions.

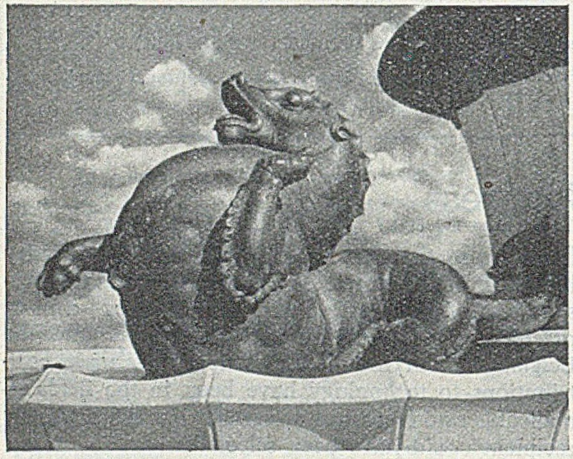
A feature of the Congress was the participation of the German foundrymen for the first time since the war. The delegation numbered about 50, and included some of Europe's best-known foundry metallurgists. In the future, this participation will, as it has done in the past, materially enrich the foundry literature of the world. An innovation was the presentation of an award to Mr. René Deprez—a past-president of the International Committee and the Belgian Foundrymen's Association. His main contributions to technology have been in the fields of malleable and historical research. No more worthy recipient could have been selected.

A little disappointment was expressed by a few that the works visits on one day were to rolling mills instead of to foundries, but this was entirely unjustified, because in the circulars outlining the programme it was distinctly stated that on request private visits could be arranged. What better hospitality could be offered? The British delegates were charmed with the reception and entertainment accorded to them and for the excellence of the programme arranged. Whilst the whole of the organisation committee co-operated to attend to the needs of the individual, the British felt they were especially indebted to Mr. Jacques Foulon, the secretary, and Mr. De Keyser, the director of the Foundry Division of Fabrimetal. In Mr. Spies, the foundrymen of Europe have found the ideal chairman; he can resolve difficulties and express with equal ease just what everybody feels.

B

New Zealand Art Castings

Mr. Richard O. Gross, C.M.G., a New Zealand sculptor, has sent us a copy of *Newsview*, which carries illustrations of a fountain he has designed for the City of Auckland. We illustrate one of the three taniwhas—a mythological creature of the Maori sagas—which form part of the centre-piece. Out of their mouths spouts water for the filling of a 75-ft. dia. circular basin. These taniwhas were cast in the foundry of one of our readers, D. Henry, Limited, of 12 to 14, Nelson Street, Auckland. They are 4 ft. 6 in. high and 12 ft. long and were cast in bronze using sand moulds. The job involved nine months for making and used the part-time services of two moulders and two sculptors. This included the central 36-ft. dia. lip which was made of nine sections screwed together. When the fountain is in operation, to complete the full cycle of jets, sprays, atomisers and colour combinations requires 39 hours. The fountain is not, as one would have imagined, situated in a city square, but in the quiet seclusion of what appears to be rural parkland. It is noteworthy that with the restricted experience available within the Dominion, such an outstanding work of art should have been achieved.



One of three Bronze Taniwhas forming Symbolic Decoration for the City of Auckland Fountain at Mission Bay.

P.O.A. "Minibition"

The Purchasing Officers' Association in connection with their national conference, being held from September 27 to 30 this year at the Craigside Hydro, Llandudno, North Wales, are again staging a "Minibition." As the name implies, this is a miniature exhibition of firms' products arranged on small stands adjacent to the conference hall. The function has this year again been well supported by foundries, who number a score or more out of the hundred exhibitors and include many well-known firms.

Among the speakers will be Sir Hugh Chance M.A., on "Management Education in America," and N. Ker Lindsay, B.A., B.C.L., director of the British Non-Ferrous Metals Federation, who will discuss "Non-ferrous Metals." Discussion group meetings will deal with such subjects as "The Purchase of Plant," "Training the Young Purchasing Officer," and "Co-operation between Purchasing and other Departments."

Conference Paper Author

Dr. R. V. Riley.

Ralph V. Riley, Ph.D., B.Sc., is author of the Paper "Some Factors Affecting the Solubility of Carbon in Iron" (printed on the opposite page). He graduated from the Department of Fuel and Metallurgy of Leeds University in 1938, and took up a training appointment with Steel, Peech and Tozer, Limited, of Rotherham. In 1939 he returned to Leeds University to work on the high-temperature oxidation of steel for the Alloy Steel Research Committee of the Iron and Steel Institute, where he gained the Ph.D. degree in 1941. He then went as chief research metallurgist to Bradley & Foster, Limited, Darlaston, where he studied the manufacture of acid-resisting silicon iron castings under the ægis of the Ministry of Supply. When, in 1945, Bradley & Foster became amalgamated with the Staveley Coal & Iron Company, Dr. Riley was made research manager of the newly-formed research department. This has since become the research department of the Staveley Iron & Chemical Company, Limited.

"What's Going on Over There"

This is the title of a pamphlet summarising the productivity Report made by a team of British foundrymen after their visit to the United States. It has been prepared by the Council of Ironfoundry Associations for free distribution to the ordinary employees of the industry. Sufficient number is being printed for everybody entering this classification to receive a copy. The pamphlet is made up in a style which the "man in the street" should appreciate. It is well illustrated and deals with the subject in three short statements:—(1) The objectives sought by the visiting team; (2) the current adverse conditions surrounding the industry, and (3) the proposals made by the team. The sole criticism the reviewer makes is, that there should have been incorporated a more prominent appeal to the readers of this pamphlet to purchase the original report. The inclusion of a tear-out order form would not have been amiss. It was wise to present the implications of the Report in the present form, but there are obviously matters not included which would interest the man on the floor. Yet, on the other hand, the literature of so many ordinary workmen is limited to football and racing; perhaps the actual Report would be a little too advanced for them. Foundry owners are strongly urged by the reviewer to write to the Council of Ironfoundry Associations at Crusader House, 14, Pall Mall, London, S.W.1, for the receipt of the conditions appertaining to the free supply of quantities of this interesting pamphlet.

Sir Lynden Macassey, K.B.E., K.C., should have been included in the list of newly-appointed vice-presidents of the British Internal Combustion Engine Research Association published in our issue of August 30. In the same item the president of the Association was said to be Chairman of the National Gas and Oil Engine Company Limited; he is actually the *late* Chairman.

Factors Affecting the Solubility of Carbon in Iron*

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

This Paper gives details of an investigation into factors governing the solubility of carbon in cast iron. The experiments were carried out in laboratory furnaces in which carefully controlled conditions were maintained. Carbon solubility in iron was determined in selected atmospheres of hydrogen, oxygen, nitrogen and air, at normal and low pressures, and in vacuo.

The work has shown that available knowledge upon the form of the liquidus of iron-carbon alloys containing over 4.5 per cent. carbon is incomplete. Carbon solution rates in high-carbon cast iron are in conformity with the general laws relating to the solution of a solid in a liquid. The rate of solution depends upon :—(a) Temperature of the molten iron; (b) concentration of carbon in iron; (c) mixing of the carbon with the molten iron; (d) nature of the carbonaceous materials and surface characteristics, and (e) the presence of agents which may interfere with or assist carbon solution.

The ambient atmosphere has an important indirect effect upon carbon solubility rates. It is shown that the normal cupola atmosphere is not conducive to the production of high carbon iron. Calcium carbide additions have specific action in raising the carbon content of cupola melted iron.

Introduction

MUCH has been written concerning methods which have been employed in the control of the carbon content of cupola melted cast iron. With a metal so commonly used as cast iron and with a universal melting furnace like the cupola it might be expected that the technique of carbon control would already be well-known and generally practised. This is not the case.

Silicon, manganese, phosphorus and sulphur, may be controlled within relatively fine limits to any normal value. In alloy cast iron it is possible to regulate with some degree of precision the content of nickel, chromium, molybdenum, copper, etc. Similarly, the microstructure of cast iron and the physical properties are capable of control. An iron may contain carbon in the combined form as carbide or it may be arranged to be graphitic, having the graphite in any of a number of recognised forms ranging from flake to nodular. The form of the graphite in iron may be regulated more easily indeed than can the amount of carbon which will dissolve in iron during cupola melting.

Iron from a cupola runs to a given carbon content characteristic of the furnace, the type of coke, and the prevailing working conditions. Charges of high carbon irons tend to lose carbon whilst charges of steel and low carbon scrap iron tend to absorb carbon from the coke in the furnace.

One method of obtaining a carbon value in the cupola melted iron greater than that the cupola normally produces, is to include high-carbon pig-iron in the charge, however this method has its short-comings, hematite is in large demand for steel making and is not available in unlimited quantities for foundry purposes. Furthermore, it is expensive as compared with other foundry irons.

The purpose of the experimental work described was to study the reasons for the difficulties in respect of carbon control in cupola-melted iron and to find out more about the laws governing carbon solubility in commercial irons. The work described was carried out entirely in the laboratory, under controlled experimental conditions.

Earlier Work

As a prelude to the work it appeared necessary to consider the mechanism of carbon solubility in molten cast iron. A study of the literature cited at the end of this Paper indicates several factors which have an influence upon carbon solubility.

1.—Effect of temperature of molten iron.
2.—Time of contact with carbonaceous material.
3.—Type of carbonaceous material.
4.—Active surface area of carbonaceous material.
5.—Carbon concentration in the iron.
6.—Effect of agitation and mixing.
7.—Effect of other constituents in the iron.
8.—Effect of gaseous atmosphere above molten iron.

Interesting fundamental work upon the solubility of carbon in pure iron is that by Ruer and Birens.[36]† In this work the absolute solubility of carbon in pure iron was determined at temperatures from 1,150-2,600 deg. C. in the presence of a neutral gas. Calculations made by Chipman[39] on the assumption that Fe_3C is present in solution give figures substantially in agreement with the experimentally determined values of Ruer and Birens (Table I). The assumpton that carbon goes into chemical combination with the iron before solution is of some importance in the light of the

* 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.

† Bibliography will be printed at the end of the Paper.

Solubility of Carbon in Iron

present work and will be considered at a later stage.

In its general accepted form, the iron-carbon equilibrium diagram has a liquidus in the hypereutectic region which conforms almost exactly to the solubility values given in Table I. Whilst it is

TABLE I.—*Carbon Solubility in Iron.*

Temperature, deg. C.	Calculated carbon, per cent. in pure iron. (Chipman.)	Observed carbon, per cent. in pure iron. (Ruer and Birens.)
1,150	4.24	4.24
1,200	4.36	4.36
1,300	4.60	4.62
1,400	4.86	4.88
1,500	5.10	5.15
1,600	5.37	5.41
1,700	5.65	5.66
1,800	5.96	5.96
1,900	6.31	6.33
2,000	6.71	6.76
2,100	7.17	7.31
2,200	7.68	7.77
2,300	8.27	8.30
2,400	8.92	8.90
2,500	9.72	9.52
2,600	10.71	11.15
2,700	11.96	—

recognised that there might be small differences between the carbon equilibrium diagram of graphite : iron and cementite : iron, these are ill-defined at present. For the purpose of this paper it is proposed to recognise the iron-carbon equilibrium diagram in its more liberal application and in the form shown in Fig. 1.

Outline of Experimental Work

Part I.—Rate of Solubility of Coke and Other Commercial Forms of Carbon in Cast Iron

One part of the Author's work was to carry out experiments which were designed to evaluate the relative carbonising powers of several commercially obtainable forms of carbon when in contact with molten iron at cupola temperatures. For this purpose a grey iron was melted in a high-frequency electric laboratory furnace. The iron was maintained molten at 1,500 deg. C in contact with the selected material for a period up to three hours. Samples were taken at intervals for carbon estimation. In this way the rate of carbon solubility was measured.

Part II.—Relative Merits of Other Carbonaceous Materials

The materials used for these experiments have been suggested from time to time in the literature as aiding carbon solution in cast iron. Carbon black, potassium ferricyanide, coal gas, acetylene and calcium carbide were added to molten iron at 1,500 deg. C. and the rate of carbon solubility was measured by taking samples over a period of time.

Part III.—The Production and Utilization of a High Carbon Iron Alloy

An attempt was made to add carbon to molten iron at high temperature so as to produce a very high carbon alloy which might be used as an additive to give a positive means of controlling the carbon content of commercial cast iron. The difficulties attaching to this are discussed.

Part IV.—The Influence of Ambient Atmosphere in Melting Units upon Carbon pick-up

Experiments were made in sealed apparatus in which the atmosphere above the molten iron could be carefully controlled. In this way melting *in vacuo* or in elemental gases under low partial pressures was carried out. Important results were forthcoming which have a bearing upon the whole subject of carbon solubility and which enable a rational understanding of some of the otherwise conflicting evidence obtained in the course of this work.

PART I—CARBON SOLUBILITY EXPERIMENTS USING COKE AND OTHER COMMERCIAL FORMS OF CARBON

Experimental Details

The base iron in this series of experiments was made from a high phosphoric grey iron and steel mix to give on melt down a typical analysis of:—
T.C.—0.60, Si—0.75, Mn—0.40, S—0.06 and P—0.25 per cent.

The charge during melting in the high frequency crucible was in contact with the particular coke or other form of carbon chosen for the purpose of the test. The duration of the experiment was timed from the moment the bath was completely molten. The actual melting time was between 20 to 30 minutes in each case.

When the bath was completely molten an immersion thermocouple was put in place working in a silica sheath (3 mm. bore × 8 mm. wall) pro-

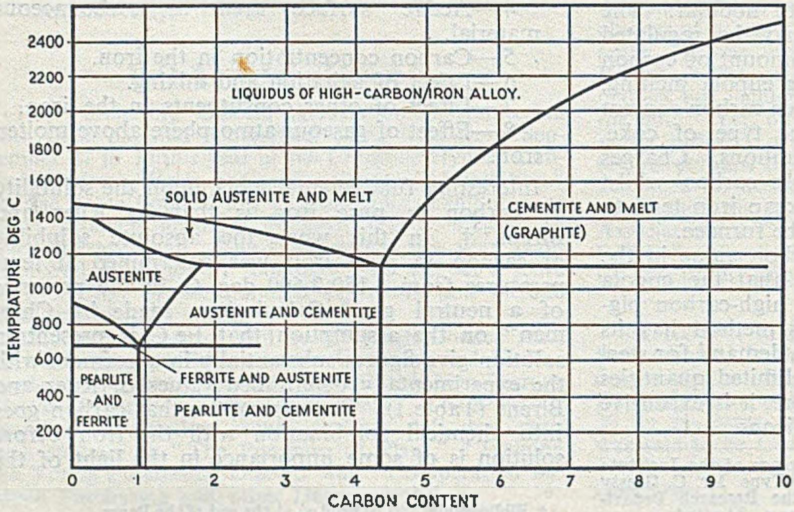


FIG. 1.—*Iron/Carbon Equilibrium Diagram.*

tected with alumina cement. A thermocouple of platinum/platinum: 13 per cent. rhodium was capable of withstanding the conditions of immersion at 1,500 deg. C. for periods of up to three hours. The input to the high frequency electric furnace was constantly adjusted by hand to hold the bath to 1,500 deg. C. ± 5 deg. C. during the time of the experiment.

Molten metal samples were taken at intervals of 5 or 10 minutes by inserting a silica tube, 3 mm. bore × 2 mm. wall, into the melt and sucking up a pencil of metal about 2 to 3 in. long. This method of sampling was excellent for obtaining suitable combustion-carbon samples. The almost instantaneous chilling of the molten iron in the tube gave a white iron even with carbon contents of over 4.5 per cent. In this way there was little chance of loosing graphite during solidification and subsequent handling. Adventitious carbon from the coke was prevented from occurring in the sample by plunging the tube well below the surface during sampling.

The coke and other forms of carbon tested in these experiments was first prepared to give the desired grading of particles and was then spread upon the molten metal surface to a depth of two inches. The layer of coke was replenished at intervals during the experiment to allow for solution and burning losses. No attempt was made to stir the coke layer; the only mixing was caused by the natural movement of the molten metal due to the high frequency heating currents which continually brought fresh streams of iron into contact with the partially submerged carbon.

Experimental Results

The results of these carbon solubility experiments are given in Table II and are plotted graphically in Fig. 2. For the sake of clarity in the diagram (Fig. 2) some of the experimental points are omitted. The carbon content after the iron had been molten for 20 minutes was taken as the datum level in each case. This method was adopted to avoid the misleading values which were obtained at the beginning of each experiment when the rate of carbon solubility was comparatively large and thus somewhat erratic. The observed values demonstrate the importance of the following factors upon the rate of carbon absorption by cast iron.

(a) *Effect of Carbonaceous Material*

Differences in carbon pick-up have long been recognised in the cupola melting of iron which are attributable to the coke. The laboratory experiments have also demonstrated these differences. Fig. 2 shows that each one of the various types of foundry coke used was a relatively poor carboniser for molten iron at 1,500 deg. C. The rate of solubility or carbon derived from coke was extremely slow

TABLE II.—*Percentage Solubility of Carbonaceous Materials at 1,500 deg. C.*

Experiment No. / Time of contact.	1. Electrode graphite 1/16-1/2 in. graded lumps.	2. Electrode graphite 1/16-1/2 in. graded lumps.	3. Proprietory graphite powder A.	4. Proprietory graphite powder B.	5. Steam coal 1/16-1/2 in. graded lumps.	6. Anthracite 1/16-1/2 in. graded lumps.	7.* Petroleum coke 1/16-1/2 in. graded lumps.	8. Coke A, 1/16-1/2 in. graded lumps.	9. Coke B, 1/16-1/2 in. graded lumps.	10. Coke C, 1/16-1/2 in. graded lumps.	11. Coke D, 1/16-1/2 in. graded lumps.	12. Coke E, 1/16-1/2 in. graded lumps.	13. Proprietory addition 1/16-1/2 in. graded lumps.
0 min. ..	—	—	0.77	0.74	—	—	—	—	—	—	—	—	—
	—	—	1.32	1.22	—	—	—	—	—	—	—	—	—
10 min. ..	3.99	2.80	1.48	1.16	1.11	0.83	2.31	0.54	1.00	1.02	1.14	0.85	1.27
	4.14	—	1.93	1.20	1.26	1.17	2.43	0.77	1.06	1.17	1.11	0.98	—
20 min. ..	4.19	—	2.13	1.28	1.53	1.45	—	0.62	1.06	1.07	1.22	0.87	—
	—	3.31	2.32	1.99†	1.43	1.55	2.44	0.68	1.03	1.14	1.16	0.98	1.21
30 min. ..	4.29	—	2.51	1.98†	1.79	1.90	—	0.66	0.98	0.81	—	0.92	—
	—	—	—	—	2.09	1.96	2.45	0.65	1.03	1.13	—	1.01	1.50
40 min. ..	4.44	4.08	—	—	2.22	2.00	2.49	0.66	0.98	1.10	—	0.91	1.41
	—	—	3.06	1.58	—	—	—	0.70	1.05	—	1.27	—	1.48
50 min. ..	—	—	—	—	—	—	2.95	—	—	—	—	—	—
	—	4.42	—	—	2.95	—	2.92	—	1.05	1.04	—	0.91	—
hr. 0 min. ..	4.76	—	4.18†	1.65	—	2.41	2.89	0.74	—	—	1.54	—	1.78
	—	—	—	—	—	—	2.93	—	—	—	—	—	—
10 min. ..	4.68	4.68	—	—	2.67	2.63	—	—	—	—	—	—	—
	—	—	3.56	1.40	—	—	—	—	1.08	1.13	—	1.21	—
20 min. ..	4.68	4.69	—	—	—	—	3.04	1.25†	—	—	1.67	—	1.83
	—	—	—	—	—	—	—	—	—	1.21	—	—	—
30 min. ..	—	—	3.75	2.78†	3.01	2.78	—	—	1.08	—	—	0.95	—
	—	—	—	—	—	—	—	0.84	—	—	1.49	—	2.03
40 min. ..	—	—	—	—	3.20	2.31†	2.96	—	—	—	—	—	—
	—	—	3.80	2.14	—	—	—	—	1.19	1.21	—	1.05	—
50 min. ..	—	—	—	—	—	—	3.05	0.93	—	—	1.79	—	2.07
	—	—	—	—	3.34	2.87	—	—	—	—	—	—	—
hr. 0 min. ..	—	—	4.01	2.40	—	—	—	—	1.26	—	—	0.97	—
	—	—	—	—	—	—	3.05	1.03	—	—	2.09	—	—
10 min. ..	—	—	—	—	3.40	2.94	—	—	—	—	—	—	—
	—	—	4.12	2.46	—	—	—	1.07	1.28	—	2.09	1.08	—
20 min. ..	—	—	—	—	—	—	3.16	—	—	—	—	—	2.08
30 min. ..	—	—	4.13	2.62	—	—	—	—	—	—	—	—	—
40 min. ..	—	—	—	—	—	—	3.01	—	—	—	—	—	—
	—	—	4.19	3.16	—	—	—	—	—	—	—	—	—
50 min. ..	—	—	—	—	—	—	—	—	—	—	—	—	2.21
hr. 0 min. ..	—	—	4.27	3.76	—	—	—	—	—	—	—	—	—
10 min. ..	—	—	—	—	—	—	3.02	—	—	—	—	—	—
	—	—	—	3.65	—	—	—	—	—	—	—	—	—

* Experiment 7 calculated carbon = 1.5 per cent. † Suspected faulty results due to adventitious carbon in sample.
Chilled pencil samples taken in silica tube for carbon determination.
Typical analysis of base iron: Si, 0.75; Mn, 0.40 P, 0.25; and S, 0.06 per cent.

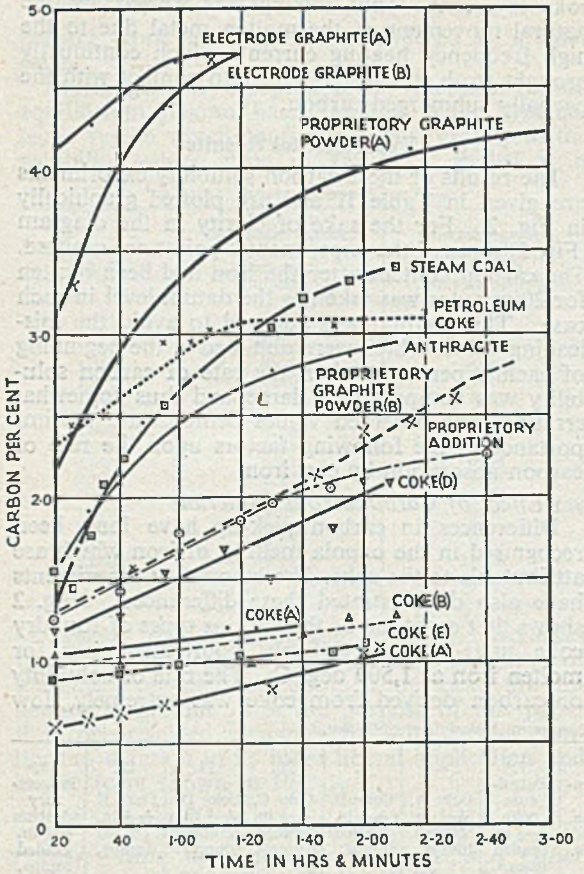


FIG. 2.—*Rate of Solubility of Coke, etc., in Cast Iron at 1,500 deg. C.*

and compared unfavourably with the purer graphite type of material.

Graphite of the type used for electric arc furnace electrodes proved to have much the quickest rate of solubility in molten iron. Steam coal, anthracite coal and petroleum coke came next, and also two proprietory granulated graphites believed to be natural graphites. The cokes as a group came last. The petroleum coke was a good carboniser and may be regarded as being outside the normal foundry coke classification.

In seeking an explanation of the different carbonising powers of these carbonaceous materials it was noticed that the surface of electrode graphite remained clean whereas the cokes rapidly become coated with ash. Anthracite, steam coal and graphites A and B also retained a fairly clean surface during the experiment. It was of interest to observe that the carbonising powers of the materials used were roughly inversely proportional to their ash contents. Table III shows the materials arranged in order of ash content which also places the materials roughly in order of carbonising efficiency.

The behaviour of steam coal was noteworthy. The high rate of solution appeared to be due to the evolution of gases of carbonisation which kept the surface free from ash.

With one exception all the materials employed as carbonisers were graded to $\frac{1}{16}$ in. to $\frac{1}{4}$ in. particles for the purpose of these experiments. In Experiment 2 electrode graphite of identical composition to that used in Experiment 1 was employed in lumps 1 in. to $\frac{1}{4}$ in. The larger sized particles of graphite were somewhat slower of solution, but after a slightly increased time of contact the ultimate carbon solubility for each material was the same. Although in this series the finer grade of graphite gave a greater rate of solution, it does not follow that very finely divided carbon would dissolve more readily. In one experiment on a commercial scale using powdered natural graphite, a very poor

TABLE III.—*Composition of Carbonaceous Materials of Value as Carbonisers.*

Material.	Moisture, per cent.	Volatile matter, per cent.	Ash, per cent.	Carbonising power.
Electrode graphite ..	0.05	0.60	0.60	Grade A
Proprietory graphite A	0.02	0.90	0.60	
Steam coal	1.40	33.50	1.20	Grade B
Anthracite	1.60	2.15	1.20	
Proprietory graphite B	0.03	0.50	1.30	
Petroleum coke ..	1.70	5.90	5.60	
Coke A	0.05	0.60	5.50	Grade C
Coke B	0.60	0.62	6.20	
Coke C	1.00	1.00	7.00	
Coke D	0.35	1.90	9.40	
Coke E	2.56	0.30	12.80	

Materials in this table arranged in order of ash content.

carbon increase was obtained due, perhaps, to lack of contact owing to non-submersion in the molten iron. In this connection, the British Cast Iron Research Association have recently shown that 12-in. to 44-in. mesh electrode carbon is an optimum size for ladle additions for the reduction of chill with cast iron.

The surface masking effect of ash or slag was found to be a very important factor governing the rate of carbon solution in molten iron. This aspect is considered later. The physical nature of the carbon surface appeared to be more important than the chemical composition of the carbonaceous material.

(b) Effects of Time of Contact and Carbon Content of Iron

These experiments showed clearly the importance of time of contact of the carboniser with the molten iron. The melt-down carbon content was, with one exception, calculated to be 0.60 per cent. C. The solution of carbon during the first few minutes of the experiment was very rapid and it was not possible to measure it accurately owing to the difficulty of obtaining a satisfactory average sample. During the period when sampling was practicable the carbon content rose regularly to the final values given in Table II.

The rate of carbon increase during the first few minutes was exceedingly rapid with electrode graphite, so that when sampling commenced the carbon content of the melt was already in excess of 2.5 per cent. Petroleum coke also gave a high carbon percentage after only a few minutes. On the other hand, with poor carbonisers like coke, the initial carbon pick-up was less. With all materials, however, there was a clear indication that the rate of solubility fell off with time and, of course, also with percentage of carbon already dissolved in the iron.

With a good carboniser (*i.e.*, electrode graphite) a saturation value was reached at 4.7 per cent. C. after only 1 to 1½ hrs., whereas with a less soluble form of carbon the time required for complete saturation under the conditions of the experiment was indeterminately long. This effect is shown clearly in Fig. 2. A form of curve showing a rapid rate of initial solution followed by a slowly diminishing rate ending asymptotically appeared to be general for all the experiments carried out in this section. The maximum carbon content after an infinite time of contact may be regarded therefore as the solubility of carbon in the commercial cast iron under the conditions of the experiment. As the time required for complete saturation was very long in all but the instances quoted with electrode carbon, and was quite outside the order of time of contact of iron with carbon in the cupola furnace, it was considered that no useful purpose would be served in prolonging the experiments.

(c) *Effect of Agitation on Carbon Solubility Rate*

The molten iron in the laboratory 10 lb. high frequency furnace was in continual rapid circulation due to eddy currents, causing the molten metal to stream over the surface of the submerged carbonaceous material. Ideal conditions existed for the absorption of carbon.

When electrode graphite additions were made to a 100 lb. induction furnace working at lower frequencies the rate of increase in carbon was much less, presumably owing to the less vigorous stirring action of the circulating metal.

PART II—MERITS OF OTHER CARBONACEOUS MATERIALS

Laboratory experiments of the same form as those described in Part I were carried out but with other forms of carbonisers. Some of the substances considered and tested have been suggested in the literature or have appeared likely as a result of the Author's investigations.

It was desired, for example, to test as an additive a very finely divided type of carbon which would be low in ash content and have a large surface area. Such a type of carbon is acetylene black.

(a) *Acetylene Black*

Acetylene Black was put on to the surface of a cast iron kept molten at 1,500 deg. C in a laboratory high frequency furnace. Samples were taken by the silica tube method for carbon estimation at intervals up to 2½ hours. The base iron used contained:—Carbon—3.10; Silicon—2.04; Manganese—0.62; Sulphur—0.086 and Phosphorus—0.04 per cent.

The changes in carbon content are shown in Table IV.

In experiment 2 a small carbon pick-up was obtained which was maintained throughout the course of the experiment. Two further trials operating under the same conditions failed to give any increase in carbon content. This failure to dissolve was probably due to the lack of contact between this light form of carbon and the molten metal.

TABLE IV.—*Percentages Carbon Solution in Cast Iron Using Acetylen Black.*

Experimental Conditions	Exp. 1.	Exp. 2.	Exp. 3.
No addition	3.54	3.28	3.14
Acetylene black .. .. after ½ hr.	3.54	3.54	3.14
" " .. .. " 1 "	3.50	3.64	3.12
" " .. .. " 1½ "	3.56	3.52	3.08
" " .. .. " 2 "	3.52	3.52	3.08
" " .. .. " 2½ "	—	—	3.08

It was concluded that acetylene black was unlikely to be useful as a carboniser and the trials were abandoned.

(b) *Potassium Ferricyanide*

It has sometimes been suggested that a cyanide might offer a source of carbon in a form in which it might be readily taken up by molten iron. Potassium ferricyanide granules were put upon the surface of the melt at 1,500 deg. C. Samples taken at intervals up to one hour showed no increase in carbon. The original carbon content of the melt was 3.44 per cent and after one hour the carbon was 3.38 per cent.

(c) *Carbonising powers of Carbonaceous Gases*

An attempt was made to use coal-gas as a source of carbon. The gas was bubbled through a silica tube into the molten iron at 1,500 deg. C. A slight loss of carbon occurred due, it is thought, to the oxidising effect of the atmosphere upon the surface of the iron roughened by ebullition. This was prevented by scattering some graphite powder upon the surface and then a slight carbon pick-up occurred but this was due entirely to the direct solution of the graphite.

Acetylene gas was substituted for coal gas but this proved impossible to feed into the molten iron owing to the deposition of carbon in the hot tube. After many attempts the project was abandoned.

(d) *Calcium Carbide as a Source of Carbon*

Calcium carbide added to the surface of molten iron proved fruitless. For reasons which become evident later this was not the best way of using calcium carbide to secure a carbon pick-up

(e) *Influence of Ash Fluxing Agents added to Coke*

The work described in Part I showed that the amount of ash in the cupola coke was an important factor governing carbon solubility. The smaller the ash content the more readily was the coke absorbed in the molten iron (with one exception Coke D, Table II). It was considered that if the surface of the coke in contact with molten iron could be kept clean and free from an accumulation of ash, then a greater rate of carbon solubility might be obtained. Two fluxing agents were tested (a) sodium carbonate, (b) borax using Coke A (Table II) which had an ash content of 5.50 per cent.

The coke was treated prior to the experiments by soaking in saturated solutions of sodium carbonate and borax respectively. The treatment consisted of soaking graded coke ¼ to ½ in. mesh in the

Solubility of Carbon in Iron

solutions, followed by drying at 150 deg. C. This procedure was repeated six times so as to secure the penetration of flux to the interior of each coke lump.

The treated coke was used to carbonise laboratory high frequency melts in a silimanite crucible of low carbon iron made to contain 2.00 per cent. silicon and 0.25 per cent. phosphorus. The experiments were conducted at 1,500 deg. C for a period of up to two hours; samples were taken every five or ten minutes.

The rates of carbon increase during the experiments are given in Table V together with the final composition of the carbonised samples

TABLE V.—*Percentage Carbon Pick-up from Treated Coke at 1,500 deg. C*

Time of contact, min.	No flux.	Sodium carbonate flux.	Borax flux.
0	0.64	0.64	0.64
5	0.54	1.45	0.81
10	0.77	1.78	0.90
15	0.62	2.04	0.90
20	0.68	2.18	0.93
25	0.66	2.63	1.15
30	0.65	2.66	1.54
35	0.66	—	1.65
40	0.70	—	—
45	—	3.17	1.82
55	0.74	—	2.06
60	—	3.42	2.16
70	—	—	—
75	—	3.02	—
85	0.84	—	—
90	—	3.89	—
100	0.93	—	—
115	1.03	—	—
125	1.07	—	—

Composition of Carbonised Iron.

	T.C.	Si.	Mn.	P.	S.
No flux addition ..	1.02	1.85	0.40	0.25	0.056
Sodium carbonate ..	3.66	2.27	0.61	0.25	0.069
Borax	2.22	2.08	0.73	0.24	0.053

Under the experimental conditions both treated cokes showed greater rates of solubility than the untreated coke, and the coke treated with sodium carbonate was the better carboniser. This experiment was interpreted as demonstrating the retarding influence of ash remaining upon the surface of coke and the possibility of improving the solubility of coke in iron by the provision of suitable fluxing materials to remove the ash and keep the carbon surface active

PART III—PRODUCTION AND UTILISATION OF A HIGH-CARBON IRON ALLOY

(a) *The Preparation of High Carbon Iron Alloys*

An attempt was made to produce a type of ferro-carbon alloy of higher carbon content than hematite or other existing carburised iron products.

Fig. 1 shows the conventional iron:carbon diagram with the liquidus extended by means of Ruer and Biren's values to a carbon content of 10 per cent. It is clear that in order to produce even a 10 per cent. carbon:iron alloy, it is necessary to attain a temperature of over 2,500 deg. C. According to the diagram, however, at this carbon content even a small further increase in temperature would cause a large increment in carbon dissolved. For the purpose of making a really high carbon-iron alloy this approach to a maximum temperature is of considerable interest. If indeed the compound Fe_2C could be obtained, even if only in a metastable form by quenching, it might be very helpful as an addition to cast iron for the purpose of raising the carbon content.

The highest temperature which could be obtained with the laboratory facilities available was in the region of 2,300 deg. C. This temperature could be reached only in a small vacuum fusion apparatus melting some 50 gms. of iron. The melt of armco iron was held for one hour at 2,300 deg. C. ± 50 deg. C. and was then cooled as rapidly as possible by the water-cooled silica furnace tube (see diagram of apparatus in Fig. 3). The carbon content of the ingot produced was 8.25 per cent., a value which falls almost exactly upon the curve of results obtained by Ruer and Birens (Fig. 1).

A series of experiments were conducted in a 100 lb. basic-lined high-frequency furnace fitted with a graphite liner turned from a large piece of electrode. The space between the liner and the fritted magnesite crucible was packed with magnesite powder for purposes of heat insulation. The crucible was charged with 60 lb. of cast iron scrap of composition given below:—T.C. 2.80; Si 2.30; Mn 0.75; P 0.20 and S 0.070 per cent.

This iron was melted in contact with Mexican graphite powder and was superheated to 1,800 deg. C. for 1 hour. The crucible furnace was then poured via a launder into a water jet so as to secure the rapid cooling of the iron shot which was collected in a tank of water. The temperature of the shot was such that partial decomposition of steam occurred and the operation was accom-

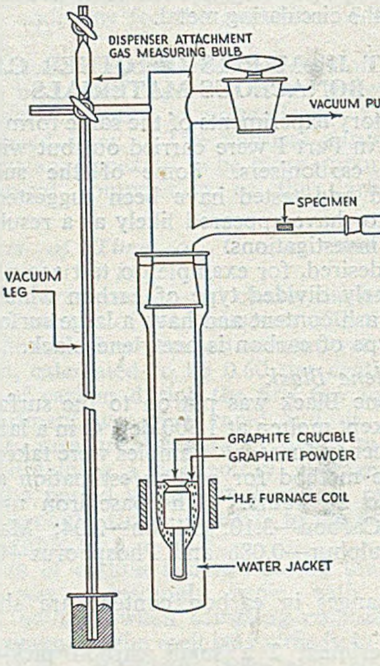


FIG. 3.—*Diagram of Apparatus for Controlled-atmosphere Melting.*

panied by flames of burning hydrogen and sharp explosions. The carbon content of the shot produced proved to be 5.17 per cent. Allowing for the silicon and phosphorus contents of this iron, the carbon equivalent was 5.87 per cent., a value which again compared almost exactly with the predictions of the Ruer and Biren's practical curve and the theoretical curve of Chipman.[36 39] The carbon equivalent was calculated using the well-known formula:—

$$C.E. = TC + \tfrac{1}{3}(\text{per cent. Si} + \text{per cent. P.})$$

This formula for the calculation of carbon equivalent is, of course, only intended to be used with cast iron of ordinary engineering compositions. Its adoption for irons of higher carbon content may be unjustifiable. Nevertheless, the relationship between the carbon equivalent value, so calculated, and the theoretical and experimentally determined carbon solubility curve for pure iron is of interest. The concept of carbon equivalent is used in the following text in order to allow for composition variations and to bring the various experiments to a common basis.

The same experiment was repeated in a 15 kva. induction furnace similarly fitted with a graphite liner. It was possible in this case to obtain a temperature of 1,900 deg. C. ± 50 deg. C. The carbonised iron was poured directly into a water bosh through a spray of water. The granulated shot had an average carbon content of 6.06 per cent. (C.E. = 6.76 per cent).

The high carbon iron alloys produced in this way were very pasty and the moment the temperature fell, the whole of the metal in the crucible tended to solidify instantly, only to liquefy again as carbon was evolved as " kish."

(*b*) *The value of a high carbon alloy as an Additive for Carbonising Iron*

The high carbon: iron alloy shot containing 6.06 per cent. carbon, made in the manner described above, was used as an addition to molten iron. The shot was added in weighed amounts to iron maintained at 1,500 deg. C. in the 15 kva. high-frequency furnace. These additions proved to be a very easy way of obtaining an increase in carbon from 2.8 up to 3.7 per cent. The results given in Table VI show that carbon content of iron in, say, a heated metal receiver, could be readily controlled and augmented, provided such a carbon alloy was available for the purpose.

TABLE VI.—*Carbonising Low-carbon Cast Iron with High-carbon Alloy.*

Experiment.	Calculated carbon, per cent.	Actual carbon obtained, per cent.	Carbon equivalent.
a. No addition	2.80	2.80	3.60
b. 8 per cent. carbonising alloy	3.08	3.06	3.66
c. 16 " " "	3.31	3.21	3.81
d. 26 " " "	3.51	3.27	3.87
e. 28 " " "	3.68	3.46	4.46
f. 32 " " "	3.83	3.52	4.32
g. 35 " " "	3.95	3.70	4.50

Initial Composition of Iron.

	per cent.
Carbon	2.8
Silicon	2.0
Manganese	0.70
Phosphorus	0.50
Sulphur	0.10

By this means even a hyper-eutectic carbon iron might be made with only a slight loss of carbon during mixing. However, since the carbon content of the high carbon alloy is limited to something like 6.0 per cent., large additions are required to produce a substantial increase in carbon in the mixture.

PART IV—EFFECT OF AMBIENT ATMOSPHERE DURING MELTING

The experimental technique was modified to allow of a study of the solubility of carbon in molten iron *in vacuo* and in the presence of selected gaseous atmospheres. Small specimens of cast iron weighing 30 gms. were melted in a graphite crucible contained in a silica tube which could be evacuated. The crucible was heated by high-frequency currents generated in a water-cooled coil placed outside the furnace tube. The essential details of the assembly are shown in Fig. 3.

The furnace tube was evacuated by means of a three-stage mercury vapour pump and a two-stage rotary oil backing pump. The working vacuum was 0.0005 mm. of mercury and under the conditions of operation the blank value of the apparatus was 0.1 mls. per hour. Provision was made for the introduction of small and controlled amounts of pure gases into the apparatus after evacuation.

The temperature was measured by optical " vanner " pyrometer which was calibrated against a platinum:platinum-rhodium thermocouple at 1,500 deg. C. All the experiments upon the influence of atmospheres were carried out at this temperature. The temperature control was to ±20 deg. C. during the period of the experiment.

Experimental Method

The graphite crucible and the graphite powder insulating the crucible in the silica furnace tube were first degassed by heating the crucible assembly to 2,000 deg. C. *in vacuo*. The degassing period was some 20 hours or until the blank value of the apparatus at 1,500 deg. C. was lowered to 0.1 mls. per hr. When the blank value had reached the stated value the experiment was commenced. The special atmosphere of oxygen, nitrogen, hydrogen or air was admitted to the desired pressure through the measuring tube shown in Fig. 3. Two standard working pressures were chosen, namely, 10 mm. pressure and 750 mm. pressure. One experiment was carried out *in vacuo*.

The solid specimen of iron was then introduced magnetically into the crucible from the side arm of the silica furnace tube. At 1,500 deg. C. the iron melted at once and remained molten for the duration of the experiment which was one hour in every case. At the end of this period the heating current was switched off and the furnace assembly cooled to room temperature. The molten iron solidified in about 10 seconds due to high thermal conductivity of the graphite and the water-cooling arrangements outside the furnace tube.

After each experiment the solidified button of iron was removed from the graphite crucible, carefully cleaned free from surface graphite and was then sectioned for analysis and micro-examination.

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Samples for analysis were obtained from slices cut from the solid specimen. In this way strips $\frac{1}{8}$ in. by $\frac{1}{8}$ in. by $\frac{3}{4}$ in. were obtained and these were used for the carbon estimation. This method of taking samples of cast iron for carbon estimation has been found to be very suitable for the high carbon contents which have been recorded in this work. Drillings could not be used owing to liability of significant loss of graphite carbon during preparation and handling. Solid samples for high carbon irons have been recommended by the British Cast Iron Research Association.[38]

Where possible the specimens were also analysed for sulphur. Their small size did not permit the checking of other elements in all specimens. In every case, however, the specimens were cut from the same bar and it is unlikely that the small changes which might take place in the percentage of silicon, manganese and phosphorus could materially affect the conclusions in respect of carbon solubility. Where analyses for silicon were carried out no important changes were recorded.

Another aspect of this work was the investigation of the action of lime and also calcium carbide upon the pick-up of carbon in iron. For this purpose a further two sets of experiments were run in which instead of melting the iron in contact only with graphite power it was melted along with graphite plus lime and also graphite plus calcium carbide. The weight of lime and calcium carbide added in each case was 20 gm. For each experiment 20 gm. of electrode graphite powder was used.

Results Obtained

The analytical figures for carbon are tabulated in Table VII and are shown diagrammatically in Fig. 4. Carbon content is expressed as the true figure found upon analysis and also as the calculated carbon equivalent assuming that the influence of silicon and phosphorus remains the same with these alloys as with grey cast iron of normal carbon content.

(*a*) *Vacuum Melting of Iron in Contact with Graphite, Graphite and Lime and Graphite and Calcium Carbide*

The specimen melted *in vacuo* at 1,500 deg. C. for one hour absorbed a large amount of carbon and 4.95 per cent. remained in the ingot after rapid cooling in the apparatus. When allowance was made for the silicon and phosphorus content of the iron according to the well-known formula, the carbon equivalent became 5.73 per cent. This carbon content is in excess of the amount predicted by the theoretical curve of Chipman and the experimental curve of Ruer and Birens (5.10 per cent. C.)

The specimen vacuum melted in contact with graphite and lime also gave a high carbon pick-up, although slightly less than with the previous experimental condition when lime was absent. The carbon equivalent was again slightly in excess of the value predictable by the iron:carbon diagram (see Fig. 1).

Calcium carbide in place of lime appeared to retard the carbon solubility *in vacuo*, resulting in a carbon equivalent of 4.80 per cent., which is less than the theoretical solubility.

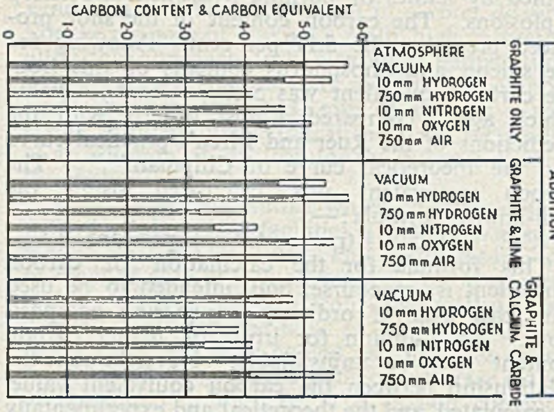

FIG. 4.—*Carbon Solubility in Iron under Various Atmospheres after 1 hour at 1,500° C. (Carbon Equivalent is the Highest Value in each case. Actual Carbon Content is Shown Shaded.)*

(*b*) *Molten Iron in Contact with Graphite, Graphite and Lime and Graphite and Calcium Carbide in an Atmosphere of Hydrogen*

These experiments were run in two parts; in one case hydrogen at only 10 mm. pressure was admitted to the apparatus and in the other hydrogen at 750 mm. pressure was present. The influence of lime and calcium carbide on the carbon solution at these two pressures was determined.

The most important fact which emerged from this work was that the carbon solubility under the higher pressure hydrogen was much less than with a pressure of only 10 mm. of hydrogen in the apparatus. The difference in carbon absorption due to the variation of hydrogen pressure was sufficient to outweigh the possible effects of the presence of lime or calcium carbide.

(*c*) *Molten Iron in Contact with Graphite, Graphite and Lime and Graphite and Calcium Carbide in an Atmosphere of Nitrogen*

Specimens melted in nitrogen at 10 mm. pressure absorbed only $\frac{3}{4}$ of the carbon which dissolved *in vacuo*. The effect of lime and of calcium carbide was to prevent the solution of carbon to a small, but measurable extent, in this ambient gas.

(*d*) *Molten Iron in Contact with Graphite, Graphite and Lime and Graphite and Calcium Carbide in an Atmosphere due to Oxygen*

Oxygen was admitted to the apparatus to give a pressure of 10 mm. Due to the graphite crucible the atmosphere around the specimen at 1,500 deg. C. would be largely carbon monoxide. In this work the actual state of the ambient atmosphere was not determined. Carbon dissolved to an extent approaching that found when the furnace tube had been completely evacuated as in experiment No. 1. The action of lime appeared to help carbon solution slightly, but calcium carbide, on the other hand, reduced the amount found in solution.

(*Continued on page 339, at the foot of col. 1*)

I.B.F. National Works Visits

The second annual national works visits day has been organised by the London branch of the Institute of British Foundrymen for Friday, October 12. These works visits supplement the arrangements which are already made by branches and those afforded at the annual conferences, and in particular enable those members who cannot spare the time to attend the conference to take part in an annual national gathering. The arrangements made by the London branch are summarised below. The foundries to be visited have been divided into groups of two (with the exception of the Ford Motor Company, Limited). Each group will consist of a visit in the morning and a visit in the afternoon. Luncheon will be provided at some suitable place about mid-day. The visit to the Ford Motor Company, Limited, will consist of the journey by river steamer in the morning, with luncheon on the boat, and a visit to the works in the afternoon. This party will assemble at the Tower Pier gate (near Tower Bridge) at about 10.15 a.m. The other parties will rendezvous to join coaches outside the Leicester Square Theatre, London, W.C.2, some 10 to 15 min. before the time of departure shown below. In the evening, there will be a dinner and cabaret show at the Holborn Restaurant (corner of High Holborn and Kingsway), London, W.C.2.

It is understood that applications can still be accepted for all except parties "D" and "F." All groups will be returned to the Holborn Restaurant at 6 to 6.30 p.m. where changing facilities will be available if required for the dinner and cabaret.

Party.	Depart a.m.	Morning visit.	Luncheon.	Afternoon visit.
A.	9.15	Dyson & Co., Enfield. (Die-casting)	Belling & Company ..	Belling & Company, Enfield. (Manufacturers of electrical equipment.)
B.	9.15	Qualcast (Ealing Park), Ltd., Ealing. (High-duty ironfounders. Cast crankshafts)	Railway Hotel, Greenford	British Bath Company, Greenford. (Bath manufacturers; mechanised enamelling shop)
C.	10.30	River trip to Ford Motor Company.	On the river steamer ..	Ford Motor Company, Dagenham. (Motor-car manufacturers. Large highly-mechanised foundry)
D.	9.0	J. & E. Hall, Dartford. (Refrigeration engineers)	J. & E. Hall	Fraser & Chalmers Engineering Works, Erith. (High-class electrical and general-engineering iron castings)
E.	9.30	Harland & Wolff, London, E.16. (Ship repairers)	Royal Standard Hotel, E.16	J. Stone & Company, Charlton. (Non-ferrous founders)
F.	8.45	Langley Alloys, Langley, Bucks. (Non-ferrous founders)	Langley Alloys, Ltd. ..	High Duty Alloys, Ltd., Slough. (Aluminium founders)
G.	9.30	Gillett & Johnston, Croydon. (Bell founders)	Greyhound Hotel, High Street, Croydon ..	Morgan Crucible Company, Battersea. (Crucible manufacturers; small experimental foundry)
H.	8.45	Renshaw Foundry, Staines. (Jobbing iron foundry)	Renshaw Foundry ..	High Duty Alloys, Slough. (Aluminium founders)

The attention of readers who wish to participate in visit "B" is particularly drawn to a reversal in the order of visits from those announced in an earlier circular sent to members and to the change in venue for luncheon.

Factors Affecting the Solubility of Carbon in Iron

(*Continued from page* 338)

(*e*) *Molten Iron in Contact with Graphite, Graphite and Lime and Graphite and Calcium Carbide in an Atmosphere due to Air*

Air was admitted to simulate the atmosphere which might be expected to be present in a cupola. The air at 750 mm. would form with the graphite at 1,500 deg. C. a mixture of nitrogen and carbon monoxide (+ carbon dioxide). Under these experimental conditions lime and calcium carbide additions had a big effect upon the amount of carbon found on analysis. The carbon was some 20 per cent. higher with lime and some 33 per cent. higher with calcium carbide additions.

In the absence of the lime or calcium carbide the carbon equivalent of the melt was similar to that found in the experiments made with high pressure hydrogen and low pressure nitrogen. The carbon percentage found in the experiment with air without lime or calcium carbide was 2.76 per cent. (carbon equivalent 4.2 per cent.). The action of lime and especially calcium carbide was quite marked, giving carbon contents similar to those which have been found on a large scale during cupola melting in a basic lined furnace and with carbide additions to the charge.[41] It is of some interest, however, that only under these atmospheric conditions did calcium carbide appear helpful from the point of view of permitting an increase in dissolved carbon in the iron.

(*To be continued*)

Cornish Metal Deposits

Discussions on the possibility of obtaining other metals apart from tin—particularly zinc and tungsten—from Devon and Cornwall took place at Camborne on September 10 when a deputation from the Cornish Mining Development Association met Mr. R. R. Stokes, the Minister of Materials.

It has long been held by the association that modern methods of surveying, including diamond drilling, would show areas in south-western England worth developing for various types of minerals, and the association has pointed out that the strategic possibilities of U.K. mineral resources can only be developed on a long-term basis and not suddenly in the event of war.

Mr. P. Cook and Mr. F. Ridley have been appointed directors of Daralum Castings Limited of Darlington. Mr. Cook has been promoted to general manager, and Mr. Ridley to secretary of the Company, and its associate John Vickers and Sons, master patternmakers of Darlington.

Brussels International Foundry Congress

Under the distinguished patronage of the King of the Belgians, the jubilee International Foundry Conference was held in the magnificent offices of Fabrimetal during last week where some 480 foundrymen and their ladies from 16 different countries were present. The meeting was opened by a gracious speech from the president of the Belgian foundrymen's association, Mr. J. Borgerhoff, who extended a cordial welcome to all the delegates. Mr. F. Spies, the president of the International Committee replied on their behalf. Then the Congress was formally declared open by Mr. Coppee, the Minister for Economic Affairs. A telegram was sent to His Majesty the King of the Belgians, acknowledging his gracious patronage. Supporting the speakers on the platform were Mr. Colin Gresty, president of the Institute of British Foundrymen, Mr. V. Delport, representing the American Foundrymen's Society, Signor Olivo, president of the Italian foundrymen's association, Mr. V. C. Faulkner, past-president of the International Committee, Mr. Waeles, president of the *Association Technique de Fonderie,* Mr. T. Makemson, M.B.E., secretary of the Institute of British Foundrymen, Mr. Küster, president of the *Verein Deutscher Giessereifachleute,* Mr. E. Lissell, Sweden, Mr. John Sissener, Norway, and Professor O. Hoff, Denmark.

The English delegation, in addition to the names cited, included Dr. H. T. Angus, Mr. R. Blandy, Mr. W. W. Braidwood, Mr. E. H. Brown, Mr. A. D. Busby, Mr. F. G. Butters, Mr. W. R. Cooper, Mr. N. Croft, Mr. J. A. Evans, Dr. A. B. Everest, Mr. J. Ferguson, Mr. L. W. Gummer, Miss C. Hanson, Mr. R. G. Hanson, Mr. F. Hudson, Mr. H. P. Hughes, Mr. E. Jackson, Mr. G. J. Jones, Mr. G. Lambert, Mr. D. G. Mather, Mr. J. D. Mather, Mr. R. A. Miller, Mr. B. Millington, Mr. Noel Newman, J.P. (past-president of the Institute of British Foundrymen), Dr. W. T. Pell-Walpole, Mr. N. Richards, Mr. A. S. H. Sawers, Capt. Tom Shanks, Mr. G. R. Webster, Mr. A. N. Wilson, Mr. P. H. Wilson, O.B.E. (past-president of the Institute of British Foundrymen) and Mr. A. N. Wormleighton.

After a communal luncheon at the Hotel Metropole, the delegates returned to the various technical sessions which were filled almost to overflowing. In the early evening there was a reception and cocktail party at the town hall, where the visitors were welcomed by the Lord Mayor and Aldermen of the City of Brussels. The evening was free, but all Tuesday there were technical sessions and meetings of the international sub-committees. The day closed with a very enjoyable dinner-dance. During the evening, Mr. Spies introduced Mr. W. L. Seelbach, the president of the American Foundrymen's Society, who was accompanied by his wife.

Wednesday was devoted to a visit to Liège, where the delegates saw the complete operation of rolling sheet and other products. In the evening, the members of the International Committee, the presidents of the various participating associations and the national reception committee were the guests of Mr. Borgerhoff at the famous "Brussels" restaurant. The evening being very warm, the guests appreciated to the full the benefits accruing from the sliding roof. The cordiality of the welcome and the excellence of the cuisine will long remain a pleasant memory.

Thursday was a day of technical sessions plus a meeting of the International Committee. The main business was the admission of the following national societies to membership: the *Verband Schweizerischer Eisengiessereien* (Switzerland), *Stoperiteknisk Forening* (Norway), *Instituto del Hierro y del Acero* (Spain), the Institute of Indian Foundrymen and the *Dansk Stoberiteknisk Forening.*

Mr. Borgerhoff presided over the closing banquet, his speech being mainly devoted to all those who had helped to make the Congress the success it undoubtedly was; Mr. Jacques Foulon, the secretary, was specially lauded. Fabrimetal received, as the organisation so well merited, the eulogies of the chairman. Mr. Spies in his reply, after thanking the hosts on behalf of the nations, made a plea for more co-operation amongst the nations through the exchange of young executives. His plant at Werkspoor was carrying out researches in conjunction with the British Iron and Steel Research Association which was being conducted by Dutch, English and French technicians working as a team.

Then Mr. Seelbach issued a cordial invitation to everyone to participate in the next congress to be held in the Spring of 1952 at Atlantic City. He expected any attendance of 15,000 foundrymen as the simultaneous exposition of the latest plant available to the industry was invariably a great attraction. A steamship had already been chartered to carry the European delegates to New York. Ample reservations had been made in the hotels bordering the seven-mile water-front. The Congress would last a full week. There was a hint that E.C.A. might accord some financial aid to foundry executives on account of the potential technical lessons to be learned.

The banquet concluded with the presentation of the International Committee of Foundry Technical Association's Award of Honour to Mr. René Deprez. The Award takes the form of an exact replica of Benvenuto Cellini's masterpiece "Perseus" together with a smaller one to be retained by the recipient. The larger one passes each year for re-award by the association organising the current congress. The replicas have been presented by Commandatore Mario Olivo of Milan. Dr. Guido Vanzetti of Italy was elected president of the Committee for the next Congress. The last day was devoted to a series of works visits, and thereafter was arranged a sight-seeing tour in the east and south of Belgium.

Institute of British Foundrymen *South African Branch*

Annual General Meeting and Dinner

THE South African branch of the Institute of British Foundrymen held their fourteenth annual general meeting and dinner at the Victoria Hotel, Johannesburg, on June 22. An outstanding success from every point of view, this function was thoroughly enjoyed by more than 100 members and guests.

After the Royal toast had been observed, the retiring president, Mr. S. Jane, extended a cordial welcome to the guests, among whom were Prof. W. J. Walker, head of the department of mechanical engineering, University of the Witwatersrand; Dr. A. Rowe, principal of the Witwatersrand Technical College; Mr. L. T. Campbell-Pitt; Mr. J. Renwick, president of the Institution of Production Engineers (S.A. branch); Mr. W. G. Sutton, president of the Associated Scientific and Technical Societies; Mr. W. E. Gooday, president of the Chemical, Metallurgical and Mining Society; Mr. J. W. N. Sharpe, vice-president of the Geological Society of South Africa; Mr. L. A. Woodworth, vice-president of the South African Institution of Welding; and Mr. F. C. Williams, advisory secretary of the Steel and Engineering Industries Federation of South Africa.

The report of the branch council of the Institute, which was unanimously adopted, showed that the membership of the South African branch, including the Cape Town section, now stands at 309, comprising 52 subscribing firms, 36 representatives, 75 members, 121 associate members and 25 associates. (The total membership in July last year was 288.)

After the minutes of the annual general meeting held on June 23, 1950, had been confirmed, Mr. Jane drew attention to some of the items in the report of the branch council. It would be seen, he said, that membership had shown a satisfactory increase during the year. The branch hoped that a further substantial increase would take place in the number of members during the coming twelve months. During the year under review, eight Papers had been presented to the branch, all of which had been most instructive. In addition, two very interesting discussion evenings had been held.

The branch council had considered the formation of a section of the Institute in Durban, following a successful meeting held there in August last. Negotiations were proceeding. Mr. Jane pointed out that the Cape section was still very active and making good progress.

Founding Fifty Years Hence

In his valedictory address, Mr. Jane surveyed some developments which will probably take place in the foundry sphere during the next half-century. He recalled that Mr. Simpson in his farewell address last year reviewed the progress made by the Union's foundry industry in the first half of this century. He thought one could regard the past 50 years as being the foundry industry's first 50 years of development in South Africa, and he proposed to give some personal impressions as to what was likely to happen in the growth of this industry from now until the dawn of the 21st century.

He had no doubt that during the next 50 years the engineer's demands on the foundryman would be very much more severe than they had been in the past. The foundry industry would have to work with greater accuracy to meet those demands. Increasing use was being made of castings in the aircraft industry, for instance, and in the years to come there would be a general tendency in the direction of more and heavier precision castings for many applications. The next 50 years would reach the stage where practically every casting would have to be a precision casting. Already one could see the rapidly increasing popularity of castings made by the die-casting and investment moulding methods, which had made it possible to cast a wide variety of products to an accuracy of 0.002 in. This greater demand for precision casting would affect the education and training of workers in the foundry field. There would be fewer men of higher skill to produce the very accurate patterns required, and a larger number of men in the operator class to make the castings on a mass-production basis. Most of the skill would lie in the patternmaker's department, while the casting methods used would require less skill than was required today from the men on the foundry floor.

Another important change likely to take place in the next 50 years concerned cupola practice. The average thermal efficiency of cupolas in general use today was about 26 per cent. Hot-blast investigations made recently overseas had been aimed at increasing the thermal efficiency of cupolas to 60 per cent., and it seemed that there would undoubtedly be important developments as a result of these experiments.

Atomic power would develop during the next 50 years; and it seemed likely that this new form of power would be applied in greater or lesser degree to most industrial processes. But, whatever changes occurred in the art of founding in the future, he appealed to members, in the interests of the foundry industry, to do their best to ensure that this Institute would contribute as much to the development of the industry in the future as it had done in the past.

Election of Officers

Mr. Jane announced that Mr. J. J. Marais had been elected president of the branch for the ensuing year. Mr. H. A. Godwin had been elected senior vice-president, and Mr. F. J. Bullock, junior vice-president. Three vacancies had occurred on the branch council, and Mr. K. L. Futter, Mr. H. Hughes and Mr. J. Robertson had been elected to fill those vacancies.

Mr. Jane then announced that it had been decided

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to award the year's Commendation Certificate to Mr. V. M. McGowan for his Paper entitled "Manufacture of Ingot Moulds for an Indian Steel Works."* He was sure everybody would agree that this Paper had been the best presented to the branch in the year. Mr. Jane then presented the certificate to Mr. McGowan, who thanked members of the Institute for the honour they had conferred on him.

Presidential Address

Mr. Marais then delivered his presidential address, in the course of which he said:—

Most of the good qualities—for example, patience, tact, discretion and dignity—were characteristic traits which developed in mankind only with age. So he asked for indulgence if during his year of office, or during his address, he did not display these qualities. However, he humbly thanked members for the honour and privilege bestowed on him by electing him president.

He would endeavour to give of his best to the Institute during his term of office; and with the able assistance of the Council and secretaries, hoped to ensure that it would be a very successful year for the Institute. He had always found members of the branch council intensely interested in the growth of the Institute and unselfishly active in carrying out their duties. The Institute owed a debt of gratitude to these men, who were serving so well the cause of foundry progress.

He recalled that only 12 years ago he entered the foundry field as a young man full of ambition, keenly interested in foundry technology. However, his high ideals and spirits were immediately dampened. He was prevented from ramming up a mould because he was not a moulder. It appeared to him that he was regarded as an intruder in the sacred art of moulding. Happily, that was becoming a thing of the past.

The Institute was largely instrumental in bringing about this ideal state through the friendly spirit that prevailed; and through the free exchange of thought and ideas it had broken down a barrier that existed not only between technical, operating and business staffs, but between different foundries. It had been learnt that nobody was in possession of a little black bag of magic which worked wonders, and it had been appreciated that by keeping knowledge to oneself, one was only barring oneself from receiving from others information which might be of great benefit. Being secretive accomplished nothing; one only encouraged a state of stagnation.

Founding today by no means appeared to be an exact science, but he felt confident that in the years to come, by standardising, simplifying, etc., it would become very exact indeed—and that one would be able to eliminate altogether the dreaded waster. Today founding was a field in which the young scientist, trained in the ways of conducting research, should be in his element; for chemistry, physics and metallurgy all played their part in producing a sound casting. The time was now at hand in which South Africa was in a position to contribute knowledge of fundamental interest to the foundry industry in general.

Unfortunately, the scientist was still regarded in industry as a necessary evil, or even a parasite, for the simple reason that he was not directly productive. But the fact many industrialists lost sight of was that the scientist might indirectly contribute very considerably to the reduction of production costs.

He disagreed with those people who stated that nearly all the foundries were too small to conduct a research programme. Prof. W. J. Walker, in a recent address to the Institute, said that the term "research" might mean anything from spotting a Derby winner to atomic physics. Personally, research meant just that. Any problem, no matter how small, should be tackled systematically; and the ground covered should be recorded so that it was not necessary to retrace one's steps. Variables should be eliminated one by one, and then only would one come to the fundamental facts of the matter in hand. If a university student, or any other person for that matter, well versed in science, was employed by a small foundry—and if this individual was prepared to soil his hands and use his initiative—he felt sure that the cost of maintaining his services was warranted and would be fully repaid.

For example, in the fields of sand research, solidification of metals in moulds, heat transfer, gating and risering of castings, and many other aspects of foundrywork, knowledge was still empirical and by no means fundamental. He realised that the managements of most foundries held the view that by experimenting valuable production time might be lost. Therefore, if for no other reason, they should employ, to conduct these experiments, somebody who did not interfere with production. Surely somewhere in every foundry a little nook could be set aside in which tests could be conducted? Before any job was put into production the method of moulding, gating, etc., should be investigated until perfection was obtained—and only after such an investigation should the job be produced in quantity. He gave the following advice to the university graduate wishing to enter the foundry industry:—

"Never be afraid to get your hands dirty; the foundry is a good place to work in and the dirt is healthy; use your own initiative. Some odd, seemingly inexplicable phenomena daily occur in the foundry, which will never be found in a textbook. Never be afraid to ask questions. One sometimes gets the answers from unlikely quarters. Read as much as you can on foundry work, but don't believe it all. Never assume that you know everything. There is plenty in the foundry that most people know nothing about."

Presidential Certificate

Mr. Marais then called upon Mr. Holdsworth to present a presidential certificate to Mr. Jane.

Mr. Holdsworth then presented to Mr. Jane a momento of his year of office. This certificate was highly valued by all past-presidents. Mr. Jane had done a great deal to further the work of the

* Printed in the FOUNDRY TRADE JOURNAL, April 19, 1951.

Institute and members were extremely grateful to him.

Mr. Jane said the certificate would always remind him of a very happy year. He thanked members of the Institute and the members of the branch council for their valued assistance and co-operation.

Limiting Factors for Mechanisation

Mr. D. Lion-Cachet congratulated the Institute on its selection of Mr. Marais as president for the ensuing year. After listening to the presidential address, he felt sure that Mr. Marais would be of great value to the Institute. The normal times we lived in were full of problems. He called these times normal because times like this, full of problems, were in the majority. It was a curiosity of mankind that when people had problems to tackle they tended to favour the principle that several heads were better than one, and they formed associations or institutes. Back in 1936, Colonel A. H. Guy, Mr. F. C. Williams and he had one thing in common—a lot of problems on their hands. They got together and spent many happy evenings together talking about those problems, and those discussions soon resulted in the formation of the South African branch of the Institute of British Foundrymen. This branch had served a very valuable purpose ever since it was formed about 15 yrs. ago. It had been of great assistance to South African foundrymen in helping them to tackle a problem common to all foundrymen—the problem of production.

During the second world war, when the foundry industry was responsible for a very substantial contribution to the defence of this country, it seemed obvious that mechanisation was the only answer to the production problem of South African foundrymen. Mechanisation was comparatively cheap then, since it fitted in very well with the large amount of work required. In the immediate post-war period they found that there was still a heavy demand for many castings off one pattern, and there were many foundrymen who held the view that mechanisation had come to stay. But gradually, as the country settled down again to peace-time production—characterised by an increasing amount of jobbing work for the mining industry—it became more and more apparent that mechanisation in the foundry industry must not be carried too far. The capital cost involved was such that, to make full mechanisation an economical proposition, most foundries in the country would have to work 24 hrs. a day. And so it appears that semi-mechanisation was the answer to their production problem in the Union.

Dr. A. Rowe, principal of the Witwatersrand Technical College, congratulated the foundry industry on its continued progress in the face of such difficulties as the shortage of skilled manpower.

Mr. F. C. Williams, after congratulating Mr. Marais on his election as president, said his main task, as for many years past, was to convey to the Institute the goodwill of the Steel and Engineering Industries Federation of South Africa. It gave him much pleasure to do so, for there could be no doubt that the Institute played a fundamental part in the development of the foundry industry in the country.

B.O.T. Investigation into Specialloid's Affairs

Pursuant to powers granted under the Companies Act, 1948, the Board of Trade has appointed Mr. Philip Michael Armitage, solicitor, of Norton Rose Greenwell & Company, London, E.C., to act as inspector to investigate the affairs of Specialloid, Limited, piston-ring manufacturers, of London, with special reference to the acquisition of Aero Piston Rings Company, Limited, to the increase of capital. and to the placing of ordinary shares in 1945, and to report thereon in such manner as the Board may direct.

Specialloid was registered as a private company in 1921 and converted into a public undertaking in 1938. There is now in issue £200,000 of 5½ per cent. cumulative £1 preference and £40,007 in ordinary 2s. shares. The last payment on the ordinary shares was a 25 per cent. interim dividend in respect of the year ended March 31, 1948. The preference dividend has been in arrears since November, 1947.

In June the shareholders' committee, appointed in February to investigate the company's affairs, reported that it was studying a preliminary report from the investigating accountants and hoped to make an interim report in the "relatively near future."

A report issued to shareholders by the committee on September 10 stated that it had invited the entire present board of directors to retire, "in the best interests of the company and the shareholders." Making it clear that the committee had made the first approach to the Board of Trade, it was stated that: "Until the inspector has made his report it is clearly improper for us to inquire further or to reach any conclusions; but it is our intention to report to shareholders at a later date on any matters coming within our terms of reference but not dealt with by him."

Scrap Shortage Alarm

Concern over employment prospects at the Blochairn steelworks, Glasgow, of the Steel Company of Scotland, Limited, was expressed by a deputation of employees at a meeting on September 7 with Mr. William Reid, M.P., and Mr. J. C. Forman, M.P. The deputation, representing all grades of steelworkers, expressed the fear that, because of the shortage of scrap, a large number of men would require to be paid off within the next month unless immediate steps were taken to deal with the situation. Mr. Reid and Mr. Forman gave an undertaking that they would seek an early interview with the Secretary of State for Scotland, and would ask him to use his influence with the Minister of Supply to ensure that mass unemployment at the works would be prevented.

An official of the Colvilles' group said that the proposed closure of the cogging mill, involving about 70 men, was the logical result of the closure of the melting furnace in May. The works would not be making less steel, but the raw materials were to be supplied to the plate mill in a different form. It was merely a matter of internal reorganisation, he said.

Provisional returns for United Kingdom overseas trade in August show that imports at £368,200,000 reached a new record level. Exports (including re-exports) for the month were valued at £239,800,000, the adverse balance being £129,400,000, an increase of £2,700,000 on July when imports totalled £358,500,000 and exports £231,800,000.

In the first eight months of the year imports exceeded exports by £807,700,000.

New Catalogues

A Welding Accessory. The British Oxygen Company, Limited, Bridgewater House, Cleveland Row, St. James's, London, S.W.1, have used a four-page leaflet to illustrate and describe a water-cooled shield as an accessory to Mark III torch. Its value is that it can be used where currents up to 350 amperes are called for, as when welding thicknesses up to ¼-in. copper or ½-in. aluminium.

Electric Hammer Drill. A leaflet received from Victor Products (Wallsend), Limited, Wallsend-on-Tyne, describes and illustrates the Victor electric hammer drill, one use for which is the fettling of castings. With this leaflet comes news of the operation of service depots in London, Birmingham, Manchester, Glasgow, Sheffield and Leeds. A new model using 100 to 110 volts supply is now on the market.

Briquetted Alloys. The British Electro Metallurgical Company, Limited, Grange Mill Lane, Wincobank, Sheffield, have just issued a four-page leaflet specially for the foundry industry. Simplicity is the keynote of this publication. The claims for briquettes are set out in such a fashion that they can be readily understood by a foreman with a minimum of technological training. Then, again, the colouring of the briquettes to indicate whether they be chromium, silicon or manganese also makes for simplicity. A further advance is the packaging of each individual briquette carrying an appropriate coloured band. This concern also sent us a very nice little pocket notebook, and amongst the most useful entries are the names and telephone numbers of the best-known provincial hotels. The technical data have been particularly well chosen, whilst the cut-away section is useful for address records. These publications are available to our readers on application to Wincobank.

Mould Blowing Machines. It was a second or so before we realised that it was a *mould*-blowing and not a *core*-blowing machine which is illustrated and described in a four-page leaflet received from Richardson Engineering (Birmingham), Limited, Singleton Works, 333, Icknield Port Road, Birmingham, 16. It is of French design made by a firm with extensive experience in core-blowing, and employs a device which applies a force of compressed air behind a column of sand; this causes the sand to be projected vertically into the box. The boxes are brought to the machine along a short length of roller conveyor—a second one being installed on the opposite side for mould removal. The operator pushes the box into its seating and then lowers the moulding machine head carrying the pattern plate, the whole being held in position by pneumatic clamps. Moulding is effected by operating a lever which blows the mould in a manner similar to a core-blowing machine. The pattern is then withdrawn vertically by a pneumatic cylinder, during which process a vibrator operates. The base of the mould is scraped automatically, and the whole is then pushed along the second layer of conveyor. The wear on patterns is stated to be practically nil and so wooden patterns can be used. Using a pair of machines and simple patterns, it is claimed that 200 to 240 complete moulds per hour can be produced. With progressive complications—difficult coring and so forth—this figure might easily be reduced to 160. A final shock was received when we noted that the range of machines covered boxes measuring 18 in. by 14 in. by 4 to 6 in. deep up to 11 ft. 6in. long by 8 ft. 6 in. wide by 16 in. deep. Readers wishing to examine this leaflet should write to Singleton Works.

Recent Progress in Metallography

Attention to Specimen Preparation

The Howe Memorial Lecture this year was entitled "Twenty-five More Years of Metallography" and delivered by J. R. VILELLA, United States Steel Company at St. Louis, recently, before a meeting of the American Institute of Metallurgical Engineers. In the course of his remarks, the author said that metallographic methods most widely used today, with the exception of the electron microscope, were firmly established more than 25 years ago. In general, specimens were prepared for microscopic examination then in much the same manner as they are today. While new techniques have been introduced and superior equipment is available today, improvements have been in the nature of refinements. Mechanical metallographic polishing, which was the only method available in 1926, is still universally practised and still consists of abrading the metallic specimen with a series of abrasives of increasing fineness until a specular surface is attained. There is now the alternative of electro-polishing, but it is not widely used because results are inferior to those of competent mechanical polishing. Likewise, most of the etching reagents preferred today were in common use more than a quarter-century ago. Yet, it is unquestionable, states the author, that on the whole micrographs are vastly superior to those of 25 years ago.

The aim of the metallographer some years ago was to attain a highly specular surface of adequate flatness, free from scratches. At the cost of many errors of interpretation and much confusion in our concept of some of the structures of steel, we have learned that these requisites are not enough; that in addition the non-metallic inclusions have to be preserved intact so that the cleanliness of the steel may be judged correctly and, most important of all, that the polished surface has to be freed from all traces of flowed or disturbed metal before the true structure of the metal can be seen. Rapid progress began when the idea spread among metallographers that the structure observed in specimens which had been polished and etched just once, was seldom the true structure of the metal. The fact that a polished metallic surface owed its specular finish to a layer of flowed metal had long been known, but the effect of incomplete removal of this layer on the appearance of the structures of steel and other metals was not appreciated. In fact, it was generally assumed that this layer of flowed, or amorphous metal, as it used to be called, was removed completely during the first etching and therefore very few questioned the authenticity of a structure revealed in a sample polished by a competent operator and etched in one of the standard reagents. It is the Author's belief that failure to rid the surface of metallographic specimens of this insidious layer of disturbed metal was one of the most subtle but effective obstacles blocking progress in our knowledge of the structures of steel and that it entailed consequences from which metallography has but recently recovered.

Synthetic Resins in the Foundry*

Discussion of I.B.F. Sub-committee Report

The discussion of this report indicated the high degree of interest aroused among practical foundrymen in resin core-bonding. Such points as the optimum degree of baking, accuracy of mixing, core-hardness in the body, di-electric drying, fumes, and moisture absorption were among those raised in one of the most interesting sessions of the Conference.

THE CHAIRMAN, Dr. C. J. Dadswell, opening the meeting, introduced Mr. Harbach, chairman of the T.S.30 sub-committee, and Mr. P. G. Pentz, B.Sc., who had joined the sub-committee during its life as a representative of the British Plastics Federation and had contributed to the deliberations and who would be pleased to assist in answering any questions which might be raised in the discussion following the Paper.

THE CHAIRMAN said it seemed to him that the subject covered one of those processes where, as often in the initial stages, from the practical application side some people claimed success and others condemned. It might be that those who condemned were doing so because conditions in their particular cases did not make it possible for success, or it might be, as was often the case, a lack of "know-how" which did not make it possible for new developments to advance. He hoped that out of the discussion members would learn something which would help those who wished to pursue the development, for which there seemed to be a great future.

When is the Core Baked Properly?

MR. GREAVES said he had recently been working with resins and had achieved very good results, but the biggest difficulty was to know when a core was baked. Had it to be done brown, chocolate or yellow? The problem had reached such proportions that his firm were seriously doubting the instruments. It had been hoped that having got this material they could start time/temperature control, but they were not quite doing it. He wondered if Mr. Harbach or Mr. Pentz could help him a little on this point.

There was one criticism which he gave very diffidently, and that was that the percentages of ingredients which one should add were indeed very important. It appeared to him that a 1 per cent. deviation from a given mixture which one found to be satisfactory would produce bad results. He thought that with the present equipment and the labour one could hardly guarantee that any sand mixture would be to within 1 per cent. of that laid down in the instructions.

MR. G. L. HARBACH said he was glad to know that Mr. Greaves had obtained good results, and with regard to the difficulty about the colour he did not know that it was important so long as the cores were baked. He certainly would not feel too happy if they were yellow, and he asked if they ever smelt of formaldehyde when they were baked. On being informed by Mr. Greaves that they did on some occasions, he said that was an indication that they were under-baked, but this raised a point which the sub-committee had found difficult to handle, and that was that the temperatures shown on indicators at the oven were not necessarily the baking temperatures of the cores.

Using a batch-type stove, with the pyrometer element let into a side-wall, the maximum temperature indicated and the recorded speed of temperature rise could both be lower than those of the cores, especially of the cores near the inlet flues. Thus, although the chart might show the temperature had not exceeded the maximum required, some cores might be scorched. In his own practice it had been necessary, not only to mark the chart with the required temperature range as a guide to the stoker, but to specify a minimum time to reach that temperature; the actual figures were: 193 to 204 deg. C. in not less than 90 min.

In a continuous stove, the effect was reversed as the pyrometer recorded the temperature a few feet above the fire whilst the cores were baked several feet higher, moreover, the temperature of the baking section depended a great deal on the weight of cores put through, so that two factors tended to cause the indicated temperature to be higher than that reached by the cores. His own practice, with a continuous stove having a cycle of 90 min., with approximately 20 min. in the baking section, was to run at 250 to 270 deg. C.

Mr. Greaves' problem was not inaccurate instruments (for they were probably giving correct readings for their positions), but to determine what temperature on the indicator coincided with correctly-baked cores. There were on the market indicators which, when placed on the core-plates, would show the temperatures reached by the cores and they were very useful when standardising or checking core-baking practice.

As regards the criticism, it was unfortunate if Mr. Greaves could not trust his sand-mixer control to less than one per cent., because if his men were already using oils and were putting a mixture in at a nominal three per cent. and were getting two per cent. one day and four another, he wondered they were getting any cores at all. It was possible that Mr. Greaves had exaggerated the point in order to make his case, and he sincerely trusted that was so because if their core-mixing was no better than

* T.S.30 Sub-committee Report presented to the Institute of British Foundrymen's annual conference at Newcastle-upon-Tyne by Mr. G. L. Harbach. Report printed in the JOURNAL, July 5, 1951.

Synthetic Resins in the Foundry—Discussion

reported they were indeed in trouble. Certainly, the resin mixtures did need close control, and that was a possible difficulty in the smaller foundries.

MR. P. G. PENTZ pointed out that one of the most important things to realise right at the outset, if one considered resins at all, was that they were very diverse. They must not be lumped together just as "resins"; they varied as much as metals did in their characteristics, indeed probably more so, and in his opinion in order to answer the query posed by Mr. Greaves the first thing it would be necessary to know was what particular type of resin he was using—whether U.F. or P.F.—because they varied very much in their reaction to heat and baking and so forth.

Indications of Correct Drying

Dealing with the question of colour, with the U.F. resin, if it was fairly pure sand, without any red sand or anything of that nature, one could tell by the colour because it did begin to brown when it became over-baked; in other words the core was to some extent over-baked if it changed colour at all, but a slight amount of browning in the normal sense did not matter. The matter was complicated because the degree of over-baking that could be tolerated depended on the size and dimensions of the core: it was very easy to have a large core and over-bake it seriously on the outside before it was properly baked on the inside, and if for a particular casting one needed a core baked throughout (which was not always the case) then it might be wrong to use conditions which would give a certain amount of browning only on the outside.

With P.F. resin, which was naturally reddish-brown in colour, one had no similar colour guide to show overbaking, but a progressive darkening usually occurred. The practical test was obviously a question of whether the core was satisfactory in the casting. Did it perform its functions satisfactorily? In that connection it was useful to bear in mind there were a number of foundries using resin-bonded cores who did not bake the cores throughout; they baked them anything from a depth of ½ to 1½ in. on a core weighing a hundredweight, the internal portion of the core being quite soft on emerging from the stove. For Mr. Greaves' particular type of work it would be necessary to bake the core throughout.

For a standard-size core, the conditions in the oven could be kept reasonably constant. The foundry should be able to determine a suitable time cycle for each particular type of core, and provided moisture conditions in the core were kept reasonably constant, they should be able to work to that cycle. Because of the differences in sand porosity and, to some extent, in the moisture content in various foundries, and because of the variations in oven conditions, it was important that every foundry using resins should determine for themselves, by practical trial, the actual baking conditions that they needed. It was quite impossible to generalise and say: "These are the temperature conditions you need—such and such a time and temperature"; each foundry presented its own problems.

Degree of Mixing Control

On the question of the control of ingredients, it was perfectly true that synthetic resins did in general require more careful control than was necessary with linseed oil or other core compounds based on oil. Resins possessed certain advantages, but one did have to pay for them; one had to take a little more care one way or another. Generally, if a foundry had reasonably good control over sand preparation and so on, it found no great difficulty and mixing control should not present too serious a problem.

MR. WALKER said that the sub-committee had given a very fair summing-up of the advantages and disadvantages of core-bonding methods. In the foundry with which he was associated they had been using U.F. on a large scale for two years and they had found great difficulty in knowing when the core had been over-stoved, and their experience was that when the colour went dark it was too late to make amends. In addition, he did not think sufficient emphasis had been placed on the undoubted disadvantage of resin-bonded cores being more susceptible to damage. His firm had experienced a great deal of difficulty because as soon as the surface was removed the core body underneath was very friable indeed, and they felt that at the present stage that was probably the most serious disadvantage of U.F.-resin binders; in fact they had been forced to go back to oil-sand for certain types of cores, particularly those which had to be carefully handled, and in some instances they had to mix oil with the U.F. in order to overcome that difficulty. He would be interested to know whether there was any means of strengthening the core so that it was hard below the surface.

Core Hardness

MR. P. G. PENTZ, dealing with Mr. Walker's second point first, said that the matter was really rather complicated because in fact it depended on various other aspects. In general, one used a high moisture content in the core sand, particularly with resins, because it greatly increased the dry-strength and surface hardness. That was partly the result of better distribution of the resin over the sand grains and partly appeared to be the result of some migration of resin from the interior of the core to the surface, thus giving high skin-hardness. Obviously, for reasons of economy, one used as low a proportion of resin as possible and as high a proportion of water as possible, and the more one did that the more one tended to get skin-hardness, and it was particularly with cores made in that way that the other trouble developed, where once the surface skin was broken the core underneath was friable. It was, however, possible to produce resin-bonded cores, even with U.F., which were evenly hard throughout the whole core, so that the core could be rubbed down and did not become friable. It was partly a question of the actual formulation of the resins themselves: they varied, and there were very large numbers indeed in each of the classes. There were at least fifty varieties of P.F. and a smaller number of U.F. resins.

On the question of over-baking, a method which was used was to have a small, sharp tool something like a knitting needle to probe into the core at some convenient point in order to see whether the interior was soft; that method should be used in establishing, in the initial development work, the required baking conditions. Certainly, it was possible to prevent any over-baking whatever by using a lower temperature. Probably the point had not been adequately or fully covered in the report that cores could be baked over a wide range of temperatures, and that included even U.F. resin cores which were more susceptible. If the cores were baked at lower temperature they could be given twice the optimum time without any over-baking.

Steel Founders' Participation

MR. BAILES said that he had been rather disturbed, on reading the constitution of that particular sub-committee to find that the British Steel Founders' Association were not represented on it, and asked if a reason could be given.

MR. G. L. HARBACH replied that his sub-committee had communicated with Mr. J. F. B. Jackson (director of research, British Steel Founders' Association) and the basis of the correspondence that had taken place was summarised under the heading "(*b*) Ferrous" in the second column on page 5 of the preprint of the report: "On the basis of a statement received from the British Steel Founders' Association, it can be said that, while a small number of steelfounders have made spasmodic or preliminary trials of synthetic-resin binders, they are not generally used." The sub-committee had more or less offered their co-operation but the Steel Founders' Association had nothing to add to what had already been proposed. The members of the sub-committee were rather disappointed, as they had practically every other foundry organisation represented and they had been rather careful to make the basis of the sub-committee as broad as possible. He understood from Mr. Pentz, however, that since that time one steel foundry was seriously considering the use of resins in large quantities. It was two years since the sub-committee had started their work and the progress with resins had gone along so fast that they could not possibly be up-to-date.

MR. ARMITAGE thought that the statement which the sub-committee had received from the B.S.F.A. now required clarification. Whilst it was true that the number of steel foundries which had carried out experimental work with resin-bonded cores was small, the Research and Development Division of the Association was now actively engaged in studying both this subject and the di-electric drying of resin-bonded cores. The Division therefore at this stage welcomed the valuable review which had been submitted by sub-committee T.S.30.

The di-electric drying technique seemed to offer advantages over normal drying methods for resin-bonded cores as in fact had been pointed out by the sub-committee in general terms. He would, however, like to have any further detailed information on this aspect of the subject.

High-frequency Drying

MR. HARBACH replied that on page 2, column 2, paragraph 3 of the preprint of the Report it said: "U.F. resins are especially suitable where high-frequency heating can be used for baking the cores, since they can be cured extremely rapidly, with a minimum consumption of high-frequency power, and without any possibility of over-baking. Provision should be made, in designing the high-frequency oven, for ventilation to remove the water vapour and lachrymatory formaldehyde gas evolved by the resin during the curing process." For the P.F. resins there had been made a similar remark, *viz.*: "The P.F. resins react well to high-frequency heating and, like U.F. resins, may be cured extremely rapidly by this means. The power required is, however, usually rather higher than for U.F. resins."

The point had been brought up in discussion at a London branch meeting of the Institute before the sub-committee started and they had gathered then from the members of the electrical industry present that there were practically no facilities on a production scale for high-frequency baking: it was then still experimental and most of the knowledge that was available was from the American side as the Americans had used it quite considerably. In this country it was hoped to produce something later on and whether that had been done he did not know, but there might have been much more progress.

MR. ARMITAGE said that in addition to the use of laboratory scale di-electric plant which had been used to establish suitable sand mixes, the B.S.F.A. Research and Development Division was also obtaining the use of a 35 k.w. plant in the near future on which production-scale development work could be carried out. He knew that some iron foundries had already developed di-electric drying beyond the stage reached in steel foundries. It had to be borne in mind, however, that both technical and production requirements were different in the two sections of the industry, and it was therefore for this reason that the Division was assessing the extent to which resin-bonded sands and di-electric drying could be applied in the steelfoundry industry.

MR. T. H. WEAVER said he could probably help on that point as they had experienced a similar set of circumstances as two previous speakers in regard to drying and also storage troubles; so much so that they had gone to the trouble to seal and insulate the casing of a portable cabinet pyrometer. This was placed with the cores in the continuous core-drying stove so that the trouble as regards variable temperature could be investigated and they had a very surprising result from the graph. That in turn had taken them to di-electric drying and his firm had achieved a great measure of success to date. He was unable to give any particular details but they certainly were making their way on to a production basis for synthetic resins and di-electric drying.

MR. HARBACH enquired if it was possible to get suitable equipment in this country, to which MR. WEAVER replied that one particular company was in a very advanced stage and he believed another company had two machines either installed or prac-

Synthetic Resins in the Foundry—Discussion

tically ready for installation, and he could assure them that he himself had achieved marked success on the score of producing a core that was symmetrically baked and could be stored for a considerable time and would stand much maltreatment.

THE CHAIRMAN, referring to the question of high-frequency heating, said he knew there was a unit in Sheffield for experimental work on di-electric drying of resin-bonded steelfoundry cores. It should be remembered, however, that H.F. drying suffered from the same disadvantages that all high-frequency units suffered, *i.e.*, high capital cost. Unfortunately, that was the chief drawback to high-frequency work. He was very interested in the subject not only from the foundry side but also from the point of view of using H.F. equipment for forging work, such as the heating of steel billets for forging. The hourly efficiency of H.F. heating theoretically was not much greater than it was with gas-fired furnaces, from the point of view of forgings, but, overall, it was very much more convenient and could be cheaper.

He imagined that if one had a well-designed, single-purpose, ordinary drying stove the efficiency of the high-frequency unit would not be much greater, if at all, but the advantage of high-frequency heating of any sort was that it could be turned off when finished with and turned on again when needed. With other types of heating the fuel costs were large because the stoves were lit up so many hours before they started work and they had to leave so much heat in them when they had finished, and if only one shift was worked all the residual heat was lost every day.

Cost of H.F. Equipment

MR. WEAVER remarked that the Chairman was fortunate in being able to speak of a cost price in the neighbourhood of £3,500 as the price which he had been quoted was in the neighbourhood of £5,000 to £7,000. It was possible the design may have influenced the difference in these quotations. There were available single, duplicate and triplicate drying furnaces.

THE CHAIRMAN replied that he had been successful in finding plants a little cheaper, such as a 35 k.w. furnace at £2,250.

MR. WALKER said he had probably rather over-emphasised the disadvantages of the resin binders and he would like to stress one very important advantage with regard to the larger cores, weighing approximately 10 cwts. His firm were able to make those cores without any form of reinforcement and to dry them in a half to one-third of the time of ordinary bonded cores. They were literally blocks of sand and by the old standards would have been looked upon as impracticable, but there never was any trouble with resin-bonded cores collapsing.

Moisture Absorption

MR. BUTTON asked if resin-bonded cores were just as liable to moisture absorption if they were slightly under-baked as were oil-sand cores.

MR. HARBACH replied that they had rather extended the experiments to try and prove whether the two types of binders were affected seriously, but there was not a great deal of difference. The P.F.-type was rather better than the U.F. but the U.F., so far as he could remember, was not at a disadvantage where oil-binders were concerned, although there were so many varieties of oil-binders that it was somewhat difficult to get a standard by which one could judge. There were no core binders which were one hundred per cent. resistant to moisture. They might say that if it was ninety-nine per cent. resistant it was all right, but that odd one per cent. over a week or a month could be very dangerous, so it was difficult to set a standard, although he did not think they would have any more trouble with synthetic resins, under the same conditions, than they would with oil.

A MEMBER said he was a steel founder who had carried out some practical experiments, not just laboratory experiments, with U.F. resins. He had found in practically every instance that they would do just exactly the same as an oil-bonded core would do, but he had found it was an advantage slightly to over-bake. Mr. Harbach had mentioned a temperature of 170 deg. C., which he had pointed out was actual and not recorded outside the stove: they had found 200 deg. C. to be about the right mark, and there was a further advantage in that with a slight over-baking one obviated any fumes when casting. They had also found that the fume effect was very much worse if they were casting oil-bonded and resin-bonded cores at the same time, because the heavy fumes from the former tended to carry around the fumes from the resin in a very unpleasant manner, whereas if they had only resin-bonded cores conditions were not bad. Undoubtedly there was very great scope for the resin-bonded cores.

MR. HARBACH thanked the speaker for his useful support.

Plea for Standardised Practice

MR. DAY said he had not yet used synthetic resins but he had been deeply interested in them ever since Mr. J. J. Sheehan had read a paper on them on one occasion. The thing that always struck him, as a jobbing founder, was that they had something new and probably advantageous to the industry but the unfortunate jobbing founders had not the facilities to do the experimenting that some of the larger foundries could do. For instance, they had not the sizeable laboratories of the larger foundries, and although they all were interested in synthetic resins, in listening to the discussion he had noticed particularly that there was no evidence of any actual practice to be followed. It had been said that there were so many variables, or in other words the product was good provided it was handled correctly. In his opinion, a discussion of the present type was the place to split up the variables and pick out the ones that could be controlled. For instance he believed the synthetic resin was not consistent all the time; there was a slight variation but perhaps hardly enough to make any difference. There was one factor which was always static ; surely they could establish a mixing time, they could name the type of machine, and eventually they would finish up with the actual sand for core-making in a given condition which should be constant. In his view, a condemnation of the product was likely when it reached the bench, and he wondered whether the resin people could establish a definite procedure up to the time when the product arrived at the core-bench, and then some of the jobbing founders could afterwards try and find the ideal core to produce from the various drying units.

He encountered various salesmen of the oil-bond compounds who came round from time to time but unfortunately very few of them could produce a core-sand that would make a core satisfactorily. He liked to see what he was buying: he liked to look at the materials and, if possible, try them out, and that was what was lacking with resin practice. It had a great future but it was hindered before the core was made because there were no constants that could be adhered to. In the concrete industry, for example, they put a certain mixture of cement with sand and moisture and got a definite result and time did the rest, and in his opinion that was what should be striven for with the resins.

Appreciation of the Suppliers' Efforts

MR. HARBACH, in reply, said he did not know how long Mr. Day had been experimenting but, speaking for the resin representatives, he could only say that they had given a considerable amount of time and study to the aspect of core-binders and the knowledge which they now possessed was good, and he had got up to say that instead of Mr. Pentz, in case it should be thought that Mr. Pentz was merely trying to sell resins.

He thought Mr. Day was asking rather a lot if he wanted a standard mixture in a standard mixer and a standard time, and for everything to be all in apple-pie order for all sorts of cores. The people with elaborate laboratories did not get such perfection, but the resin manufacturers could help a great deal. Mr. Sheehan's name had been mentioned, and it reminded him of a statement made to him by Mr. Sheehan when they had first become interested in resins, which was "The people who are selling the resins know the properties, let them have the growing pains and come along and tell you just what you ought to do." He could only pass on that good advice, and, whereas two years ago the resin manufacturers had not got all the answers, they had got most of them now.

Mr. Day had made the comment that resin-bonded sand was condemned on the bench, but had he ever put anything new into the foundry which was not? He could quote a case which had happened in a well-known foundry where there was an attitude of mind which tended to condemn the resins: the foreman of the core-shop had stipulated which should be resins and which should be oils and provided they agreed with his views the resin sands had a fair deal. On one occasion they produced a resin-bonded sand which they really felt was something "tip-top," but when put into use the foreman complained that he had wanted resin sand for that job—having a resin sand which behaved so much like oil, he thought it *was* oil. That incident had increased his confidence in resins.

MR. WEAVER, for the benefit of Mr. Day, said he would like to support the people who were supplying core-binders and core-oils, who had for many years been generous in their efforts on behalf of the foundry industry. From his own experience, he could name many such people, and he wished to put it on record that the industry very much appreciated the support which the suppliers had given to them.

MR. HARBACH associated himself with Mr. Weaver's remarks. He had found exactly the same attitude, and the suppliers had been helpful in the extreme.

More Information on Fumes

MR. KEMP asked for further information on the fumes which were given off during the baking process.

MR. PENTZ replied that as far as the fumes were concerned it depended upon which resin was used. Obviously in either case if the resin had not been cured they would have developed during the heating of the core from the molten metal similar fumes to those which normally would have been removed during the baking process, *i.e.*, the formaldehyde fumes. There were two quite distinct groups of fumes which came off in the curing of the resin. Inevitably there was formaldehyde gas, which would make eyes water, and that normally should be removed almost completely during the baking. There were also fumes from the decomposition of the resin itself. Naturally, also, there were various other quite complicated decomposition products and it was from these that the objection on the grounds of fumes arose, especially with the U.F. resin, which gave off what were called "fishy smells," although he thought they were much more like burnt fish. In that respect it would not make any difference whether they were under-baked or fully-baked because they would still have the same resin which would still decompose. He thought the practical solution was that, in foundries which were using resins for cores of various dimensions and were using only partial baking to save time, they did not in fact get any trouble. If they were using U.F. resins they got a certain amount of fumes, anyhow, and did not bother about them, and if they were using all resin and no oil-bonded cores the fumes were not so bad. Apart from the formaldehyde fumes, there was nothing very much to worry about. In any case it was possible to reduce the effect by adding various compounds which the resin manufacturer ought to be able to supply, which would help to absorb formaldehyde fumes and prevent them from causing a nuisance on removal of hot cores from the stove.

With regard to the other problem of residual moisture content it might be interesting to note that in one practical experiment which he had conducted, using a P.F. resin binder in some fairly-large cores which had been baked in a continuous oven on one cycle (instead of the two cycles needed with oil), the cores were hard to a depth of about two inches, but the inside was still quite soft. They had conducted a moisture test on the comparatively damp sand

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in the centre and found it had dropped from 5 per cent. to about 1 per cent.; in fact in many cases the dampness would merely be liquid resin and not water, and would not cause any trouble in the ordinary way of casting.

Written Contribution

MR. I. J. BIRCH wrote that he wished to raise a point with regard to the use of wax venting when used to vent U.F. resin-bonded cores. It had been found that the temperature of complete volatilisation of the type of wax generally used occurred above 300 deg. C. Using U.F.-bonded cores stoved at 190 deg. C. for jacket cores of ⅛ in. section in aluminium alloy, a considerable number of "blows" were experienced from the residual wax. Checking the volatilisation over a range of temperature showed a loss on heating for one hour at 200 deg. C. to be 2.91 per cent. This trouble had been overcome by raising the stoving temperature to 300 deg. C. for a rapid bake. Naturally the strength had fallen rapidly, but the cores were usable if blacked-up and handled carefully. However, he did not recommend this procedure and would like to have the views of Mr. Harbach. In conclusion, he said how comprehensive and clearly set out were the recommendations put forward by the sub-committee.

MR. HARBACH said his reply to that would be, could the vents be made without wax? If not, could the P.F. resin be used to enable him to get up to that high temperature without the breakdown, although with aluminium alloys it might be that he wanted the U.F. resin in order to get the easy knock-out. If Mr. Birch cared to elaborate his remarks further he would attempt to give a more complete answer.

THE CHAIRMAN proposed a vote of thanks to Mr. Harbach and Mr. Pentz for presenting the report and for giving answers to the discussion in such a satisfactory and interesting manner. This was carried with acclamation.

MR. HARBACH, acknowledging, said it was satisfactory to know that the sub-committee's two years' work had been so very well received.

Production Techniques and Defence

The greatest potentialities for higher production lay in the use of improved techniques for individual operations carried out in factories, said Dr. D. F. Galloway, director of research of the Production Engineering Research Association, recently, when he lectured on the activities of the association. His audience consisted of executives of engineering concerns in the Glasgow area, and his lecture aimed at helping to foster better production techniques in relation to the rearmament programme. Dr. Galloway said that the man on the job needed practical guidance on the methods by which higher efficiency could be obtained.

In effect, he said, the Association was a bureau of consultant engineers and its services were at the disposal of members for the solution of problems experienced within the range of production engineering.

Obituary

MR. ROBERT STUART LOW, who founded James F. Low & Company, Limited, textile machinery makers, of Monifieth (Scotland), died recently.

MR. LOUIS MADDOX FLINT, who has died at the age of 85, started the business of Flint & Bates, Limited, structural engineers, of Mansfield (Notts), in 1924.

A MIGRANT from Lithuania, MR. ALEXANDER LURIA, who went to the United States and built up a scrap-iron company with a turnover in the region of £35,700,000 a year, is reported to have died at Atlantic City, New Jersey, at the age of 70.

MR. NICHOLAS C. MUNRO has died in Aberdeen Royal Infirmary at the age of 64. He was managing director of Thomson & Stewart (Aberdeen), Limited, ironfounders, the firm he joined as foreman 32 years ago.

MR. C. J. L. BAMFORD, of The Parks, Uttoxeter, died recently, aged 66 years. He was a senior director of Bamfords, Limited, agricultural engineers, Uttoxeter, and had been connected with the firm for 46 years, assisting in the design and the introduction of new machines.

MR. CHARLES WILLIAMS, a partner in Williams & Whitelaw, consulting engineers, of Cardiff, died on September 4 at the age of 75. A member of the Institute of Marine Engineers, he was elected a fellow of the Society of Consulting Marine Engineers and Ship Surveyors in 1923, serving as vice-president in 1934 and 1935.

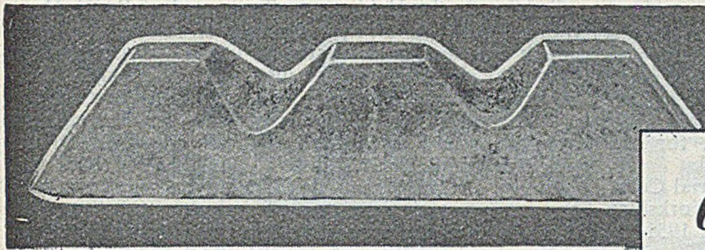
MANAGER of the Birmingham works of the British Thomson-Houston Company, Limited, since 1941, Mr. E. M. W. BOUGHTON died on September 8 at the age of 64. He joined the company in 1910 as a jig and tool draughtsman, transferring to the production staff four years later. After service in the 1914-18 war he rejoined the production staff of B.T.H. at Rugby and a year later was transferred to the Birmingham works as head of the production department. A member of the Institute of Production Engineers, he was president of the B.T.H. Birmingham Works Foremen's Association.

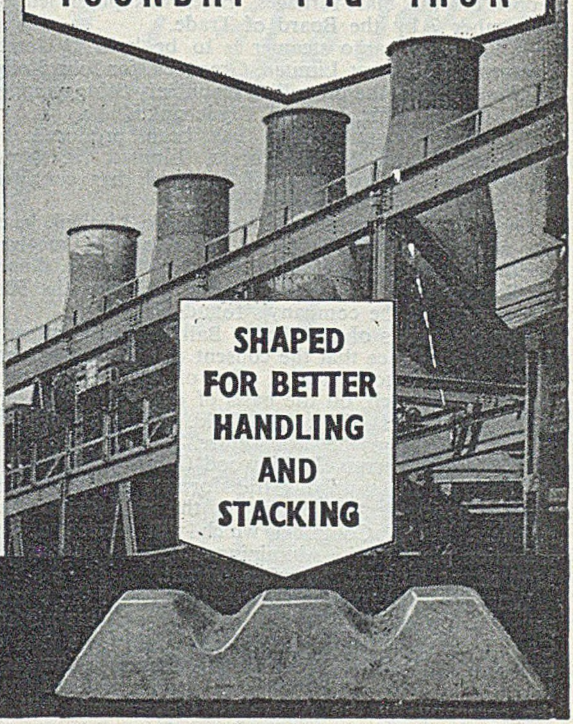
Memorial Fund Scientific Awards

Awards are to be made to British investigators in science to mark appreciation of records of distinguished work from the interest derived from the invested capital of the Sir George Beilby Memorial Fund, at intervals to be determined by the administrators, representing the Royal Institute of Chemistry, the Society of Chemical Industry, and the Institute of Metals. Preference will be given to investigations relating to the special interests of Sir George Beilby, including problems connected with fuel economy, chemical engineering, and metallurgy, and awards are made, not on the result of any competition, but in recognition of continuous work of exceptional merit, bearing evidence of distinct advancement in science and practice.

Consideration will be given to the making of an award or awards from the fund early in 1952 and the administrators will be glad to have their attention drawn to outstanding work of the nature indicated. All communications should be addressed to the Convener of the Administrators, Sir George Beilby Memorial Fund, Royal Institute of Chemistry, 30, Russell Square, London, W.C.1, to arrive not later than December 31.

THE CONSOLIDATED PNEUMATIC TOOL COMPANY, LIMITED, announce the appointment of Mr. C. L. Fisher as manager of their British-sales division, the appointment taking effect as from August 29.

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HANDLING
AND
STACKING

News in Brief

Mr. H. C. Reeves, B.Sc.(Eng.), has been appointed chief fan designer of Air Control Installations Limited.

Sheepbridge Engineering, Limited, Chesterfield, have spent over £20,000 on their new sports ground, at Newbold.

Over 2,500 tons of steel have recently been shipped under the Marshall Aid programme from the United States to this country.

Two hundred six-wheeled motor lorries are to be built by Albion Motors, Limited, Glasgow, for the Army, over six months' work being involved.

The closing date for the S. W. Wise Memorial Competition organised by the West Riding of Yorkshire branch of the Institute of British Foundrymen, 1951-52, is February 9, 1952.

A contract valued at $600,000 has been received by Fleming & Ferguson, Limited, Paisley (Renfrewshire), from the Burmese Government for a twin-screw trailing suction hopper dredger.

At a meeting of the Blyth and District Employment Committee, it was reported that, although there had been no pay-off in the local shipbreaking industry, the industry was not at all busy.

A contract for the erection of boiler-house buildings at Roosecote power station, Barrow-in-Furness (Lancs), has been received by Dorman, Long & Company, Limited, Middlesbrough.

Five hundred employees of International Combustion, Limited, Sinfin Lane, Derby, left Derby by a special train on an outing to the Festival of Britain South Bank Exhibition, on September 15.

The first section of the final report on the Census of Production for 1948, the introductory notes and the report on the blast-furnaces trade, was published on September 7 by the Board of Trade.

A 1,500-ton cargo steamer is to be built by James Lamont & Company, Limited, Greenock, for John Kelly, Limited, Belfast, the propelling machinery being supplied by Aitchison, Blair, Limited, Clydebank.

A new moulding sand has been produced by Associated Lead Manufacturers, Limited, at Newcastle-upon-Tyne, which, it is claimed, has considerable advantages over normal sand.

Over 190 employees of Thermotank, Limited, heating and ventilating engineers, of Glasgow, received certificates in recognition of long service at a dinner on September 7. The event coincided with the 50th anniversary of the company's foundation.

The directors of the Skefko Ball Bearing Company, Limited, announce that the consent of the Treasury has been obtained to a rights offer of 400,000 ordinary shares of 5s. each, on the basis of one share for every eight stock units of 5s. each held. It is proposed to make the issue in the near future.

Ferranti, Limited, Hollinwood (Lancs), has secured the contract for supplying transformers for the underground hydro-electric station in the wild country of northern British Columbia which will service a new reduction plant of the Aluminium Company of Canada, Limited, at Kitimat, 50 miles distant.

Work has started on the construction of the biggest ship ever built by Blyth Dry Docks & Shipbuilding Company, Limited—an 18,000-ton tanker, the first of two ships for the British Oil Shipping Company, Limited. The two 10,000-ton ore carriers ordered from the company by the Australian Government will be steamships and have their engines aft.

Estimated at some 300,000,000 metric tons, world output of oil, including natural gasolene, during the first six months of this year is a record for the first half of any year. If this rate is maintained, states the Petroleum Information Bureau, and it may well be exceeded, total output in 1951 will be approximately 60,000,000 tons above last year's record production.

The first merchant ship in the world to be powered by a gas-turbine—a 12-000-ton tanker of the Shell fleet—is lying at the Hebburn-on-Tyne yard of R. W. Hawthorn, Leslie & Company, Limited, where the unit, which has been built by the British Thomson-Houston Company, Limited, will be installed. The largest floating crane on the Tyne will help with the operation.

The responsibility for increasing production must not be placed exclusively on the shoulders of the workers, said Mr. Shinwell, Minister of Defence, recently. It must be undertaken in collaboration with the owners and managers of industry, together with those who were responsible for the administration of nationalised services. A serious effort should be made to hammer out a wage policy with the trade unions.

The interests of the Neepsend Steel & Tool Corporation, Limited, Sheffield, in Hattersley & Ridge (South Africa) (Pty.), Limited, have been disposed of as a result of negotiations conducted by Mr. A. Hattersley, who has resigned from the board of the Neepsend Steel & Tool Corporation and its associated companies on his undertaking to give every possible assistance to the new owners of the South African company.

Details have been issued of the scrip bonus of Wellman Smith Owen Engineering Corporation, Limited. It is proposed to capitalise £290,536 from general reserve and the excess profits tax post-war refund balance of £9,464 for a distribution of 300,000 £1 ordinary shares on the basis of one new share for each share held on September 17. The new shares, ranking for dividend from April 1, 1951, will be created at an extra-ordinary meeting on September 26 when a resolution will also be submitted converting share capital into stock, in £1 units.

A discussion symposium on "The Scoring of Metals" to be introduced by Mr. J. F. Kayser, F.I.M. (Gillette Industries, Limited), and supported by several other leading experts will be held on September 27 at 6.45 p.m. at the Grand Hotel, Birmingham. This forms the autumn meeting of the Sheet and Strip Metal Users' Technical Association. Admission tickets may be obtained free of charge from the hon. secretary, S.A.S.M.U.T.A., 49, Wellington Street, Strand, London, W.C.2.

The Staffordshire Iron and Steel Institute, oldest institute of its kind in the world, has elected Mr. W. C. Churchward, area training officer for Stewarts and Lloyds, Limited, Bilston, as its new secretary. The Institute has reappointed Mr. K. H. Wright, of C. Akrill, Limited, West Bromwich, as president, and has appointed two Wolverhampton members, Mr. W. Regan (Richard Thomas & Baldwins, Limited) and Mr. A. W. Shore (Stewarts and Lloyds, Limited), to be senior and junior vice-president, respectively. The Institute's new treasurer is Mr. G. Lunt, works manager at the Darlaston works of Bradley & Foster, Limited.

When resigning his seat on the Tees-side Advisory Committee of the Northern Regional Board for Industry, Mr. Charles S. Gill, managing director of Davy & United Roll Foundry, Limited, Billingham (Co. Durham), stated that he is retiring from business and will shortly be leaving Tees-side. He has filled many public offices, and for two years since the war was president of the Tees-side Chamber of Commerce. In December of last year he was elected chairman of the Roll Makers' Association of Great Britain for the fifth successive year. Chairman of the North East Coast Association of Steelfounders, Mr. Gill occupies a similar post on the Steel Roll Makers' Joint Council, while he is also a member of the Northern Industrial Group.

Raw Material Markets

Iron and Steel

Larger imports have relieved, for the time being, the anxieties of the blast-furnace owners concerning ore supplies. Blast-furnace scrap also is not so scarce as the better grades of iron and steel scrap required in the melting shops and foundries, but coke deliveries are running slightly below current requirements, and the repeated warnings of a winter fuel crisis discourage short-term plans for the expansion of pig-iron production. Steelmakers can readily absorb the full output of basic iron, and in greater or less degree all other grades of pig-iron are in short supply.

American buyers having apparently lost interest in European steel markets, there are hopes of a somewhat better flow of steel semis to British ports. As yet, the improvement is not very marked, but Continental exporters are being pressed to fulfil some of their contracts with this country which are heavily in arrears. The further acceleration of deliveries of home-produced semis is much more difficult, since the resources of British steelmakers are already heavily taxed. Special attention is given to the requirements of the sheet mills, and the supply of sheet bars and slabs is not so markedly deficient as that of billets.

Although the new system for the controlled distribution of steel is still in course of preparation and is not due to come into operation until December 3, the temporary arrangements which are enforced during the interim period are sufficiently effective to prevent any substantial volume of purely speculative business. At the same time, the steelmakers are endeavouring to satisfy, as far as possible, the normal needs of their regular customers. The clamour for steel for oversea is still very insistent, even at the enhanced prices now ruling, but in view of heavier home demands, some curtailment of exports is foreshadowed. Sheets are still the most urgently needed of all steel products and only a small proportion of the output is now being galvanised, owing to the zinc shortage.

Non-ferrous Metals

The easier tone of last week's tin market may, to some extent, have been accounted for by Bolivia's apparent unwillingness to sign a contract with the U.S. Reconstruction Finance Corporation (the only authority in the United States for the importation of tin) of more than 30 days' duration. That seems to be the situation at present and it may be that the Bolivians are waiting for some indication of what the United States buying policy is likely to be in the coming months. It is understood that Bolivia had some accumulation of concentrates on hand but these are probably in course of being cleared by shipments to the Texas smelter.

The sixth meeting of the International Tin Study Group will be held early next week and no doubt consideration will be given to the possibility of fixing up some kind of control of production. This aim has been before the study group at successive meetings, but, so far, it has not proved possible to reach agreement. With matters as they are, and bearing in mind the U.S. policy of abstention from buying tin metal on the world market, it may well be doubted whether any decision will be reached on this difficult matter.

On September 13 the Ministry of Materials announced a reduction of £7 in the price of electrolytic copper, with a corresponding downward adjustment in other grades. In explanation of this somewhat unexpected action the Ministry stated that it was made possible through abandonment of the policy of buying premium metal. For the consumers of copper, who have for so long suffered from exorbitant prices, this fall, though not much, is a welcome change from the continual rise in values. On the same day as the fall in virgin copper was announced, the Ministry of Supply published a list of amended scrap prices, or, at any rate, details of the downward adjustment required in the old values. Secondary copper came down by £7 and alloys of copper by amounts varying from £6 to £4. There are, of course, adjustments in the permitted maxima for brass ingots and brass billets.

London Metal Exchange official tin quotations were as follow:—

Cash—Thursday, £897 10s. to £900; Friday, £920 to £930; Monday, £905 to £910; Tuesday, £917 10s. to £920; Wednesday, £915 to £920.

Three Months—Thursday, £855 to £857 10s.; Friday, £880 to £885; Monday, £875 to £880; Tuesday, £885 to £890; Wednesday, £878 to £880.

August Iron and Steel Production

Steel production in August was again affected by the normal holidays in the industry, but showed a substantial improvement on July. The annual rate last month of 13,855,000 tons compares with 14,530,000 tons a year ago. July production was at the annual rate of 13,317,000 tons.

Pig-iron production again shows an improvement on a year ago, reflecting the improved iron-ore supply. The rate, however, is below the July level. Shortage of scrap and the restricted production of coke continue to constitute a major problem for the industry.

Latest steel and pig-iron output figures (in tons) compare as follow with earlier returns:—

	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
1951—July ..	182,400	9,484,000	256,100	13,317,000
August ..	180,900	9,409,000	266,400	13,855,000
1950—July ..	175,000	9,099,000	276,300	14,367,000
August ..	177,000	9,205,000	279,400	14,530,000

Belgian Production Falls

The provisional index of Belgian industrial production for July at 133.8, during which month there were only 25 working days, compares with the revised June figure of 149.7. Steel production in July was 436,000 tons, a decrease of 26,000 tons on the previous month, while the output of metallurgical products fell to 145,000 tons.

July coal output is provisionally assessed at 2,100,000 tons, against 2,594,000 tons in the previous month, with pithead stocks showing a further fall to 208,847 tons at July 20. More Italian miners are expected to arrive in Belgium in an attempt to strengthen the labour force and so reach the optimum output of 115,000 tons a day.

Italian Steel Output Record

Italian steel production in the first six months of the year reached a record level of 1,455,000 tons, compared with 1,128,000 tons in the same period of 1950. Production of raw steel in June reached a total of 268,000 tons, which was a slight reduction on the May figure of 275,480, due probably to seasonal causes.

Stocks of imported coal at the end of April totalled 890,000 tons, an increase of 100,000 tons on the previous month.

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

(Delivered, unless otherwise stated)

September 19, 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, £915 to £920; three months, £878 to £880; settlement, £920.

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, 31⅛d. 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., 40⅛d.; wire, 42⅞d.; 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. 6⅞d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 3s. 1d. (7%) to 4s. 0⅞d. (30%); to 12 in. wide × .056, 3s. 1½d. to 4s. 1d.; to 25 in. wide × .056, 3s. 3½d. to 4s. 3d. Spoon and fork metal, unsheared, 2s. 10d. to 3s. 9⅞d. Wire, 10g., in coils, 3s. 6⅞d. (10%) to 4s. 8⅛d. (30%). Special quality turning rod, 10%, 3s. 5½d.; 15%, 3s. 10½d.; 18%, 4s. 2⅞d. All prices are net.

Forthcoming Events

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

SEPTEMBER 25

Institution of Works Managers

Birmingham branch:—Works visits to Brush Electrical Engineering Company, Limited, Loughborough, and Josiah Parkes & Sons, Limited, Willenhall.

Institution of Production Engineers

Coventry section:—Joint meeting with the Institute of Mechanical Engineers. Discussions on "Design for Production," at 7 p.m., at the Geisha Café, Hertford Street, Coventry.

Edinburgh section:—Works visit to Shrubhill Tramway Depot, Edinburgh, at 7 p.m.

London graduate section:—"Work Study for Flow Production," by K. B. O'Dell,. at 7.15 p.m., at the Institution of Production Engineers, 36, Portman Square, London, W.1.

SEPTEMBER 26

Institute of British Foundrymen

London branch:—Presidential address by L. G. Beresford, followed by a report: "Visit to Foundries in the French Ardennes," by A. R. Parkes, at 7 p.m., at the Waldorf Hotel, London, W.C.2.

Institution of Production Engineers

Shrewsbury section:—"Working Pace and Incentives," by Lewis C. Ord, at 7.30 p.m., at the Technical College, Shrewsbury.

SEPTEMBER 26 to 28

British Cast Iron Research Association

Conference on Heating, Ventilation and Lighting, at Ashorne Hill, near Leamington Spa. (For further details see FOUNDRY TRADE JOURNAL, August 23, 1951, page 228.)

SEPTEMBER 27

Engineers' Guild

Metropolitan branch:—Annual general meeting, at 6 p.m., at Caxton Hall, Caxton Street, Westminster, S.W.1.

Incorporated Plant Engineers

South Yorkshire branch:—"Electronics in Industry"—lecture and film, by the B.T.H. Company, at 7.30 p.m., at the Grand Hotel, Sheffield.

Institution of Production Engineers

South Wales and Monmouth section:—"Materials Handling," by W. J. T. Dimmock (sound film and lantern slides), at 6.45 p.m., at the South Wales Institute of Engineers, Park Place, Cardiff.

SEPTEMBER 28

Incorporated Plant Engineers

Birmingham branch:—Symposium of films on Welding, by Quasi-Arc, Limited, Firth-Vickers, and the Aluminium Development Association, at 7.30 p.m., at the Imperial Hotel, Birmingham.

SEPTEMBER 29

Institution of Production Engineers

Lincoln section:—Works visit to Marshall Sons & Company, Limited, Brittania Works, Gainsborough, Lincs.

Personal

MR. J. BLAKISTON, foundry consultant, has changed his address to No. 5, The Gardens, Heath Road, Halifax, but his telephone number remains unchanged.

Flying to East Africa on business this week is MR. C. W. MURRY, managing director of George Fletcher & Company, Limited, sugar machinery manufacturers, etc., of Derby.

MR. AND MRS. G. A. TAYLOR, of Shipley, celebrated their golden wedding anniversary on September 11. Mr. Taylor followed his father, the late Mr. G. W. Taylor, as foundry foreman at David Sowden & Sons, Limited, Shipley. For some years prior to his retirement, he was employed by Dawson, Payne & Elliott, Limited, printing engineers, of Otley.

CLASSIFIED ADVERTISEMENTS

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

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

SITUATIONS WANTED

FOUNDRY MANAGER (age 45) desires change. Experienced marine, machine tool, diesels, turbines, jobbing, loam, drysand, greensand, floor, mechanised, up to 15 tons in iron. Accommodation essential.—Box 1236, FOUNDRY TRADE JOURNAL.

ASSISTANT SUPERINTENDENT/FOUNDRY FOREMAN seeks change (32). Wide and varied experience machine moulding, mechanisation, jobbing, sand and metal control. General engineering and machine-tool castings to 5 tons. A.M.I.B.F. Any district considered.—Box 1243, FOUNDRY TRADE JOURNAL.

METALLURGIST (36) desires senior position in Research, Development, Technical Control or Managership. Full qualifications and wide experience. Go anywhere.—Box 1250, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN desires change permanent position within reach of Merseyside; 16 years' practical experience in all classes. Highest references, A.M.I.B.F.—Box 1218, 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.

WANTED. — FOREMAN MOULDER for Jobbing Foundry, at present mainly on machine tool castings. Give full details of experience and salary expected.—Box 1241, FOUNDRY TRADE JOURNAL.

CHIEF ESTIMATOR and RATE FIXER required by old-established Foundry South of England. Only fully experienced men having held similar position, with experience in machine tool castings up to 8 tons, and conversant with fully mechanised procedure, need apply.—Reply, stating age, experience, and salary required, to Box 1242, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

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.

FOUNDRY FOREMAN required for general and repetition Iron Foundry producing 20 tons per week. Experienced all aspects foundry control and development. Permanent position with excellent prospects for keen energetic man able to take full control and exercise own initiative. Huddersfield-Bradford area. — Box 1224, FOUNDRY TRADE JOURNAL.

METALLURGICAL ASSISTANT (21-23 years) required for Foundry and Engineering Works Laboratory in the Manchester area. Good prospects and progressive position for suitable applicant.—Full details to Box 1210, 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.

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.

METAL PATTERN MAKER required for Modern Mechanised Iron Foundry in West Riding of Yorkshire. Skilled craftsman metal pattern maker for position of working foreman, with first class experience in the production of metal patterns in cast iron, aluminium alloys and bronze, for machine and plate moulding. Must be acquainted with latest methods and be able to train semi-skilled labour and be good organiser. Applicants should state age and salary required, and give full details, in chronological order of positions held previously.—Apply Box 1195, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd*

FIRST CLASS DESIGNER AND DRAUGHTSMAN required for progressive undertaking in the Midlands, able to design special plant where necessary—Box 1217, 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.

METALLURGICAL CHEMIST required for Scottish Centrifugal Iron Foundry. Responsibilities to include Chemical Analysis and Metallography of Cast Iron. Salary according to qualifications and experience; responsible in the first instance to Technical Director. Excellent prospects of advancement. Written applications to 105, Peterborough Road, Fulham, London, S.W.6, the London office of Busby Engine Liners, Ltd., Nr. Glasgow.

FOUNDRY SUPERINTENDENT, FOREMAN, and young DISPATCH CLERK required for gravity die casting foundry London outskirts. Superintendent able to handle men to get maximum production and plan output of 40 tons monthly. Applications for above situations to state age, experience of similar positions held and remuneration required to Box 1196, FOUNDRY TRADE JOURNAL.

SALES REPRESENTATIVE required by A.P.V. Co., Ltd., Wandsworth, London, S.W.18 (later moving to Crawley New Town) in the Foundry and General Sales Dept., handling sales of stainless steel, aluminium and gunmetal castings, and also valves, pipe line fittings, etc. Sales experience desirable, engineering or foundry background, car driver. Pension and bonus schemes in operation.—Apply by letter, giving personal details, experience, and salary desired, to DEPUTY MANAGER of the Department.

SITUATIONS VACANT—*Contd.*

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.

BUSINESS FOR SALE

FOR SALE AS A GOING CONCERN.—Old-established Foundry, 11 miles from Central London. Producing high grade Bronze and Aluminium Castings for all branches of Engineering Industry.—Box 1205, FOUNDRY TRADE JOURNAL.

PLANT 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.

TENDERS INVITED

CITY COUNCIL OF NAIROBI.
SASUMA DAM VALVE TOWER SCREENS.

QUOTATIONS are invited for the supply of 4 No. Cast-iron 33-in. Hemispherical Screens and 2 No. 39-in. Hemispherical Screens for the draw-off and scour pipes of the Sasuma Dam. Particulars will be forwarded on application to the Consulting Engineers, Howard Humphreys & Sons, 34, Kings Road, Reading, Berks.

AUCTION NOTICE

By Order of the Receiver, C. E. Free, Esq., F.C.A. Re Poole Foundry, Ltd.
St. James Works, Thames Street,
POOLE, DORSET.
Modern Freehold GROUND FLOOR FACTORY,
having with OFFICES and STORES a TOTAL FLOOR AREA OF 20,000 SQ. FT., and covering a SITE AREA OF ONE ACRE, with frontage to POOLE QUAY.
Also the
MODERN FOUNDRY PLANT.
Two Cupolas, 5-ton and 3-ton capacity; Blowers; Mechanical Charger; Sand Mills; Sand Conveyor Unit; PNEUMATIC MOULDING MACHINES; Core Ovens; Shot Blast Plant; Pattern Making Machinery; Boring Mill; Lathes; Milling and Drilling Machines; MACHINE MOULDING BOXES; Foundry Stores; Stock of Coke; Ganister; Sand and Scrap Iron; Office Furniture, etc.
LEOPOLD FARMER & SONS
will sell the above By Auction on the premises, WEDNESDAY, 26th SEPTEMBER, 1951, at 11 a.m.
On View 2 Days Prior and Morning of Sale.
Particulars and Catalogues of the Receiver, C. E. Free, Esq., F.C.A.; Messrs. C. E. Free & Co., Chartered Accountants, 5, Raglan Street, Harrogate, Yorks; Messrs. Pearsons & Ward, Solicitors, Yorkersgate, Malton, Yorks, and Messrs. Leopold Farmer & Sons, Industrial Property, Plant and Machinery Auctioneers, 46, Gresham Street, London, E.C.2. Tel.: MONarch 3422.

AGENCIES

LONDON AREA.—Engineers' Agents, with good offices in Westminster, require AGENCY for Malleable or Steel Castings. If principals have established connections amongst users in the area, remuneration required would be correspondingly moderate.—Box 1061, FOUNDRY TRADE JOURNAL.

FINANCIAL

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.

PATENTS

THE Proprietor of British Patent No. 591160, entitled "Improvements relating to Tubular Heating Furnaces," offers same for license or otherwise to ensure practical working in Great Britain. —Inquiries to SINGER, STERN & CARLBERG, 14, East Jackson Boulevard, Chicago, 4, Illinois, U.S.A.

THE Proprietors of Patent No. 546,039 for "Improvements in Open Hearth Furnaces" desire to secure commercial exploitation by licence or otherwise in the United Kingdom. Replies to Haseltine Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

MACHINERY WANTED

OFFER YOUR SURPLUS PLANT TO
FRANK SALT & CO., LTD.,
Station Road, Blackheath, Birmingham.
BLA. 1635.

REQUIRED immediately, one only, 400 lbs. capacity M.R.V. type Tilting Non-ferrous Furnace. State price and conditions.—NEWCAST FOUNDRIES, LTD., LTD., Silverdale, Staffs. Tel.: Silverdale 308.

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

MOULDING MACHINES wanted. Jolt Ram Rollover, plate minimum size 40 in. by 30 in.—Particulars to ECLIPSE FOUNDRY & ENGINEERING CO., LTD., Sedgley Road West, Tipton.

MACHINERY FOR SALE

AVAILABLE immediately one each 5-ton and 1-ton Geared Crane Ladle. —NEWCAST FOUNDRIES, LTD., Silverdale, Staffs. Tel.: Silverdale 308.

FOR SALE.—Surplus to requirements one Electro-Hydraulic Down Draw Moulding Machine, by British Insulated Cables, complete with Switchgear and Mercury Arc Rectifier, by Nevelin Electric. Takes pattern plate 28 in. by 28 in.; a complete machine in full working order. Inspection by appointment.—Box 1234, FOUNDRY TRADE JOURNAL.

MACHINERY FOR SALE—*Contd.*

FOR SALE

NO. 16 ATRITOR CRUSHER by Alfred Herbert, complete with Feed Hopper, overhauled and with a quantity of spares. Also a No. 12 Atritor by Alfred Herbert, for which we have available about 6 tons of spares. Both these machines are offered at extremely low prices for quick clearance.

SAVILLE-CALVERT (MACHINERY) LIMITED
BIRMINGHAM ROAD, STRATFORD-ON-AVON.
Tel.: Stratford-on-Avon 3681.

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LOCOMOTIVES.

HUDSWELL CLARKE 0-6-0 Steam Locomotive 12 in. by 18 in. cyls. Wheelbase 10 ft. 6 in. 4 ft. 8½ in. gauge. Boiler 160 lb. W.P.
HUNSLET 0-6-0 Steam Locomotive 12 in. by 18 in. cyls. Wheelbase 9 ft. 6 in. 4 ft. 8½ in. gauge. Boiler 160 lb. W.P.
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Unused RUSTON 16/20-h.p. Diesel Locomotives, 2⅔-ton models. 2 ft. gauge.
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IN STOCK IN SLOUGH FOR IMMEDIATE DELIVERY.

100 PAIRS genuine Sterling Moulding Boxes, 18 in. by 13 in. 30s. per pair.
Several new Air Receivers.
Herbert Whizzer.
Tabor Split Pattern Moulding Machine, 14 in. by 16 in.
Compressed Air Sieve, £12 10s.
Several Oil-fired Tilting Furnaces.
Two Hand-pattern-draw Moulding Machines; Jolt Squeeze and Pattern-draw Moulding Machine, 24 in. by 18 in., three available, 6 months old; £125 each.
Several Cupolettes, one brand new.
5-ton Morris Crane.
Platform Weighing Machines, 3 cwt. and 30 cwt. capacity.
Several D/E Polishing A.C. Machines; also general foundry plant available.
Immediate attention all enquiries.
ELECTROGENERATORS LTD.
Australia Road, Slough.
Telephone: Slough 22877.

MACHINERY FOR SALE—*Contd.*

TILGHMAN Shot Blast Plant. Chambers 15 ft. by 8 ft. by 8 ft. 3 in. with filters, regulators, couplers and exhaust fan. Air compressor giving 100 lbs. per sq. in. 16 h.p. motor and starter for 400/3/50 supply.—F. J. EDWARDS, LTD., 359, Euston Road, London, N.W.1. EUSton 4681.

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

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

FOR SALE—Six Cast-Iron Slag Pans. Approximate capacity 2 cub. yds. Fitted with lifting lugs and trunnions. Very little used and in excellent condition. Would be suitable for iron and steel melting shop use.—Box 1238, FOUNDRY TRADE JOURNAL.

ALBION TWW WORKS

SHOTBLAST AND DUST EXTRACTION PLANT

TILGHMAN SHOTBLAST ROOM PLANT having 6-ft. room, type WV2 Tilghman Shotblast Apparatus, Pressure Chamber, Paddle Blade, Exhaust Fan, Air Receiver, etc.

TILGHMAN DUST EXTRACTION CABINET 44 in. by 34 in. by 68 in. deep, Motor Driven Dust Extraction Fan, 400/440/3/50.

DUST ARRESTING PLANT comprising sheet steel cabinet 4 ft. by 3 ft. 6 in. by 5 ft. 6 in. high. Motor Driven Paddle Blade Dust Extraction Fan, 8 in. inlet, driven by 1 h.p. motor 400/440/3/50.

RUMBLING BARRELS

NEW MOTOR DRIVEN HEXAGONAL RUMBLING BARRELS 36 in. long by 18 in. across flats, 1 ft. 2 in. plate, driven by 3 h.p. motor and complete with starter, 400/3/50.

NEW BELT DRIVEN ditto, size 36 in. long by 30 in. across flats; driven through fast and loose pulleys with belt striking gear.

"FORWARD" FOUNDRY SAND RIDDLE 5 tons per hour capacity. Complete with tripod and 22-in. dia. sieve. Motorised.

GEARED FOUNDRY CRANE LADLES—BRAND NEW

4 tons, 3 tons, 50 cwts., 2 tons, 30 cwts., 15 cwts., 10 cwts.

AIR COMPRESSORS — WE CARRY LARGE STOCKS OF AIR COMPRESSORS OF ALL TYPES RANGING FROM 2 C.F.M. UP TO 3,000 C.F.M. AGAINST PRESSURES VARYING FROM 5 lbs. P.S.I. to 200 lbs. P.S.I. WE WOULD PARTICULARLY BRING TO YOUR ATTENTION THE "FORWARD" PORTABLE PETROL OR MOTOR-DRIVEN AIR COMPRESSOR WITH SPECIAL TWO - COMPARTMENT RECEIVER FOR LIGHTING CUPOLAS EFFECTING A BIG SAVING IN TIMBER COSTS AND SOON REPAYING THE ORIGINAL OUTLAY. CAPACITY 6 C.F.M.

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