FOUNDRY TRADE JOURNAL
Established 1902
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

Vol. 88 Thursday, June 29, 1950 No. 1765

49, Wellington Street, London, W.C.2.

Grams: "Zacatecas, Rand, London"

'Phone: Temple Bar 3951 (Private Branch Exchange)

PUBLISHED WEEKLY: 26s. per annum (Home and Overseas)

Lessons from the Venerable

Just recently, a plethora of information has been made available of a few of Britain's most venerable engineering and foundry concerns. Amongst these are books and brochures covering the histories of the Butterley Company; M. & W. Grazebrook, Limited, the bicentenary celebrations of the foundations of which were held earlier this month; John Harper & Company, Limited, and Ransomes & Rapier, Limited. We have given some thought as to why these firms have managed to prosper throughout the long years since their establishment. We would not attach too much importance to equipment, as we feel sure other concerns were equally well provided. Service is not emphasised, nor has excessive reliance been placed on revolutionary invention. The common features have been adaptability and quality, plus pioneering.

The origin of many of Britain's oldest concerns was an enterprising smith. The sons and other relations added new lines and discarded old ones according to the dictates of a constantly changing market. Making a railway from China to pioneering a revolving stage for a music-hall; then along to aviation, armaments and excavators well illustrates what we have in mind. Again, the long road between the quantity production of locks and typewriter frames also shows this readiness to seize upon the opportunities offered by changing conditions. It is interesting to note that all these companies still possess the highest sense of publicity. Moreover, they rarely emphasise their antiquity. On the other hand, a firm which only came into business a few weeks ago has perpetrated the worst leaflet reaching our desk for twenty years. It was a disgrace to the foundry industry and unworthy of the smallest back-street trader. If age has taught anything, it has certainly inculcated a dignity amongst these old concerns in the printed matter sent out.

Because a firm is old, it calls for no particular veneration unless it can show progress, preferably continuous, but sporadic will suffice, for we doubt if the turnover chart of any of them could be a straight, ever-ascending line. The interesting part of the stories of old-established concerns would be as to how they managed to weather the great trade depressions of the past. We do not remember reading much on that subject—yet it must have been of paramount importance. Nepotism has been much decried in recent years; yet the progress of the firms cited emphasises its sterling worth. Moreover, if one is dealing with a firm, the directors of which bear the same name, there is the comfortable feeling that if anything goes wrong, one can vent one's spite on a personality. On the other hand, if the firm were called the Anglo-Utopian General Corporation, it is so anonymous that a posterior to kick seems infinitely remote. To emulate the progress of the firms we have cited—and there are many others we could have included—it would seem that rapid response to ever-changing business conditions is the feature of outstanding importance. The earliest date we have seen on any foundry notepaper is that of the Exeter Foundry, which, it is stated, was founded in 1661. If there be any other foundry concern which can date their establishment to still earlier times, we should be interested to hear from them. Until that happens, then the Exeter firm must be regarded as the doyen of the foundry industry.

Contents

Clay Study Committee

An International Committee for the Study of Clays (C.I.P.E.A., *Comité International pour l'Etude des Argiles*) has been formed with the aim of grouping specialists in the study of clays, from whatever angle, in different countries. They are represented on the committee by a maximum of two members per country, the British representatives being Dr. D. M. C. MacEwan (Rothamsted Experimental Station) and Dr. G. W. Brindley (University of Leeds).

An executive sub-committee was appointed in London during the recent geological congress, and consists of the following:—Mr. S. Henin (France), chairman; Mr. M. Lepingle (Belgium), secretary; Dr. R. E. Grim (U.S.A.), and Dr. D. M. C. MacEwan (Great Britain).

The aims of the committee are to collect a full documentation on the results and methods of clay studies; to promote contacts between specialists in such studies; to organise conferences from time to time, in which questions relevant to clay studies will be discussed, aiding specialists to compare their results, and to unify their methods of description. The committee will aid in bringing about exchanges of reference samples between research workers, and will try to define the terminology and methods used in the scientific study of clay.

With these ends in view, they hope to obtain representatives in each country who will maintain contact between the International Committee and the research workers there, whether grouped or not in a regional organisation. Several national committees of this type, devoted to clay studies, have already been formed, notably in Belgium, France, Great Britain and Sweden.

Questionnaires on the various subjects within the scope of the International Committee will be sent to its representatives, who will be charged with circulating them in their respective countries and collating the replies obtained. A first inquiry of this type concerns differential thermal analysis, and a special sub-committee has been formed for the purpose.

A meeting of the full Committee is to be held in Amsterdam during the forthcoming International Congress of Soil Science (July 24-August 1, 1950), when plans for its future activities will be discussed. The committee wishes to be of help to all those concerned with the scientific study of clays, and any reader who would like to suggest ways in which it could do so is invited to write, as early as possible, to one of the British representatives, so that these may be presented to the meeting.

Foundry Coke Merchants Elect Officers

Last Thursday the annual meeting and luncheon of the Foundry Coke Merchants' Association was held at the Waldorf Hotel. Amongst the guests at the luncheon were Mr. Leslie O'Connor, Mr. J. Y. Feggetter, Mr. F. Greenwell, Mr. W. Armstrong, Mr. R. H. Grierson, Mr. G. H. Bedford, and Mr. D. Greenhill, all representing the coke carbonisation side of the National Coal Board. At the annual meeting which followed, Mr. Arnold Carr was re-elected as chairman, together with the following committee:—Mr. H. Basil Darby; Mr. A. E. Bond; Mr. J. Sillivan; Mr. F. Peart; Mr. W. D. Crellin; Mr. L. G. Dew; Capt. D. E. Treharne; Mr. F. Arnold Wilson; Mr. R. S. Smeeth; Mr. Wm. Roberts; Mr. J. J. Selby; Mr. R. J. McDonald, and Mr. R. Causebrooke.

THE NEWLY-FORMED Keighley and District Model Engineering Club, whose president is Dr. Cuthill, Principal of Keighley Technical School, has issued an open invitation to residents of the Skipton area to join the club. Those wishing to do so should write to Mr. J. Brownless, of 159, Redcliffe Street, Keighley.

Grazebrook's Bicentenary Celebrations

Congratulations are extended to the firm of M. & W. Grazebrook, Limited, on the attainment of their bicentenary. During the whole of this period the firm has remained a family concern, but the nature of the business has varied from time to time to include mining and glass making. To-day, the firm operates a well-equipped jobbing foundry, capable of making castings up to 16 tons, and only completed last year. The cupolas are semi-automatically charged and the moulding is largely by Sandslingers. The sand-preparing and handling plant are in every way well suited to jobbing conditions. The shop has 30,000 sq. ft. of working space.

There is a group of well-equipped machine shops where much use is made of welding for the construction of engineering components. A line of business which we have never seen before was the production of lead-lined chemical ware.

As reported last week, the celebrations started with a luncheon at Dudley Town Hall, at which there was a formal handing over to Birmingham Corporation of a blowing engine made by Boulton & Watt. This serviced the Grazebrook blast furnaces from 1817 to 1912. The documents were handed to Mr. J. F. Gregg, the Town Clerk of Birmingham, by Mr. Owen Grazebrook, the chairman, in the presence of the Lord Mayor. The celebrations were completed by an excursion of all the employees to Weston-super-Mare as the guests of the company.

Merchants' Federation Visit to Falkirk

On June 8 over forty members of the Scottish Metal and Plumbers' Merchants' Federation came to Falkirk to visit several of the works of Allied Ironfounders, Limited. Assembling at 10.30 a.m. at Falkirk Iron Company, Limited, members were met by Mr. R. G. Sinclair and Mr. D. McK. Webster, directors of Falkirk Iron Company, Limited, and of M. Cockburn & Company, Limited, respectively.

At Falkirk Iron Company the visitors saw in the making part of the very extensive range of fitted goods produced by Allied Ironfounders, including the heavy-duty cooking units for which Falkirk has been famous for many years. M. Cockburn & Company specialise in baths and accessories, and here the enamel-making and enamelling processes proved of great interest and were the subject of much comment and many questions. At Castlelaurie, the feature was the modern mechanised plant for the production of rain-water and soil pipes. By way of contrast, at Abbots the visitors saw an up-to-date brass foundry and machine shop where a large variety of non-ferrous work is produced.

An enjoyable lunch at Falkirk Ice Rink and afternoon tea at the works made welcome breaks in a very full programme. The day was a great success and, in the absence of Mr. Palk, president of the Federation, Mr. John Hastings, of H. W. Hunter & Son, president of the Edinburgh section, thanked the directors of Allied Ironfounders for their interest and hospitality.

THE FOUNDRY of the 78-year-old firm of Mangold Brothers, Limited, of Port Elizabeth, South Africa, has been rebuilt and now ranks amongst the most modern in the Union. There is 35,000 sq. ft. of floor space. The design and mechanisation of the new plant was undertaken by Stone Wallwork, Limited, in conjunction with their South African agents Koppel Engineering (Pty.), Limited.

Institute of British Foundrymen (London Branch)

Annual General Meeting

The London branch of the Institute of British Foundrymen held its annual general meeting at the Waldorf Hotel, Aldwych, London, W.C.2, on April 26. The hon. treasurer observed that the total of expenditure was approximately £67 more than for 1948. Expenditure on all items had increased, with two small exceptions. Against the six meetings for 1948 there were eight in 1949. A large part of the lecturer's expenses increase would be similarly accounted for. The increase in the Slough section amount was temporary and had been occasioned by the section's endeavour to encourage attendance at the meetings. Branch subscriptions amounted to £1,618 7s. 6d. for the calendar year after adjustments were made.

Mr. E. Harwood Brown seconded the proposal, remarking that they all owed a debt of gratitude to the hon. treasurer and hon. auditors for the most efficient manner in which they had carried out their voluntary tasks. The adoption of the accounts was put to the meeting and carried unanimously.

Hon. Secretary's Report

Mr. W. Moehrie then presented his report on the activities of the session, in the course of which he recalled the various Papers which had been delivered during the session—by Mr. Renshaw and Mr. Sargood, Mr. Wilson and Mr. Talbot, Mr. F. A. Martin, O.B.E., Mr. Liddiard and Mr. Forrester, Mr. F. Sievewright, Mr. F. W. Rowe, B.Sc., Mr. Brittain, and Mr. L. W. Bolton and Mr. W. E. Ford—and commented on each one. The two social occasions, the annual dinner and dance and the "men-only" function, had both been outstanding occasions. One works visit to the Crayford works of Vickers Armstrong, Limited, had been a pronounced success.

Sections

These had a very successful season, the East Anglian having six technical meetings and Slough five. Attendances had been good, not the least important being that of the president, Mr. Arnold Wilson at one meeting at each section. The Slough section for 1949/50 had made particular progress, and thanks were due to Mr. Blandy, president, and Mr. Hoesli, secretary. He also congratulated the president of the East Anglian section, Mr. Hardy, and Mr. Sanders, secretary, for their efforts in maintaining the section's usual high standard of Papers and attendance.

Council

The representatives and delegates to general council had made 28 out of a possible 40 attendances at meetings, which, considering the scattered meeting places and the pressure on the individual's spare time under present-day circumstances was, he thought, very good indeed.

Likewise, the branch council, which had held six meetings, had attendances approximating to 70 per cent. One remarkable feature of these meetings was the constant support of the past-presidents, whose wise counsel was of inestimable value to the governing body.

Membership

The branch had now felt the effects of a full year's working under the revised charter and its restrictive effect was on incoming new members, and a comparison was shown in the accompanying table of the incoming members from a full year under the new charter with those of one year's working under the old byelaws.

It would be seen that the intake of new members during the year was only about half that of last year. London was still the largest branch in the Institute, but its margin was not so great as it had been. The object of the new charter was to raise the prestige of the Institute so that it could play its more important rôle as a qualifying body. If this object was to be achieved it was obvious that the branches must be maintained at an economic level. The best means, no doubt, was to see that applications for membership were encouraged; for instance, if each member present could during the summer months introduce one new member to the branch, it would give a flying start for the new session. Considering the untapped resources in the London area and the service the Institute offered, this should not be a difficult task.

In conclusion, he thanked Mr. F. Hudson for his sterling services as the representative on the technical council, and also Mr. E. Harwood Brown and Mr. George Pierce for their regular reception of members and guests at the meetings, and Mr. J. P. Ellis for his untiring services with the lantern.

	Subscribing firms.	Members.	Associate members.	Associates.	Total.	Gains.
1947-48	27	330	275	24	656	—
1948-49	33	357	285	28	703	47
1949-50 (to date)	33	365	295	32	725	22

.B.F.—London Branch

He also thanked the council for its forebearance in this his " learner " period, and particularly, Mr. Faulkner, whose knowledge of Institute matters was indeed profound, and Mr. F. Arnold Wilson, whose guidance and help, alternately as president and immediate past honorary secretary, had steered him through his first year of office.

Mr. V. C. Faulkner moved formal adoption of the report. Mr. V. Delport seconded, paying tribute to Mr. Mochrie's sterling work for the Institute, and the report was adopted unanimously.

Election of Officers*

President

The president proposed the senior vice-president, Mr. Frank Tibbenham, to be branch president for the next year, starting from June. Mr. Tibbenham was very well qualified to take on the job. He had been on the council for quite a number of years and been president of the Ipswich section. He was on the staff of the Suffolk Iron Foundry, 1920, Limited, at Stowmarket, and he thought they would enjoy having him as president. Mr. B. Levy seconded the proposal, which was carried unanimously.

Senior Vice-president

Mr. F. Tibbenham proposed the junior vice-president for this office, namely, Mr. L. G. Beresford. Mr. Barrington Hooper seconded the proposal, which was carried unanimously.

Junior Vice-president

Mr. L. G. Beresford proposed Mr. D. Graham-Bissett for the honour of this office. He felt sure he would fill it to the satisfaction not only of himself but everybody present. Mr. R. B. Templeton associated himself with this resolution as seconder and the proposal was carried unanimously.

Honorary Secretary and Treasurer

Mr. V. C. Faulkner, proposing the re-election of Mr. Mochrie, reminded members that during the war when the meetings had been attended by bombing, Mr. Mochrie had always turned up. At that time he (Mr. Faulkner) had been secretary and he had thought to himself what a suitable person Mr. Mochrie would be to follow him, and no doubt he had shown considerable wisdom there. Mr. Mochrie had produced a very creditable report, and he counted it a privilege to be able to propose his re-election. Mr. V. Delport formally seconded the resolution.

Honorary Auditors

The president commented upon the fact that Mr. Charles Cleaver, owing to his rather poor state of health had felt reluctantly compelled to resign. He had been honorary auditor to the branch for at least 25 years, and he suggested that they should instruct the hon. secretary to send him a note expressing their very warm appreciation and thanks for the many years he had given to the office. Mr. Delport under their rules had to have an assistant. Fortunately they had had a very kind offer from Mr. Barrington Hooper, who would take Mr. Cleaver's place. Mr. E. M. Currie, proposing Mr. V. Delport and Mr. Barrington Hooper, paid a personal tribute to the work of Mr. Charles Cleaver. He also reminded members that Mr. Delport had been associated with him in the office for about 15 years, and it was certainly no sinecure, as they would gather from the hon. treasurer's report.

Members of Council

As a result of a ballot, Mr. E. S. Renshaw, Mr. W. Wilson, Mr. J. P. Ellis and Mr. M. Glenny were elected.

Representatives to the General Council and Technical Council

The president announced that the branch council at their meeting had appointed Mr. C. H. Kain, Mr. V. Delport, Mr. E. M. Currie and himself as delegate representatives. Also they had re-appointed Mr. Frank Hudson their representative on the technical council.

Stewards

The president observed that Mr. Harwood Brown and Mr. George Pierce had done some outstandingly good work in this connection, but Mr. Brown was not seeking re-election owing to his impending move to another part of the country. Mr. A. R. Wizard had volunteered in his place.

Mr. V. Delport, moving a vote of thanks, asked that they should revert to the custom of having the old president induct the new one at the first meeting in the new session, and this was agreed. The meeting then concluded.

* The officers for 1950-51 session were named in our issue of May 11.

Conference on Clay Minerals

A day conference will be held in the Department of Coal Gas and Fuel Industries in the University of Leeds on Friday, July 7, beginning at 10 a.m., at which modern knowledge of the clay minerals of importance in moulding-sand practice will be reviewed and discussed. In the morning, Papers on bond clays and their constituent minerals will be given by Dr. R. E. Grim, geologist and head of the division of Clay Resources and Clay Mineral Technology, State Geological Survey Division, Illinois, U.S.A., and by Prof. A. L. Roberts and Dr. R. W. Grimshaw of the University. The Papers will be followed by a general discussion. In the afternoon, the laboratories of the department will be open for demonstrations of physical methods for identifying and estimating clay minerals. The fee for admission to the course is 10s.

All those concerned with the use of moulding sand and clays are cordially invited, and those intending to participate are asked as soon as possible to inform Miss M. Spink, assistant to the director of extra-mural studies, the University, Leeds, 2.

DAVID BROWN TRACTORS, LIMITED, of Meltham, near Huddersfield, on July 1 transfer their manufacturing activities to their wholly-owned subsidiary company, David Brown Tractors (Engineering), Limited.

Liquid Metal Properties*

Effect on the Casting Fluidity of Alloys

By V. Kondic, B.Sc., Ph.D.

Foundrymen define casting fluidity as the moulding capacity of an alloy or the ability of an alloy to flow. The importance of this property in the manufacture of castings, and as a technological or a research tool, has now generally been recognised. On the other hand, a method of measuring such a property has not yet been standardised, neither have all the factors that play an important part either in measuring this property or in interpreting the results of such tests been fully explored. A steady progress has been maintained, however, in both of these fields, and Clark[1] recently reviewed the various methods of fluidity measurement. The object of the present Paper is that of reviewing the data available which relate the properties of a liquid alloy with results obtained in fluidity tests. Although different methods of fluidity measurements have been frequently used in the past, certain general and valuable relationships have been obtained, irrespective of the type of test.

Liquid Properties

In considering factors affecting fluidity, it is convenient to divide these into two groups. In the first group are the inherent properties of pure liquids: heat content, viscosity, surface tension and structural properties, all of which are functions of temperature and alloy composition and can be related to or calculated from standard physical constants. On the other hand, in industrial practice, metallic liquids are very rarely pure, and a number of factors, such as gas content, oxide films, metallic or non-metallic inclusions, modify to a larger or smaller extent most of the above properties. The problem of fluidity thus resolves itself into two main questions: (*a*) to what extent and in what manner is the casting fluidity related to the inherent properties of liquids, and (*b*) how are such relationships that exist under (*a*) modified in impure metallic liquids?

Before considering these relationships, the physical meaning of the casting fluidity should be explained. In a typical fluidity test, Fig. 1, the molten metal is poured into a basin A, wherefrom it flows under a constant hydrostatic pressure, H, through a runner B, and a well C, into a horizontal channel D (usually of a spiral form) of a constant cross-section. As the mould containing the channel is below the melting point of the alloy which is being investigated, the metal cools during the flow and solidifies after running for a certain distance. This distance is defined as the fluidity value for the experimental conditions under which it was determined. Clearly, therefore, the fluidity is controlled by mould and metal properties as well as by casting factors. The discussion in this Paper is restricted to the metal properties only.

The definition of the casting fluidity given above raises the important question of establishing the relationship between the fluidity values obtained by such a test and the fluidity defined as the mould-filling capacity. The fluidity mould resembles, in its general form, and can be made in the same material as, an actual

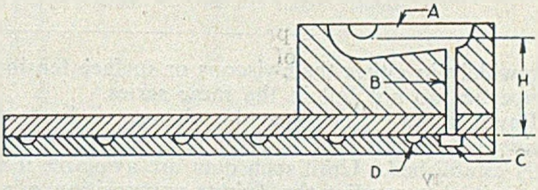


FIG. 1.—FLUIDITY APPARATUS.

mould that is used in the manufacture of castings, and thus it may appear at first sight that an alloy giving longer fluidity spirals would be at the same time superior for mould filling in the manufacture of castings. Such a conclusion may be justified only in those cases where the fluidity mould resembles closely in its design the mould for making castings. In general, the question of interpreting fluidity results for founding and manufacturing purposes is still an open one. On the other hand, the interpretation of fluidity testing for metal melting quality control or for research purposes for studying the nature of the liquid state, is without major controversies.

Inherent Liquid Properties

A. *Heat Content.*

It follows from the physical definition of the casting fluidity, that, everything else being the same, the length of the fluidity spiral will be the greater, the greater the heat content of the alloy. The length of the spiral, in terms of the available heat units, is determined by the time the tempera-

* A Paper presented at the Annual Conference of the Institute of British Foundrymen. The Author is a Lecturer in Metallurgy at Birmingham University.

Liquid Metal Properties

ture of the tip of the spiral reaches the value at which the kinetic energy of the running liquids is insufficient to overcome the forces opposing the flow. At this stage, which is that of almost complete solidification, it is the viscous forces which mainly oppose the flow. Thus, an alloy of a higher heat content requires a longer time for its flow to be arrested and, consequently, a longer spiral is obtained. The fact that flow is arrested through the phenomena occurring at the tip of the spiral has been proved experimentally.[2]

The heat content of an alloy is mainly controlled by the alloy composition and temperature. The available heat (heat of fusion plus liquid heat) can be calculated from standard physical tables for most pure metals and for a number of alloys. When fluidity measurements are carried out under comparative experimental conditions, a number of pure metals can be arranged in a series, which is the same as the series of the increasing heat content, Table 1.[2] On the other hand, metals differing widely in either their viscous or surface tension properties do not fall in the same series.

TABLE I.—*The Relation of Physical Constants and Fluidity of Pure Metals.*

	Lead.	Tin.	Cadmium.	Zinc.
Heat content at 25 deg. C. above the melting point, gr. cal. per ml. ..	73.2	110.8	110.9	188.4
Casting fluidity, inches ..	42	64	65	109
Surface tension, dynes per cm.	452	526	630	758
Absolute fluidity, $1/\mu$, poises	34.5	50	66.5	—

Physical laws governing the change of heat of fusion and specific heat by alloying have not yet been fully established. Until such data are available it is impossible to predict the fluidity-composition relationship of an alloy as dependent on the changes in the heat content with composition. In general casting practice, the value of available heat for any alloy composition is mainly controlled by the pouring temperature, and the relationship between fluidity values and pouring temperature becomes of interest.

Fluidity as a function of pouring temperature has been determined for a number of low-melting-point metals and alloys, light and copper-base as well as for ferrous casting alloys. In general, two distinct types of relationships are obtained, Fig. 2 (A and B), depending both on the experimental conditions used as well as on the type of alloy investigated. There are two main causes for the deviation from the straight-line relationship shown in Fig. 2 (A):—(*a*) The condition of the alloy may be altered with the increasing temperature, apart from the rise in the available heat (*e.g.*, degree of gassing, oxidation, etc.); (*b*) the mode of solidification (which affects the metal flow in the fluidity mould) may be modified (*e.g.*, degree of undercooling). Both of these phenomena are further discussed later.

Pouring-temperature *v.* fluidity graphs have both theoretical and practical applications. Discontinuities that are sometimes observed in such graphs can be correlated to the physico-chemical changes in metallic liquids with temperature. Changes produced in sodium-modified aluminium-silicon alloys and in grain-refined light alloys can be followed readily by fluidity measurements. On the other hand, fluidity obtained at a certain pouring temperature can be used in practice for a safety control test in the manufacture of certain types of castings. The application of fluidity measurements for such purposes has been variously reported.[1]

B. *Viscosity.*

Viscosity is that property which measures the resistance of a liquid to flow. In Fig. 3 (A), a liquid is held between two horizontal plates, which are perpendicular to the plane of paper and whose traces are *ab* and *cd*. If the plate *ab* and the liquid layer in contact with it are stationary, and the plate *cd* and the adjacent liquid layer move with a velocity V, then the viscosity of the liquid is related, on the one hand, to the force P, required to overcome the internal resistance of the liquid against the flow, and to the velocity gradient between the two plates on the other. A unit of viscosity is defined as the force per unit surface, P/F, required to produce a unit velocity gradient, V/*h*, during a steady laminar flow. Or, in standard c.g.s. units . . . $\mu = \frac{P/F}{V/h}$ gr./cm.-sec. (or poises). Laminar or streamline flow can be obtained by using capillary tubes, in which case the velocity distribution over the diameter is a parabola, as shown in Fig. 3 (B). The value of viscosity under such conditions can be obtained by measuring either (*a*) the drop in pressure over a certain length of the tube, or (*b*) the volume of the flowing liquid (Hagen-Poiseuille law).

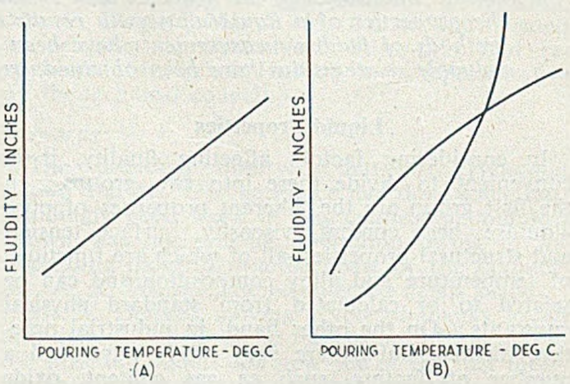


FIG. 2.—FLUIDITY/POURING-TEMPERATURE RELATIONSHIPS.

Viscosity of metallic liquids can be determined experimentally by either applying the laws governing the liquid flow in capillary tubes, or by studying the oscillations of bodies suspended in liquids. Three major conclusions have been obtained by viscosity measurements:—(*a*) The numerical value of viscosity of metallic liquids is slightly greater than the viscosity of water; (*b*) viscosity decreases with increasing liquid-metal temperature; and (*c*) the value of viscosity in pure metals is affected by the presence of dissolved or undissolved metallic or non-metallic additions to the liquid.

One of the most important questions arising in applying the data obtained in viscosity measurements to the problems of fluidity testing is that of finding whether the differences that exist in viscosity

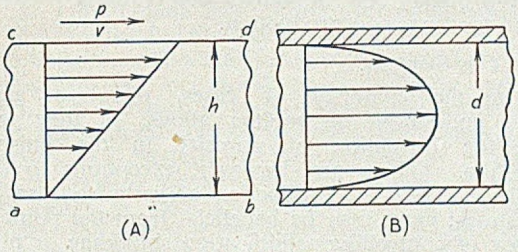


FIG. 3.—DEFINITION OF VISCOSITY AND LAMINAR FLOW.

values for different metals could account for different lengths of fluidity spirals for the same metals—or are such differences in fluidity to be accounted for by differences in properties other than that of viscosity? Is, in effect, the fluidity spiral as normally obtained, viscosity sensitive—and, if so, to what extent?

Some earlier views on this question, for example, of Desch,[4] and more recently of Briggs,[5] are against the supposition that viscosity plays an important part in fluidity testing. On the other hand, the work of Bastien,* Lips[8] and, more recently, of Poliak* tends to show that under certain conditions of fluidity testing, the length of the spiral is measureably affected by viscosity variations of the liquid. It is not likely that this controversy will be finally settled until further data on viscosity of alloys are available. Two outstanding items amongst such data which are still missing are:—(*a*) Viscosity variations close to the melting point of alloys, and (*b*) direct correlation of viscosity and fluidity measurements.

Some recent experiments of Yao[6] are of some interest in this controversy. Whilst investigating the effect of the metal condition on the casting fluidity, Yao found that the sensitivity of the spiral length to the changes in the liquid (*e.g.*, brought about by different melting techniques) increases with the decreased rate of cooling of the spiral. It may well be that a number of important observations were missed in the past fluidity research, because too fast rates of cooling were used.

C. *Surface Tension.*

Surface tension as normally defined is the force that exists at the free surface, separating the liquid from its vapour, and is a result of higher attraction of surface molecules (or atoms) towards the liquid than towards the vapour phase. The importance of this force in fluidity testing arises from the fact that it is a measure of resistance that the liquid offers in entering a narrow section of a mould and, amongst other things, giving a fine reproduction of details.

Similarly to the viscosity, there is a shortage of data on the subject of surface tension of molten metals and alloys. Certain general points have been, however, established:—(*a*) Surface tension of a metal decreases with the temperature above melting point, but copper and cast iron are two important exceptions to this rule; (*b*) surface-tension *v.* composition graphs for a simple eutectic binary alloy system do not show marked changes in the slope, maxima and minima, similar to the casting-fluidity *v.* composition graphs.[3]

Most of the surface-tension measurements have been carried out in neutral atmosphere or *in vacuo,* thus making it difficult to draw any conclusion to fluidity testing which is normally carried out in air. It is of interest, however, that the surface-tension values for metals in Table I do not seem to be directly related to the length of the fluidity spiral. Metals forming stronger oxide films may, however, be more strongly affected through this cause. For example, the surface tension of oxidised aluminium is twice as great as that of unoxidised metal.

D. *Constitution.*

The relation between the constitution of alloys and fluidity has received perhaps more attention by different investigators than any other aspect of fluidity testing. The pioneer work in this field was that of Portevin and Bastien,[7] who established two rules which are obeyed by numerous alloy systems:—(*a*) The addition of solute atoms to a pure metal lowers the fluidity proportionally to the increase of the solidification interval; (*b*) maxima are obtained in the fluidity-composition graphs whenever the alloy freezes at a constant temperature (Fig. 4). The general character of these findings is borne out in industrial practice, for it is

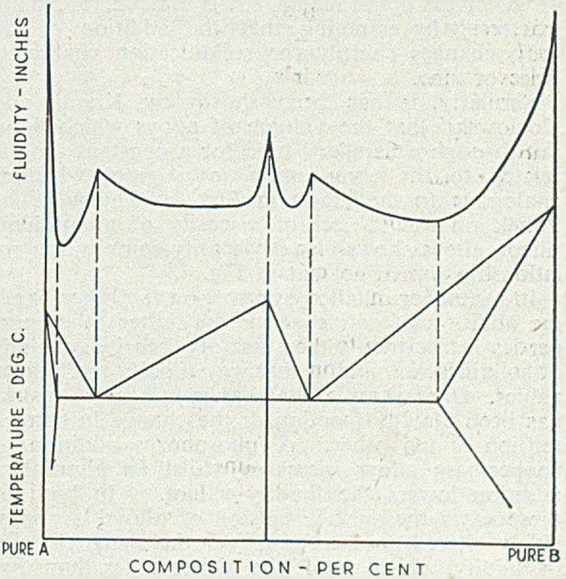


FIG. 4.—FLUIDITY/COMPOSITION RELATIONSHIPS FOR A BINARY SYSTEM.

generally recognised that eutectics are normally very fluid alloys.

There are, however, certain exceptions to these rules. An addition of an element to the pure metal may, for example, increase rather than lower its

*See remarks in references.

Liquid Metal Properties

fluidity. For example, magnesium addition raises the fluidity of aluminium. Another exception to the above rules is found in those alloy systems in which an element of high heat of fusion raises the fluidity of an alloy, although the solidification interval increases over the same composition range. This is shown with aluminium-silicon alloys containing more than the eutectic amount of silicon.[2]

Whilst the value of the above general relationships has been widely recognised, there is no agreement amongst different workers on the explanation of the phenomena involved. Two main schools of thought are held. The low fluidity spiral characteristic of alloys having a long freezing range is explained by one school in terms of the mode of solidification of these alloys, and in terms of the changes in viscosity with composition by the other school. In other words, either the dendritic crystals formed at the mould surface interfere with the flow, thus giving short spirals, or the addition of solute atoms increases the viscosity of the alloy which, in its turn, leads to low fluidity values. Further experimental work is required to determine the conditions under which either of these hypotheses is correct.

An interesting experiment in this direction was carried out by Yao.[6] According to the experimental evidence available, there is no detectable solid solubility of tin in zinc. However, only 0.1 per cent. atomic (or approximately 0.18 per cent. by weight) of tin, lowers sharply the fluidity of zinc from 92 to 45 in. of the spiral length. It is difficult to explain this result by assuming that the addition of tin only changes sharply the solidification characteristics of zinc.

Similarly, it has been shown by Kondic and Kozlowski[2] that the volume of alloys which flows out through a capillary tube for a constant time is related to the composition in a graph which is analogous to the graph in Fig. 4. The work of Poliak on the subject of viscosity of aluminium-silicon alloys shows also a viscosity-composition relationship similar to that in Fig. 4.

In a number of alloy systems, on the other hand, the addition of solute atoms may alter other properties rather than either that of viscosity or mode of solidification, and in that way modify the fluidity values. One example, the change in heat of fusion, has been already mentioned; the change in surface tension is the other. A phosphorus addition to copper-base alloys increases whilst an aluminium addition lowers the fluidity values. In both of these cases the surface tension of alloys is appreciably altered, and accounts for the sharp changes in fluidity, which are of the higher order than that caused by purely alloying effects of these elements.

Non-inherent Liquid Properties

For the understanding of the fluidity test it is necessary to consider the inherent properties of metallic liquids, but, from the foundry point of view of the utilisation and usefulness of the fluidity test in foundry control and production, it is the effect of non-inherent properties that is of general interest. For, in this case, the information required is whether gaseous or other types of inclusions are likely to affect, and in what degree, the length of the fluidity spiral as compared with that of an alloy of a good quality. In other words, one of the main practical applications of fluidity testing is that for metal quality control and for observations of trends and tendencies in production.

A. *Gas Content.*

In the majority of cases, dissolved gases are undesirable in molten alloys, as they lead to the formation of porosity in the finished casting. (There are, however, exceptions to this rule, and for the production of certain classes of castings; gases may be beneficial from the point of view of controlling solidification shrinkage or pressure tightness.) The essential feature of the mechanism of formation of gas porosity is that of concentration of gases (or gas-producing constituents) in the residual liquid during solidification. At a certain stage of this process, gases are liberated, and retained within the casting in the form of gas porosity, except in those cases where an outward passage of the gas to the free surface is still available. It is thus clear that gas liberation during solidification interferes with the flow of the metal during feeding of the shrinkage cavities.

There are two possible ways whereby dissolved gases may affect the results of the fluidity tests. Firstly, the solution of the gas may change the viscosity of the metal and, secondly, the liberation of the gas during solidification may interfere with the metal flow (mechanical effects). No experimental work is available so far to show which of these two mechanisms is more important.

The results that are available in this field show that the effect of gas varies with the rate of solidification of the spiral. In moulds where the rate of solidification is fast, the effect of the gas on the fluidity value is small. With slower rates of solidification (sand moulds), the effect of the gas is detectable in the fluidity test. As, however, this change is comparatively small (as compared with compositional and temperature effects), the fluidity test cannot be used generally as a gas control test (except under laboratory conditions).

B. *Surface Oxide Films.*

The nature of oxide films present on the free surface of liquid alloys plays an important part in all stages of production of castings: melting, pouring, and feeding. Two properties of oxide films that are important in this respect are their condition, *i.e.*, whether solid or liquid, and specific gravity. Weak solid films that are lighter than the parent metal (*e.g.*, zinc oxide films in brass) break readily and float to the surface. Strong films, on the other hand, form a continuous envelope around the metal stream. If these films are of a similar gravity as the parent metal, they tend to be retained in the alloy if torn away from the liquid surface (*e.g.*, light alloys).

The effect of solid oxide films on fluidity may show itself in several ways. Such films may:—(*a*) form a continuous film around the metal stream, in which case they raise the apparent surface tension and decrease the effective cross-sectional area of the flow channel; (*b*) be torn off at the flow surface and dragged, causing turbulent flow; (*c*) act as a thermal insulating film at the mould surface. The overall effect of solid oxide films is that of reducing fluidity values. Liquid oxide films, on the other hand, generally increase the fluidity value.

No experimental work has been reported to give quantitative data on the changes of fluidity produced by either type of oxide films. The evidence about the general nature of oxide film effects is, however, well established. The fluidity of aluminium is, for example, lower than should be expected from either its viscosity or heat content values. Similarly the value of fluidity spiral of aluminium is sharply reduced if the conditions of pouring are such that oxide films are torn off the surface, inducing turbulent flow. The effect of phosphorus addition to copper base alloys is, on the other hand, that of producing liquid oxide films on the parent metal, thus increasing the spiral fluidity values.

C. *Impurities.*

For the sake of convenience, this term is used in the present discussion to include all those constituents in liquid alloys, excluding dissolved gases, that are not intentionally added to secure the desired alloy properties. These constituents, metallic or non-metallic, and soluble or insoluble in the liquid metal, may affect either its viscosity or character of oxide films (and thus the surface tension).

Both soluble and insoluble impurity constituents affect the viscosity and thus fluidity of liquid metals. Insufficient quantitative data are available which are necessary to compare the relative effects of soluble elements. Yao's work[6] tends to show that in some binary systems, slightly soluble and insoluble elements reduce the fluidity more than readily soluble elements. Similarly, there are no quantitative data on the fluidity effects of insoluble compounds (mainly non-metallic in nature) except the work of Lips,[8] who found that flaky particles reduce the viscosity more rapidly than spherical particles.

On the other hand, there is a considerable amount of data of a general character to show that impurities may affect seriously spiral fluidity values. Yao[6] showed with zinc and some zinc-base alloys that fluidity decreases appreciably with the time of holding the metal above its melting point. Aluminium behaves similarly, as was shown by Krunitsky[9] and Yao.[6] The fluidity of light alloys is generally reduced by giving these metals a higher superheat, when the pouring temperature is the same as with the metal without superheating. If, on the other hand, the degree of undercooling of the alloy is increased by such treatment, the fluidity value is also increased. The technique of melting and deoxidation of copper-base alloys affects their fluidity values. The fluidity of cast iron is also affected by superheating times and temperatures.[5] Cast steel is known to be sensitive to the melting and deoxidation procedure.[5]

Whilst thus there is ample evidence that the condition of a liquid alloy affects its fluidity, the exact nature of the mechanism in different cases is little understood. If all the effects in a particular case (due to gases or impurities) are in the same direction, or if there are some strong changes in inherent liquid properties due to any single cause, then the fluidity test becomes metal-quality sensitive. This is one of the main applications of fluidity testing in foundry practice.

Remaining Problems

The fluidity test was conceived and is still carried out essentially as an empirical test. It has some good points and it has a number of limitations. The tendency of the most recent researches is that of providing the data that would allow a better understanding of the phenomena involved in fluidity testing. The provision of such data is still the main preoccupation in the more theoretical aspects of fluidity testing.

The fluidity test has also been used with a moderate success in the foundry industry. The main problem that remains here is of further simplifying the technique of testing without necessarily losing in its sensitivity. It is not very likely that one and the same type of fluidity test is going to prove equally suitable for all metals and alloys. Finding out the right type of fluidity test in each case and finding out right conditions for its use are the remaining important problems in this field.

References

A comprehensive list of published works on the subject of fluidity and viscosity is given in reference Nos. 1 and 2, and on the surface tension in reference No. 3, and will not be repeated here.

REFERENCES.

1 K. L. Clark, *Proc. Inst. Brit. Found.*, 1945-6, 39, A52.
2 V. Kondic, H. J. Kozlowski, *Journ. Inst. Metals*, 1949, 75, 665.
3 H. T. Greenaway, *Journ. Inst. Metals*, 1947, 74, 133.
4 C. H. Desch, *Proc. Inst. Brit. Found.*, 1936-7, 30, 77.
5 C. W. Briggs, *Metals Handbook* (*Amer. Soc. Metals*), 1948, 199.
6 T. P. Yao, Unpublished work.
7 A. M. Portevin, P. G. Bastien, *Proc. Inst. Brit. Found.*, 1935-6, 29.
8 E. Lips, H. Nipper, *Giesserei*, 1938, 25, 369.
9 A. I. Krunitsky, C. M. Saeger, *Met. Industry*, 1935, 46, 119.

New Catalogues

Light Alloys. International Alloys, Limited, of Haydon Hill, Aylesbury, Bucks, have just issued a particularly attractive book, which relates by text and illustration the purpose of their business. This consists of the production of the pure metal, and the compounding of alloys from this and refined metal for use by rolling mills and foundries. These functions are carried out on the grand scale in the most modern plant controlled by all the resources of science. The story is well told and the reviewer congratulates those responsible for the production of this high-grade addition to the technical reference library.

Centrifugal Casting Machines. From Richardson Engineering (Birmingham), Limited, Singleton Works, 329-333, Icknield Port Road, Birmingham, 16, we have received a four-page leaflet which illustrates and describes a centrifugal casting machine of Dutch origin. Most of our readers are well aware of the nature and advantages of the centrifugal casting process, and whilst this leaflet recalls them, it says insufficient about the actual machine—a fact which should be remedied in future publicity. This is recognised by the English agents, as a covering letter contains a wealth of technical information.

An Early Cornish Foundry

By T. R. Harris

It is not surprising that Cornwall should have been in the forefront of the industrial revolution when it is remembered that the county contained some very valuable mineral deposits, and, consequently, engineering and foundrywork were well advanced in the latter half of the eighteenth century. It is often thought that the development of Cornish mines was due to the inventions of James Watt, but actually many mines flourished years before the granting of his patent and a number of local engineers pioneered the way for him to exploit his ideas later.

Amongst these were George John and John Budge, both of Camborne. In a patent specification of 1755 the former is styled "engineer" and from the cost books of some of the old mines, such as that of Great Work for 1759-64, it is stated that payments to George John of Camborne, engineer, for casting brass work for the engine, were £30; for brass cylinder 10 cwt. (odd) at 1s. per lb. £59, and for brass working barrel £70, as well as payments for smaller work.

A reference to this foundry is found in a manuscript book of the old Tehidy Estate of Francis Barret. Presumably, George John died and the foundry was inherited by William John, for on June 1, 1767, the following memorandum is entered. "It is hereby agreed between Francis Barret and Mr. William John that the said William John shall continue to hold and Occupy the Works on Entral in Camborne called the Foundry and Plots, etc., thereunto belonging together with Pengigan Moor Water and Dolcoath spare Waters in the same manner as they have been lately used for the benefit of the said Foundry and without doing any prejudice to the mine of Dolcoath, at the yearly rent of Twenty pounds from the first of June, 1767, to the first of June, 1768, which said rent William John do hereby agree to pay the said Francis Barret."

The pay books of Dolcoath Mine for 1771-3 contain numerous references of payment to William John for "Foundry" and, after his decease, to Mrs. Mary John and later to Mary John & Company.

High Quality of Cornish Brass

On the advent of James Watt and his improved steam engine, many Cornish Mines bought various castings from Watt's friend, John Wilkinson, who had, on Watt's advice invested money in certain of the mines. From a letter written by Watt to Boulton on August 20, 1781, it appears that some of the adventurers in several of the Cornish mines were suspicious of the quality of the brass work being supplied and consequently at Wheal Virgin account an order was made to have a pump barrel assayed, and it was found to consist of 16½ parts of copper and 3½ lead. Watt writes "Without he (Mr. Wilkinson) makes some abatement there will be a noise about it and he will not easily get paid." Later on October 11, Watt again writes to Soho "Mr. Wilkinson has given no definite answer about his allowing the discount of 2d. per lb. to this mine (Wheal Virgin) which he did to the United Mines on the brass working barrels, and I assure you his brass is much inferior to Bouges, however, I shall leave him to settle the matter himself."

The interesting point is not so much the quality of Wilkinson's brass, as the fact that another Cornish Engineer, John Budge (referred to by Watt as Bouge, the local pronounciation of the name), had turned founder and was producing a material superior in quality to the imported article. It is almost certain that Budge was managing the old foundry of William John now known by the name of Mary John & Company. In July, 1788, Mary John & Company receives £55 10s. for a Brass Working Barrel from Cook's Kitchen adventurers and the same firm received various payments from the Tehidy Estate for sundry jobs, the latest being in September, 1787. Six years later, the sum of £1 13s. 9d. was paid to J. Budge & Company, for "brass pipes for the house pump." The inference is that Mary John died or sold her interest in the foundry sometime between 1787-93 and that Budge became principal partner.

Samuel Smiles suggests that Murdoch was invited by Budge "the Cornish Engineer—a man of means as well as of skill and experience" to join him in an engineering partnership, but "William remained loyal to the Boulton and Watt firm and in due time he had his reward." There appears, however, to have been some connection between Budge and Murdoch, for Richard Trevithick, writing to Mrs. Giddy on October 1, 1803 says "I have desired Captain A. Vivian to wait on you to give you every information respecting Murdoch's carriage—whether the large one at Mr. Budge's foundry was to be a condensing engine or not."

This pioneer foundry, which we know existed before 1760, flourished all through the nineteenth century, only to close in the early years of the twentieth, having served the neighbouring mines, not only with brass castings as at first but later with iron and, for a time, with crucible steel castings.

THE FIFTH ANNUAL GOLF TOURNAMENT of the Aluminium Development Association was held at the Stoke Poges Golf Club on June 20. Hosts for the day were Alar. Limited, and after dinner at the Bull Hotel, Gerrards Cross, the president of the A.D.A., Mr. Edward Player, distributed the various awards. The Horace Clarke golf trophy was won by Mr. W. D. Scott with a net score of 75, and the runner-up was Mr. P. M. Parish, who also scored 75, the decision being reached on the play of the last nine holes. Mr. G. A. D. Smith secured third place (77). A replica of the cup was presented to Dr. J. Jakobi, the 1949 winner.

Where is Cast Iron Going To ?*

By P. A. Russell, B.Sc.

The title "Where is Cast Iron Going To?" can be taken in two senses. First, where does the cast iron that we make go to? What markets and applications are open to it? Second, having started as a comparatively weak brittle material, recent developments are towards the production of a very strong and fairly ductil material—where is this leading to? It is this second aspect that will be stressed, although the first point also comes into the picture and has a bearing on the second.

TO discuss where cast iron is going to, it is necessary first to examine where it came from. It is fashionable in this year 1950 to review events over the last 50 years. So far as the metallurgy of cast iron is concerned the most important discovery was at the end of the 19th century by Turner and others of the effect of silicon. Next in importance there were the discoveries in cutting tools, first high-speed steel and then carbide-tipped tools, which have enabled cast iron to develop as it is known to-day. Prior to this, the prime consideration for cast-iron machinery components was to produce a material that could be tooled by ordinary carbon-steel tools, and very little progress would have been made if this limitation remained in force. The resulting change was that irons mainly pearlitic in microstructure could be used instead of irons mainly ferritic.

From this grew the control of carbon, first by amount, as in the production of "semi steel," particularly by Maclain, and then in size and form. It was found that the lower-carbon irons tended to be unduly brittle owing to the excessively large dendrites, with graphite in the same arrangement, and it was discovered that this could be changed to the more favourable "random" graphite by ladle addition of silicon or other graphitisers. The work of Smalley on this subject is well known, but the process was worked out quite independently by many other investigators, and no one process can claim to have a monopoly of this form of control.

There was also the realisation that phosphorus is bad for strength and soundness, in which work West was prominent. Thus, at present, high phosphorus is not permissible in irons of Grade 17 and over, and also in pressure-tight castings such as automobile cylinders and valves.

The net result of all the advance is shown in the progress of the requirements of British Standard Specifications. All grades of iron to the latest specification (B.S. 1452) are now in regular production, with the possible exception of Grade 26, which is normally only met by heat-treated irons or by the "acicular" irons. No survey of progress in the half century would be complete without reference to the irons in which the matrix has been altered by the use of alloys—the austenitic irons, martensitic irons, high-silicon and high-chromium irons. All these, however, are special-purpose irons and they are excluded from the general trends discussed in this Paper. This naturally leads to the consideration of nodular cast irons.

* A Paper presented to the Lancashire branch of the Institute of British Foundrymen, and in a modified form to the East Midlands branch and the East Anglian section of the London branch. The Author is past-president of the East Midlands branch.

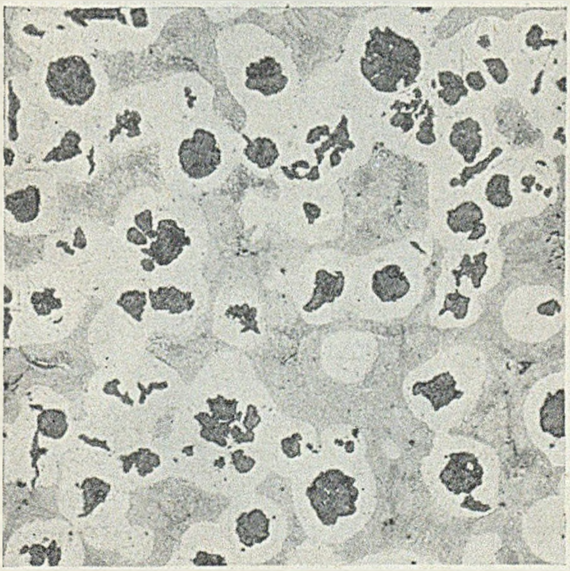


Fig. 1.—Microstructure of Nodular Iron, Cerium Treated. × 100.

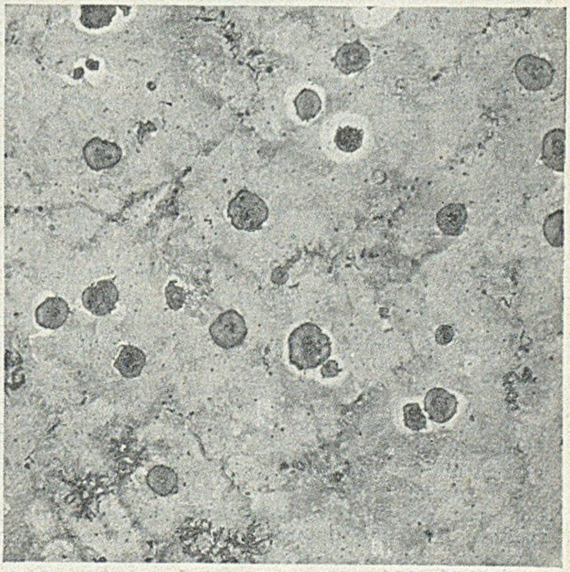


Fig. 2.—Microstructure of Magnesium-treated Nodular Iron. × 100.

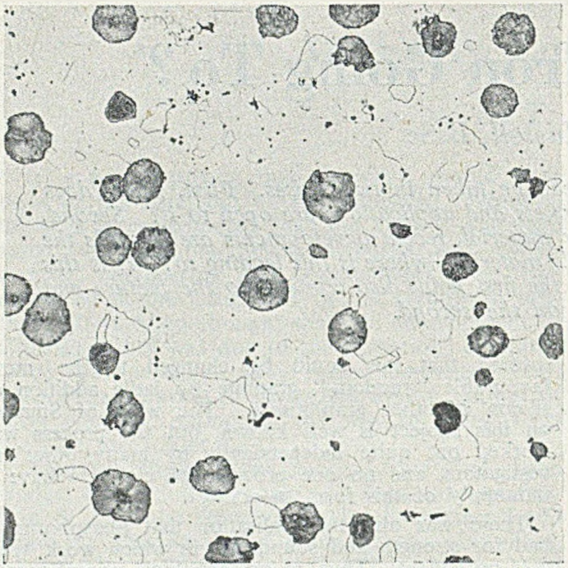


FIG. 3.—MICROSTRUCTURE OF NODULAR IRON AFTER ANNEALING. × 100.

NODULAR CAST IRON

The discovery as to how cast iron can be produced with graphite in the nodular form as cast, by Morrogh[1] and his associates working at the British Cast Iron Research Association, is undoubtedly one of the major metallurgical discoveries of the century, and it is particularly interesting that this discovery was the result of pure research on graphite formation. The results of the work on cerium treatment of cast iron are now well known and have been fully reported to this Institute.[2] Donoho[3 5] and others, working in the United States, have produced similar graphite structures by treating the iron with magnesium, and some work has also been done by the Meehanite Metal Corporation,[4] but the methods used are not disclosed.

Apart from some experiments in the early stages, the Author has not produced nodular cast iron and he is not in a position to give any facts concerning its production beyond those published by various workers. All he can do at this stage is to outline the present position of the development of these irons as disclosed by the literature. Both processes depend upon the virtual elimination of sulphur from the iron, with traces of the treatment elements remaining.

So far as has at present been disclosed, the cerium method works best with iron containing carbon above the eutectic amount, with a fairly high silicon and inoculated with ferro-silicon, or similar material, after treatment. The resulting structure is normally that shown in Fig. 1, consisting of nodules of graphite mainly in a background of ferrite with some pearlite. The resulting iron has about 35 tons per sq. in. tensile with 2 to 4 per cent. elongation. It is thought that it is possible to produce a matrix containing much more pearlite, thus increasing the tensile strength and reducing the elongation. The production of irons with carbon above the eutectic and low in sulphur presents certain problems, but it is an undoubted advantage of this iron that the shrinkage characteristics do not present a very serious problem and, so far as personal experience shows, the feeding problems are no greater than those of high-duty cast iron of grade 20 or higher.

On the other hand, the magnesium process works with iron having carbon below the eutectic amount. The

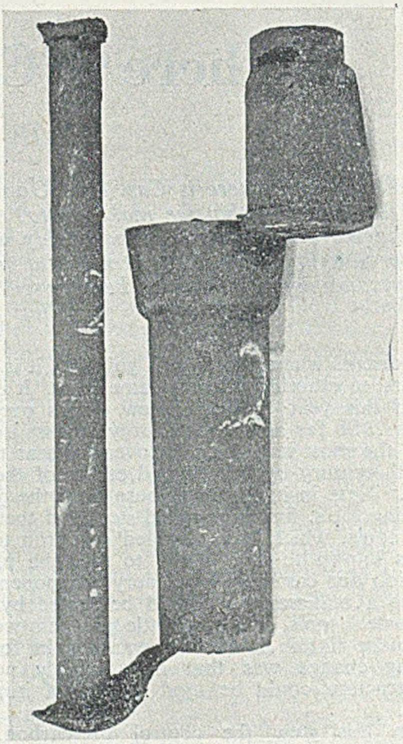


FIG. 4.—METHOD OF RUNNING AND FEEDING CYLINDRICAL CASTINGS FOR CERIUM-TREATED NODULAR IRON.

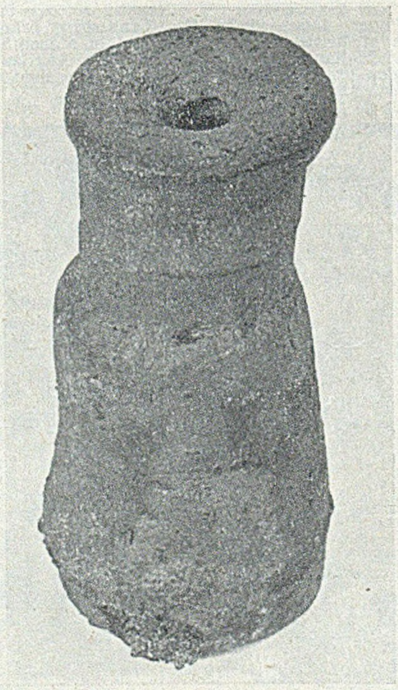
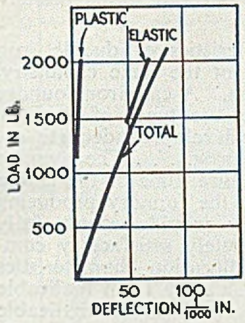


FIG. 5.—ADDITIONAL HEAD USED FOR MAGNESIUM-TREATED NODULAR IRON.



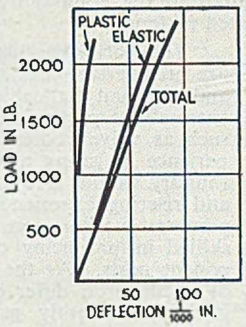


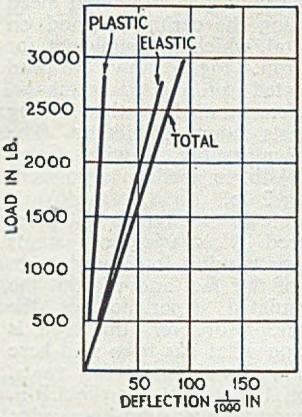
Fig. 6 (left).—Transverse Test, Material No. 1, B.S. 1452, Grade 10, E = 12.5 × 10^6 lb. per sq. in. One-inch dia. Bar at 10-in. Centres.

Fig. 7 (right).—Material No. 2, B.S. 1452, Grade 14, E = 13.9 × 10^6 lb. per sq. in.

resulting structure is almost completely pearlitic, as shown in Fig. 2. This iron has strength of about 45 tons per sq. in. with one to two per cent. elongation. The shrinkage problems with this type of iron appear to be considerable.

It is possible to anneal these irons, using a comparatively-short annealing cycle, to make them fully ferritic, when the structure, shown in Fig. 3, resembles that of blackheart malleable and the tensile strength is about 30 tons per sq. in. with about 10 per cent. elongation. The magnesium iron gives better results on full annealing than the cerium iron, partly owing to the lower initial silicon content, although the annealing cycle is longer.

To summarise—to date there are three types of nodular irons available:—(1) The cerium iron, mainly ferritic, as cast; 2) the magnesium iron, mainly pearlitic, as cast, and (3) either of these annealed, fully ferritic. All have some degree of ductility, and give impact values which are too great to be measured by the present standard method for cast iron.



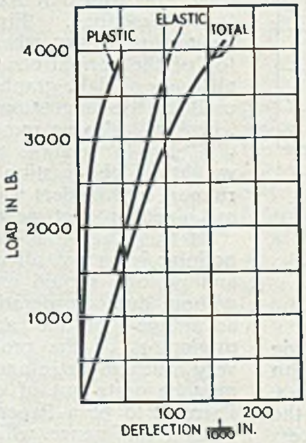


Fig. 8 (left).—Material No. 3, B.S. 1452, Grade 17, E = 16.2 × 10^6 lb. per sq. in.

Fig. 9 (right).—Material No. 4, B.S. 1452 Grade 20, E = 15.9 × 10^6 lb. per sq. in.

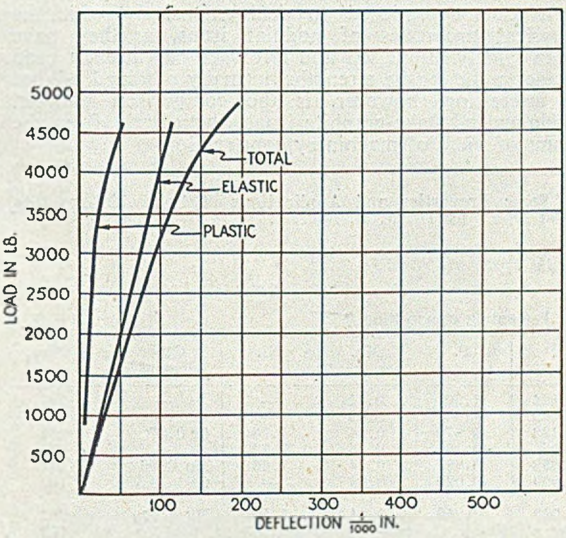


Fig. 10.—Material No. 5, B.S. 1452, Grade 23, E = 17.2 × 10^6 lb. per sq. in.

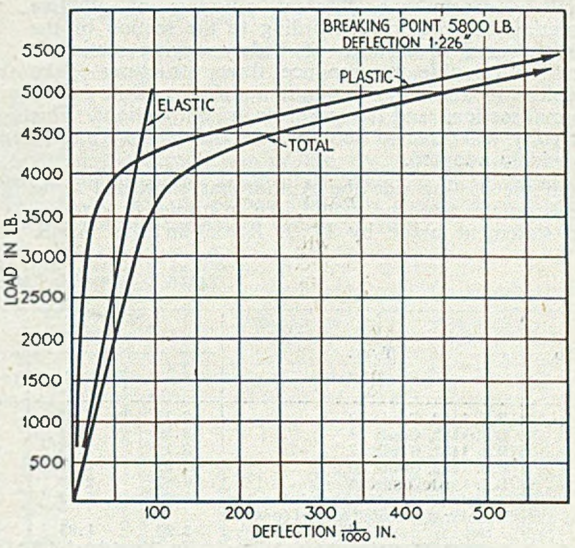


Fig. 11.—Material No. 6, Nodular C.I., Cerium Treated, E = 21.5 × 10^6 lb. per sq. in.

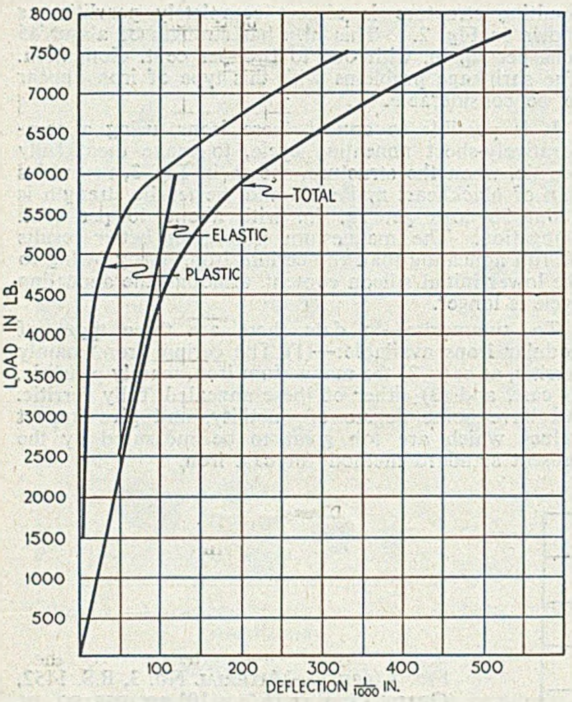


FIG. 12.—MATERIAL NO. 7, NODULAR (MG), "AS-CAST," $E = 22.0 \times 10^6$ LB. PER SQ. IN.

Production Problems

On the production side, the problems seem to include the production of liquid iron, low in sulphur, with sufficient superheat to stand the various ladle processes. There is some evidence that it is difficult to assess the exact amount of addition required, and that excess addition can give trouble with free carbides while insufficient addition gives flake graphite. There is also some evidence that different amounts of additive materials are required according to the section of the casting,[4] and in castings of widely-varying section it may be possible to produce three structures—flake graphite in the heavy sections, nodular graphite in the normal sections, and free carbides in light sections. This difficulty will have to be overcome before the iron can be widely adopted.

On the casting side the Author has expressed some views on this, and he would like to quote, *in extenso*, the statement made by D. J. Reese in the A.F.S. Symposium on Nodular Irons,[3] referring to magnesium-treated material:—

> "The shrinkage characteristics of ductile iron are greater than cast iron of the same chemistry, and less than malleable iron. A cast iron foundry successfully producing pressure types of castings, such as valve bodies, has developed adequate experience in gating and risering. . . . The average foundry would have to acquire some of the gating and risering experience of the foundry producing pressure work before they would become fully skilled in producing completely satisfactory component parts. As the solidification characteristics of ductile iron differ considerably from malleable iron, a sufficiently gated arnd risered malleable pattern might not produce sound ductile iron castings as there could be reverse feeding from casting to riser. That is, some of the risering provisions for malleable would have to be removed for ductile iron."

The only personal evidence that can be offered is in the castings produced for the Author by the British Cast Iron Research Association for the cylinders later to be described. Fig. 4 shows the additional head deemed necessary when using the cerium method on top of the normal head metal, which was sufficient for all types of flake-graphite iron. Fig. 5 shows the head used for the magnesium-treated iron and the shrinkage. There will also be some reference made to this feeding difficulty in relation to tests later described. The weight of the casting shown in Fig. 4 with down-runners and feeders was 28½ lb. to produce a finished-machined product weighting 2 lb.

At this stage it is desirable to point out that these nodular irons are all covered by a variety of patents and no one should envisage rushing into production without due consideration of this fact and without the advantage of the accumulated experience of the originators of the processes. Moreover, this iron is very much in its infancy, and what has been said here may be quite out of date within the next few years. There is to be a Paper* on the subject for the I.B.F. Buxton conference, which may take existing knowledge of nodular irons much further.

Physical Properties of Nodular Iron

It is not proposed to deal extensively with the physical properties of nodular irons, as they have been widely publicised and reference has already been made to the tensile strengths normally obtained. What is interesting, however, is the comparison between nodular and flake-graphite irons, particularly from the point of view of machinery construction.

* Some Properties and Applications of Spheroidal-graphite Cast Iron." by Dr. A. B. Everest.

TABLE I.—*Materials Used for the Transverse Tests.*

No.	Type.	Percentage composition							B.H.N. ⅜ in. section.
		T.C.	Si.	S.	P.	Mn.	Ni.	Other elements.	
1	B.S. 1452, Grade 10	3.11	2.61	0.124	1.30	0.41	—	—	197
2	B.S. 1452, Grade 14	3.30	2.44	0.109	1.04	0.69	—	—	248
3	B.S. 1452, Grade 17	3.11	1.75	0.133	0.670	0.64	1.13	Cr 0.37	255
4	B.S. 1452, Grade 20	2.97	2.13	0.05	0.10	0.65	1.73	—	235
5	B.S. 1452, Grade 23	2.87	2.09	0.058	0.087	0.54	1.26	Mo 0.36	244
6	Nodular Ce-treated (mainly ferritic)	3.63	3.00	0.009	0.029	0.63	—	Ce 0.065	197
7	Nodular Mg-treated as-cast (pearlitic)	3.20	1.85	0.020	0.049	0.44	1.56	Mg 0.070	262
8	Nodular Mg-treated annealed (ferritic)	No. 7 heat-treated for 12 hr. at 950 deg. C., cooled to 700 deg. in 8 hr., held for 8 hr. at 700 deg., and slowly cooled							152
9	Bright-drawn steel	Carbon 0.15							134

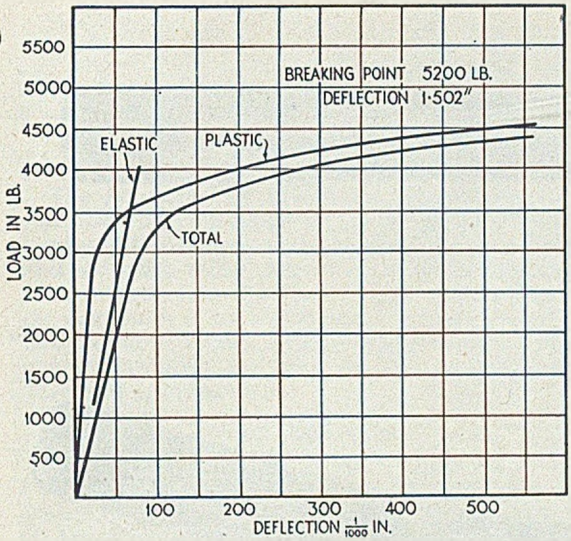


FIG. 13.—MATERIAL NO. 8, NODULAR (MG), FULLY ANNEALED, E = 23.0 × 10^6 LB. PER SQ. IN.

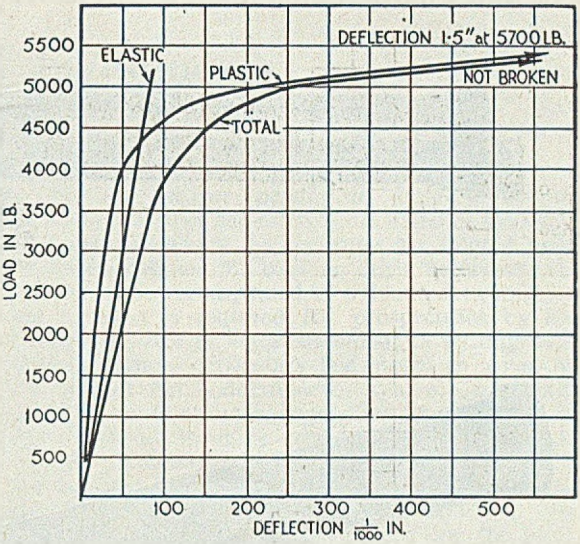


FIG. 14.—MATERIAL NO. 9, B.D. MILD STEEL, E = 25.6 × 10^6 LB PER SQ. IN.

Probably one of the best methods of evaluating the relative value of various irons, is the transverse test as carried out in the manner recommended by Pearce,[7] so as to separate plastic and elastic deflection and give a measurement of the elasticity value. Most iron castings are used at stresses very much lower than breaking stress and it is important to know their behaviour as regards deformation under load, how much they deflect and whether this deflection is permanent (plastic) or is recovered on removal of the load (elastic).

Transverse Tests

A series of transverse test-bars was prepared 1 in. diam. by 12 in. long (tested on 10-in. centres). They were cast 1.2 in. diam. and machined to size. The reason for the choice of this unusual size was the difficulty of producing nodular irons in bars with any greater length-to-diameter ratio without "starvation" in the centre. The nodular-iron bars were prepared for the Author by the Research Association. In spite of special precautions there were signs of inadequate feeding as the tensile strengths obtained were rather lower than the structure warranted. Tensile bars for nodular iron are best prepared from keel blocks, as used for similar tests on steel. It is also relevant to point out that sound malleable bars could not be made to the dimensions 1.2 in. diam. by 12 in. long.

Five types of flake-graphite irons and two of nodular test-bars were prepared, plus one nodular fully annealed and a piece of bright-drawn steel. These are set out in Table I, which shows the analysis and Brinell hardness, the latter being taken from a ring parted-off from the bottom of the cylinder castings to be described later. The structures of the three nodular irons tested are those in Figs. 1, 2 and 3.

All the bars were tested in transverse and the results are shown in Figs. 6 to 14. All the graphs are on the same scale and in examining them it should be borne in mind that:—

(1) The more nearly vertical the lines for plastic and total deflection, the less the irons will "give" under load.

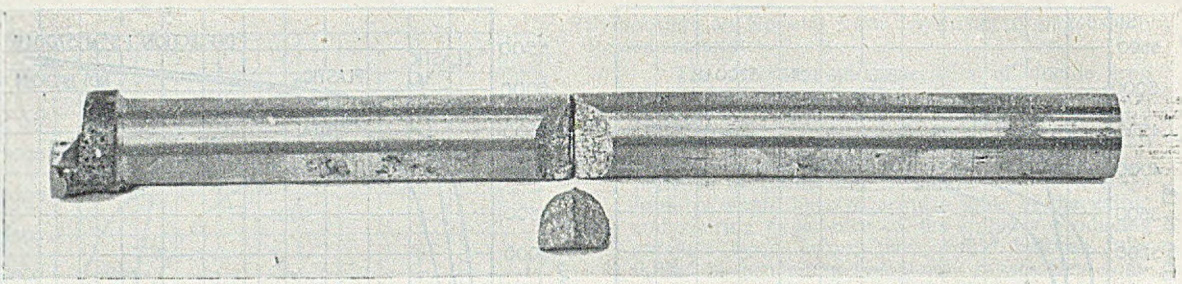
(2) The higher the plastic deflection line goes before commencing to bend over, the more load the iron will carry without serious distortion.

(3) The more nearly vertical the line for elastic deflection, the higher the E-value.

The results of these tests are more easily interpreted from the summary given in Table II which gives the results as in an ordinary transverse test in the first two columns and then states the deflection, plastic and total at certain definite loads. It is not intended to discuss in detail the comparison of the various flake-graphite irons, but the high rigidity of No. 3 is noteworthy. This is an iron developed for wear resistance and is not necessarily typical of Grade-17 Iron.

TABLE II.—*Transverse Tests on 1 in. Diam. Bars at 10 in. Centres.*

No.	Material.	Transverse rupture stress, tons per sq. in.	Defl., in.	"E" × 106 lb. per sq. in.	Deflection at 2,000 lb.		Deflection at 3,000 lb.		Deflection at 4,000 lb.	
					Plastic.	Total.	Plastic.	Total.	Plastic.	Total.
1	B.S. 1452, Grade 10 ..	25	0.082	12.5	0.010	0.080	—	—	—	—
2	B.S. 1452, Grade 14 ..	27	0.091	13.9	0.013	0.075	—	—	—	—
3	B.S. 1452, Grade 17 ..	34	0.092	16.2	0.010	0.062	—	—	—	—
4	B.S. 1452, Grade 20 ..	48	0.156	15.9	0.009	0.063	0.020	0.100	—	—
5	B.S. 1452, Grade 23 ..	56	0.190	17.2	0.010	0.058	0.016	0.090	0.035	0.133
6	Nodular (Ce), as-cast ..	66	1.226	21.5	0.007	0.048	0.016	0.076	0.059	0.137
7	Nodular (Mg), as-cast ..	80	0.539	22.0	0.004	0.044	0.006	0.065	0.013	0.089
8	Nodular (Mg), annealed ..	59	1.502	23.0	0.010	0.050	0.023	0.080	0.207	0.277
9	Bright drawn steel ..	Not broken	1.5	25.6	0.014	0.049	0.023	0.100	0.047	0.111



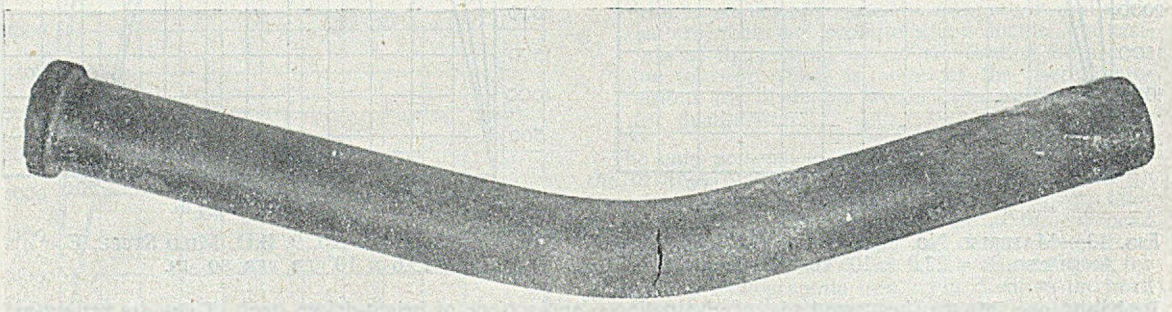


FIG. 15 (UPPER).—MAGNESIUM-TREATED NODULAR IRON, BROKEN AS-CAST. (LOWER)—DUPLICATE BAR, BROKEN AFTER ANNEALING.

No. 7, the magnesium-treated nodular iron, is undoubtedly a very strong iron and shows very little plastic and elastic deflection at 4,000 lb. load (half its breaking load). No. 7 may be generally classed as being twice as strong as No. 4, but it will be noted that the plastic and total deflection of No. 4 at 2,000 lb. (half its breaking load) is considerably less than No. 7 at 3,000 lb. Therefore if No. 7 iron was substituted for No. 4 in a casting which required to stand double the normal load, the casting would deflect more. The same is true at half these loads, namely, at 1,000 and 2,000 lb. respectively. The same is true if No. 6 be similarly regarded as a substitute for No. 5 at 50 per cent. overload. The annealed nodular iron, whilst still very strong, is obviously much more plastic and at loads of 3,000 lb. and over the plastic deflection is much greater than that of any of the other irons listed.

No. 9, that is, bright drawn steel, is very interesting in that the shape of its graph is very similar to that of No. 8 (annealed nodular iron), but higher stresses are reached before the very high deflections set in. It is noteworthy that the graph for this does not conform to the usual stress/strain diagram for steel, in that plastic deflection sets in almost immediately, indicating that, in the transverse test with central-point loading, the elastic limit is locally very quickly reached. The loading point, which has a radius not a knife edge, dug 0.006 in. into the specimen before the test was completed and this may have some influence on the result, but not enough to vitiate the whole conclusions.

Before leaving Table II it is worthwhile to touch briefly on the "E"-values disclosed. The steady increase as the strength of the iron increases, will be noted. The efficiency of this type of transverse testing was demonstrated by the remarkably-straight lines obtained for elastic deflection. If the transverse test is to be really useful, it should be conducted in this manner. The ordinary "break" and "total-deflection-at-break" test should be used merely for routine control checks on iron of the same types, and not to compare irons of different types.

It is important to note that the E-value of mild steel as disclosed in this type of test only reaches 25.6×10^6 lb. per sq. in., whereas this is recognised to be at least 29×10^6 lb. per sq. in. in real fact. It would appear that the E-values disclosed are all low, but this would require confirmation. (A test on black mild steel carried out after Table II was prepared gave E-value = 28×10^6 lb. per sq. in.)

Fig. 15 shows the appearance of the two magnesium-treated nodular irons after testing. The appearance of the "as cast" bar (upper) seems to indicate that compression takes a large share in the actual cause of fracture. On the annealed sample (lower) the bar did not actually break but only cracked.

REFERENCES.

1 Morrogh, H., and Williams, W. J., "Graphite Formation in Grey Cast Iron," *Proc. I.B.F.*, Vol. XL, 1946-47, p. A47.
2 Morrogh, H., and Grant, J. W., "Nodular Cast Irons: Their Production and Properties," *Proc. I.B.F.*, Vol. XLI, 1947-48, p. A.29.
3 American Foundrymen's Society, Symposium on Production of Nodular Graphite Cast Iron, *American Foundrymen*, 1949, Vol. XVI.
4 Austen, C. R., "Some Engineering Aspects of Nodular Cast Iron," *Iron Age*, Vol. 164, No. 22.
5 Donoho, C. K., "Producing Nodular Graphite with Magnesium," *American Foundrymen*, 1949, XV, 30-37.
6 Braidwood, W. W., and Busby, A. D., "Speroidal-graphite Cast Iron," FOUNDRY TRADE JOURNAL, Sept. 15, 1949, p. 327.

RESEARCH for the Dunlop Rubber Company, Limited, and their 25 home and 16 overseas factories will in future be carried out at a new centre at Fort Dunlop, Birmingham, which was opened recently by Sir Lawrence Bragg, Cavendish Professor of Experimental Physics at Cambridge University. The centre comprises 50 fully equipped laboratories, as well as a cinema and lecture theatre.

Investors and Investments

By F. J. Tebbutt

The Prevention of Fraud (Investments) Act is a measure which makes general provision for preventing fraud in connection with dealings in investments and securities. This Act was not much publicised when it came into operation in late 1944, owing to the war, but it is a measure which is actively applied and should be known, as most business people (and people privately for that matter) are naturally interested in investments.

Stock Exchanges

The Act provides that a list of members of the London or other stock exchange or association of dealers in securities, must be furnished to the Board of Trade yearly, with name and business address given and the style under which the business is carried on (if a corporation the name of each director is required). Moreover the Board of Trade can at any time ask a stock exchange or association, etc., for a list in respect of any specified member, or persons who are for the time being authorised by that member to deal in securities on his behalf. But the Act as regards licensing (shortly explained), etc., does not apply to the foregoing bodies and persons.

Licences Required

For any person not a member of a body as above (there are exemptions also) licensing is required. That is, any person carrying on the business of dealing in securities must have a principal's licence, and a representative's licence is required by any servant or agent of the concern; thus proprietors, directors, managers, partners, etc., are all included. Licences are renewable each year, the fee for a principal's licence being £25 p.a. for a company, and £10 per person for any other concern (the maximum however is £25, no matter how many partners there may be in a partnership); the fee for a representative's licence is £2 p.a.

Furthermore, in connection with a principal's licence there must be £500 deposited ordinarily with the accountant general of the Supreme Court, but an approved guarantee may be accepted by the Board of Trade. In cases where the applicant has been a dealer in securities since the beginning of 1939, the Board of Trade may dispense with this deposit requirement, if it is thought that it would cause undue hardship for a deposit to be made.

The object of this provision is to protect investors by only permitting sound firms to operate, and there are certain rules of trading also which must be observed, or the licence may be revoked. The Board can refuse (or revoke) a licence on various grounds, as for instance when in formation concerning the business has not been forthcoming, or if the applicant, an associate, or an employee has been convicted of fraud or dishonesty, or of an offence under this Act, and generally where it is considered that the person concerned is not a fit and proper person to hold a licence.

When securities are offered, the name of the stock exchange on which the securities are quoted must be given and, in the case of other securities, the offer must be accompanied by a document conforming to what is required for prospectuses by the Companies Act or by a statement in writing containing certain particulars laid down in rules of the present Act under review. Where a sale takes place, a contract note (signed by the dealer and duly stamped) must be issued which must include various particulars such as, name and address of the licensed dealer with names of the partners or directors as the case requires, nationality, the amount and description of the securities; the price (*i.e.*, per share or unit of stock); the amount of the consideration money; if any commission is charged, the rate and amount there of the amounts of all stamp duties (if any); and the date of settlement.

Exemptions

In addition to stock exchanges and association of dealers in securities, there are others not required to be licensed as follow:—the Bank of England; any municipal or statutory corporation (ordinary companies under the Companies Act are of course included under this Act); and there are what are known as "exempted dealers," exempted by the Board of Trade. An "exempted dealer" is, roughly, one where the main business is one other than dealing in securities and where the greater part of the "securities" business is done with an excepted concern or a licensed dealer; banks, finance houses and so forth are examples. Furthermore there is general exception for underwriters of shares, etc., or where the business is done with the bodies excepted (*e.g.*, stock exchange members, etc.), or a licence holder under this Act; this provision covers insurance companies, investment trusts, solicitors, and so forth.

Circularising in connection with investments (except by a licensed dealer or any of the persons or bodies excepted) is prohibited, but this does not mean the distributing of prospectuses or similar documents associated with the requirements of the Companies Acts.

Industrial Space Heater. Since the 1937 Factory Act attention has been focused on space heaters. Tangyes, Limited, of Cornwall Works, Smethwick, Birmingham, have just issued a new catalogue which describes and illustrates a type which is popular in foundries. It is solid-fuel-fired and incorporates good principles of economic heat production and dissemination. One model has a grid around it on which is shown a teapot! This is better than a red-hot casting, but it is not considered quite *comme il faut* in the best-managed works. Complete technical data have been included. We suggest that the summer time is appropriate for giving attention to the question of winter heating, and that readers should write to Tangyes for a copy of this interesting booklet.

Flotation of Cores

By " Chip "

Many castings are scrapped in the foundry due to the shifting of a core during pouring. Occasionally, this is due to some oversight of the moulder, but often the cause is due to some fault in design, and a slight modification would convert an otherwise risky job into one comparatively simple from the point of view of core movement.

For example, certain structural castings, of which Fig. 1(a) is typical, are prone to this trouble due to the

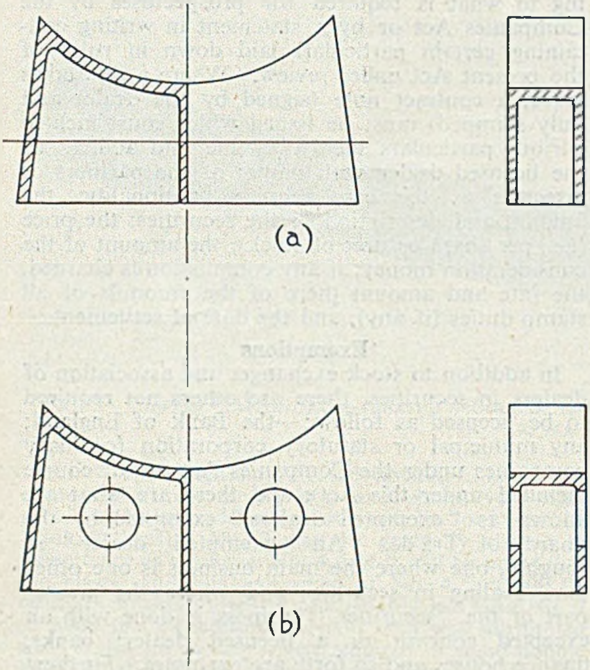


FIG. 1 (*a*).—THE CORE OF THIS TYPE OF CASTING IS LIABLE TO FLOAT OUT OF POSITION DURING POURING. (*b*) SUGGESTED MODIFICATION: THE LARGE HOLES THROUGH THE PLATE SUPPORT THE CORE AND PREVENT ITS LIFTING.

" lift " resulting from the ferrostatic pressure of the metal, and unless special precautions are taken the core floats out of position and causes a waster, or at best an unsightly casting. This is often due to the lack of rigidity of the mould or core allowing of the studs keeping them the correct distance apart being pressed into either the mould or core. To avoid this, pieces of material which will not yield easily can be rammed into both the mould and core. For light castings, pieces of firebrick are ideal, but for castings carrying heavy sections of metal, iron inserts are to be preferred. Those in the mould can be secured to the box bars, whilst those in the core can be made integrally with the core-grid. The position these are to occupy should be clearly marked on both the pattern and core box, so as to correspond when the job is assembled.

Whenever possible, however, a modification in design is to be preferred whereby these expedients can be dispensed with. The alteration required is to cast a number of large holes through the plate of metal as Fig. 1(b) which are of sufficient area adequately to support the core in the bottom and prevent its lifting to the top.

Business Administration Scholarships, 1950

The Dean and Faculty of the Harvard School of Business Administration jointly with the chairman and Council of the British Institute of Management, are offering two scholarships in 1950, at the Business School. Funds for one of these scholarships are being provided by Harvard; the other is the result of subscriptions from British industry.

The scholarships, which are tenable for two years, are designed not only to maintain the student for the full two years of the course, but also to provide adequate subsistence and travel during the vacations. The value of each will be $2,400 (£860) per year. Travel to the United States will be provided under the Fulbright Scheme.

Conditions of Entry

Applications are invited from men of British nationality of adequate educational standard, who are potential managers, university graduates or who occupy junior positions in industry, commerce, labour organisations or the public services. Special attention will be paid to the qualities of intellect and personality essential to the successful exercise of managerial responsibility. It will be a qualifying condition that the candidate is already making or intends to make his career in British business.

Application forms may be obtained from the head of the Educational Development Department, British Institute of Management, Management House, 8, Hill Street, W.1, and must be returned not later than June 30, 1950. Applicants may be required to attend a preliminary interview in London at short notice, and successful candidates will be expected to join the Business School by September 20, 1950.

Wage Freeze Opposition

The demand for a wage increase would become even more pressing now that coupon rationing was gradually being superseded by price rationing, said Mr. A. M. McDougall in his presidential address at the annual conference of the Amalgamated Union of Foundry Workers at Bridlington on June 19. He said that at no time had the Union agreed that wage freezing was the answer to the country's economic difficulties. It was contrary to Socialist teaching to suggest that full employment could be maintained by curtailing the purchasing power of the people, Mr. McDougall added.

A resolution demanding equal pay for women in industrial and professional jobs, to eliminate a source of cheap labour, was passed unanimously by the conference. It was said by one delegate that the introduction of female labour into the foundries was not for the benefit of the foundry worker but only for the employers.

On June 20 a resolution calling for a £1 weekly increase for all engineering workers was carried unanimously. Mr. J. Gardner, the general secretary, told the conference: " Profits continue to increase and prices to rise; a wage increase is overdue and should be granted out of the swollen profits of the engineering industry." He announced that his Union's figures in the ballot of the 37 organisations affiliated to the Confederation of Shipbuilding and Engineering Unions to decide between strike action and arbitration on their rejected wage claim did not favour strike action.

THE 1951 CONGRESS of the *Association Technique de Fonderie* will be held towards the end of May, and Papers are being solicited. These should reach the secretary at 2, Rue de Bassano, Paris XVI, before January 15, 1951.

Visiting Someone Else's Foundry*

By W. Amos

There are few things that a foundryman enjoys more than to take discriminating visitors round the foundry in which he works. Of course, the thing that he enjoys even better, is to become one of the discriminating visitors being shown round another man's foundry, and it is with this pleasure that the writer is concerned. Quite apart from the temporary relief from the problems, cares and concerns of his daily routine, the keen foundryman will always experience pleasureable anticipation. This anticipation can be attributed to the quest for knowledge in any field which will be of advantage in his own foundry; the making of new and the meeting of old acquaintances; and the confidential exchange of these scraps of information, which are often looked upon as being the key to success.

The thoughts entering one's mind are mainly concerned in forming a picture of the foundry to be visited. In the case of a previous visit having been made to the same foundry, the construction of the picture is somewhat easier. One generally reflects on those points leaving the strongest impression from the previous visit, those personally applied during the course of one's occupation, or what was behind that certain door away from which the guide deliberately ushered the visitor. Certain operations, possibly not fully understood, will undoubtedly be noted for further investigation, along with any changes that may have been made. If however, no previous visit has been made, the picture is sometimes rather difficult to imagine. In this case, one usually considers the reputation of the foundry in question. This may be judged by visual experience of various castings produced, or alternatively, believing the views of some prejudiced individual who has worked there for quite a number of years. One thereby usually obtains very glowing contrasts, and can only be definitely sure of the foundry's reputation if the castings were bad ones in the first place. The original work of any individual on the foundry's staff may be considered as really worthwhile acquaintance. Generally, however, one appears to find the superior attitude adopted, that attitude which causes well-accepted facts to become questionable at some inopportune moment.

Nature of the Visit

It is then essential to consider the type of visit, this being either as a large party split into various groups, or a personal visit of two or three persons. In the first case, one must expect something of a show to be put on, the guides being picked more on their willingness to spend a Saturday afternoon amongst all too familiar surroundings, than on their ability as guides. In the smaller class of visit, a well-seasoned guide, probably an expert in sales talk, is often encountered. The foundry in the latter case, is generally in the "take it, or leave it" condition, and the ensuing visit usually much more interesting.

At the start of the visit, one is usually too engrossed in the approach, and the first impressions of the foundry layout, suitability of access, etc., to pay much attention to any official welcome. The visit usually starts from some lecture room, where the visitors are carefully briefed for the arduous but interesting task ahead. This frequently consists of some executive expressing his regrets at his coke ovens having blown up the day before, and that these will not be visited, as a result; or there are other distressing mishaps.

Guides

At this stage one meets the most interesting feature of the visit, that being the guide. This gentleman is usually approached along the same lines as a new workmate. His position on the works gives a certain amount of information but it is essential to distinguish between the two types usually met with. These are the academic, highly technical apprentice type, and the straight-down-to-earth foundryman. The academic type of guide is very useful, but tends to bore the visitor by elementary slips on working procedure and basic practice, so that the visit takes on a farcical note. On the other hand, a list of equations occurring inside a particular furnace complete with details of heat changes is often very useful. During visits of this nature, one finds oneself wandering towards an old labourer leaning on his shovel, to supplement the information, much to the dissatisfaction of the guide.

Where the old-foundryman type of guide is met with, the success of the visit depends more than ever on the visitor. If that visitor can co-ordinate the practical information received with a technical explanation known, a great amount of knowledge is gained. Each type of guide, however, seems to encroach into the other's sphere, and usually ends by making a statement which the visitor may strongly disbelieve, or see that the opposite is done. This has a marked effect on the visitor, who may as a result of human nature being what it is, proceed to wrap, pack and parcel up the poor guide on the subjects he knows least about. The very rare combination of practical and theoretical qualities may be found in the guide from whence one can expect a most enjoyable visit.

The mental ability in general of the visitor contributes greatly to a successful tour. The type of work done should fall within his particular field of interest. He must be very observant of minute detail, and also have the ability to question intelligently. The visitor must be able to assess the value of any knowledge or experiences gained, and to modify it if necessary to suit any particular purpose. Naturally, one must see as much as is possible, ask as many questions, and also notice as many faults in the operational side of the foundry as can possibly be observed. Important details on the layout should be noted, the ease by which a casting is despatched from one operation to another, along with the amount of control exercised in daily practice.

The visit over, the foundryman will return to his own foundry, weigh up the points in favour of his and the visited foundry, but it is only natural that a quick decision is reached as to which is by far the most modern, efficient, and successful.

Controversial points being settled, and the best of the new ideas incorporated, the foundryman's mind usually reverts to dwell upon the free tea, given in such great style, which rounds off the visit: leaving the picture imagined before the visit absolutely shattered.

---

* An entry for a Short Paper Competition organised by the East Midlands branch of the Institute of British Foundrymen.

Glasgow Royal Technical College

Sir Andrew McCance is the new chairman of governors of the Royal Technical College, Glasgow, following the resignation of Sir James French, which was intimated at the meeting of governors on June 13, when Mr. Alex. Turnbull, who presided, was elected vice-chairman. Sir James, who has been chairman since 1945, will give up his seat on the board when his term of office expires in October.

Mr. Turnbull said that Sir James had taken this step on the grounds of health and partly on account of other commitments. A resolution was passed expressing appreciation of the services given by Sir James. Sir Andrew McCance is deputy chairman and joint managing director of Colvilles, Limited, and one of Britain's leading metallurgists. Two new governors—Sir Murray Stephen and Mr. Gabriel Steel—were given a warm welcome.

The opinion that the college was going ahead of other technical institutions in the country by extending their works training scheme was expressed by Dr. J. W. M'David in a reference to the scheme for sending final-year students to the Ardeer factory of Imperial Chemical Industries, Limited, for training on the lines followed by the Massachusetts Institute of Technology. The scheme would be one of the first of its kind in the country and he thought it would give graduates and undergraduates some idea of the sort of work they were likely to meet in industrial establishments.

As there was the possibility that research work conducted in the College might yield inventions of commercial value, the governors agreed that such inventions should be patented. Reference to the College extension scheme in Montrose Street was made by Mr. Turnbull. The site had already been cleared and the recommendation of the Scottish Building Committee for the contract for excavation and foundation work was already in the hands of the Scottish Education Department. Work on this contract should be started within the next few weeks.

British Standards Institution

Simple Bend Test (*BS* 1639 : 1950)

The material contained in this standard was originally intended for the use of Committees of the Institution as guidance in preparing specification requirements for a simple bend test, but as there were indications that a wider dissemination would be appreciated, it was decided to publish it in the general series of British Standards as "Notes on the Simple Bend Test." Although the simple bend test is widely used to give a ready qualitative assessment of the ductility of a metal, it is not generally appreciated that certain features of the test, probably because of its simplicity, have to be given due consideration when the precise form of the test is being decided, or when the value of the test is being assessed. It is hoped that these notes will be of assistance in this respect.

The publication is complementary to the bend-test clauses of B.S. 485—"Tests on thin metal sheet and strip (not exceeding 0.128 in. (10 SWG) in thickness)," but it is recommended that the provisions of that standard should be followed when testing thin metal sheet and strip. It does not, however, refer to composite or welded metals. Copies of this standard may be obtained from the British Standards Institution, Sales Department, 24, Victoria Street, London, S.W.1, price 2s. (post free).

Personal

MR. J. P. HUNT, managing director of the Hallamshire Steel & File Company, Limited, has been appointed chairman of the National Association for Rolled and Re-rolled Steel Products, in succession to Mr. H. C. Waterston, vice-chairman of Bairds & Scottish Steel, Limited.

MR. A. D. BROADBENT, A.M.I.Mech.E., has joined the staff of Stone Wallwork, Limited, of 157, Victoria Street, London, S.W.1. In his new position, Mr. Broadbent's extensive experience in mechanisation and mechanical handling will be utilised through personal visits to foundries.

MR. E. LONGDEN, M.I.Mech.E., is shortly relinquishing his position as works manager, David Brown-Jackson & Company, Limited, engineers and steelfounders, Salford, Manchester, and is re-establishing himself as a consulting engineer. His address will be Roseville, 11, Welton Avenue, Didsbury Park, Manchester, 20.

The highest honour that Birmingham University can bestow — the honorary degree of Doctor of Science — will be conferred upon PROF. M. L. E. OLIPHANT at the Degree Day Convocation on July 1. The award is in recognition of his services as head of the University's Department of Physics since 1937. On July 11 Prof. Oliphant leaves England to take up the position of Director of the Research School of Physical Sciences at the Australian National University at Canberra.

Successor to Prof. Oliphant is PROF. PHILIP BURTON MOON, who has been appointed Poynting Professor and Director of the Department of Physics.

Obituary

MR. ALBERT ABBOTT, who was assistant secretary of the Department of Scientific and Industrial Research, 1918-21, has died at the age of 78. He was chief inspector of the technological branch of the Board of Education from 1921 until 1932, and in 1937 reported to the Government of India on vocational education in that country.

MR. ARTHUR L. DARRAH, managing director of Baxendale & Company, Limited, lead manufacturers, of Thomas Street, Birmingham, 4, and a director of F. Parramore & Sons (1924), Limited, ironfounders, etc., of Chapeltown, near Sheffield, and of the Fourness Manufacturing Company, Limited, Pritchard Street, Manchester, 1, died suddenly on June 14.

Wills

PEARSON, JONAS, of Bradford, ironfounder £905

RICHARDSON, JOHN, for 50 years general manager of the Wellinboro' Iron Company, Limited, Wellingborough £5,436

DICK, W. McL., sales representative of Stanton Ironworks Company, Limited £6,702

LOBLEY, A. G., founder of Birmingham Electric Furnaces, Limited, now known as Birlec, Limited, of which he was managing director £17,132

BEARD, REGINALD, of Colchester, retired iron merchant £21,151

BURDER, A. E. F., a director and secretary of Messenger & Company, Limited, ironfounders and heating engineers, of Loughborough £23,602

WALKER, R. R., a managing director of William Jacks & Company, Limited, iron, steel, and metal merchants, and engineers, of Old Broad Street, London, E.C.2 ... ... £37,989

ANDERSON, J. K., formerly chairman and managing director of Fairbairn Lawson Combe Barbour, Limited, textile and general engineers, etc., of Leeds, and Urquhart Lindsay & Robertson Orchar, Limited, textile engineers, etc., of Dundee ... £61,803

BAILEY, CAPT. W. R., a director of C. H. Bailey, Limited, shiprepairers, dry-dock owners, etc., of Newport (Mon), Tubal Cain Foundry & Engineering Works, Limited, Cardiff £69,110

News in Brief

London Metal Warehouses, Limited, have added a light-alloy section to their foundry at Thames Ditton.

Dorrator Iron Company, Limited, Camelon, Falkirk, are to erect wash-rooms, lavatories, and a canteen at their foundry at an estimated cost of £2,500.

The Harborough Construction Company, Limited, of Market Harborough, will be closed from July 27 to August 8, when the annual vacation will be taken.

The Manchester office of the Brush Electrical Engineering Company, Limited, is now at Victoria Buildings, 32, Deansgate, Manchester, 3 (telephone: Blackfriars 4426).

A conference and exhibition on high-vacuum equipment, organised by the Midland branch of the Institute of Physics at the University, Birmingham, was held on June 27 and 28.

An immediate start is to be made on extensions to the Newark works of F. Perkins, Limited, Diesel-engine manufacturers. The extensions, which will double the size of the existing factory, will cost approximately £1 million.

A fire at the foundry of James F. Low & Company, Limited, Monifieth, Dundee, last Saturday, gutted part of the premises and caused damage estimated at £25,000. It was later stated that production would not be seriously affected.

Lanark Town Council have been authorised by the Department of Health for Scotland to place orders for pipes and special castings for the big water-mains scheme, estimated at £50,000, of replacing the 7-in. mains from Loch Lyoch with modern 10-in. pipes.

Bradley & Foster, Limited, of Darlaston, in 1933 inaugurated a golf competition. It has been resuscitated this year, and a challenge cup has been presented by Mr. T. A. McKenna, the chairman. The winner was Mr. H. J. Turner, of Revo Enamel Company. The competition was followed by a dinner held at the George Hotel, Lichfield.

An international conference on hot-dip galvanising which has been arranged by the Hot-Dip Galvanisers' Association will take place at Copenhagen from July 17 to 20. Full details regarding the arrangements made for the conference can be obtained on application to the Zinc Development Association, Lincoln House, Turl Street, Oxford.

L. A. Witham & Company, of 402, St. Vincent Street, Glasgow, C.3, have been appointed sole Scottish agents for F. & M. Supplies, Limited; Lees Hall & Sons, Limited (furnaces); Molyneux Foundry Equipment, Limited; Bilston Stove & Steel Truck, Limited (moulding boxes), and J. Boardman, Glasgow, Stamp and Brand Works (foundry letters).

The *Associazione Italiana di Metallurgia* (via San Paolo 10, Milan) announces that the annual congress will be held in Florence from September 28 to October 1, 1950. A new gold medal, honouring the name of Luigi Losana, has been struck and will be awarded at least biennially to an Italian or foreign research worker who is designated as being a worthy recipient.

As from July 1, Sheepbridge Engineering, Limited, group sales, the combined sales office of Sheepbridge Stokes, Limited, Sintered Products, Limited, Van de Horst, Limited, and Automotive Engineering Company, Limited, will operate from Drayton House, Gordon Street, London, W.C.1. Mr. A. E. Akerman and Mr. J. A. Sparks have respectively joined the Birmingham and London sales staff.

Judgment was given by Lord Strachan in the Court of Session on June 16 sending for trial by jury the action brought by Henry Balfour & Company, Limited, Durie Foundry, Leven, Fife, claiming £40,000 damages from the Railway Executive in respect of alleged fault in allowing a spark from one of their locomotives to cause a fire on August 23, 1948, in a warehouse belonging to the foundry.

Industrial undertakings in Scotland can now extend their premises by 10 per cent., up to a maximum of 5,000 sq. ft. floorspace, without planning permission from the authorities. This relaxation, with similar concesions to other groups of the community, is part of a general development order made by Mr. Hector McNeil, Secretary of State for Scotland, and which came into force last Tuesday.

Two more large contracts for hydro-electric plant in New Zealand have been secured by U.K. manufacturers. Metropolitan-Vickers Electrical Company, Limited, has a contract for generators for a station with a total capacity of 100,000 kw., and Ferranti, Limited, is to supply main transformers for another station. A third contract, for turbines, has gone to the Dominion Engineering Works, Limited, Lachine, Quebec (Canada).

Harland & Wolff, Limited, Govan, Glasgow, have received a second contract in two days. This is for the construction of a single-screw cargo motorship for the Royal Mail Lines, Limited. The new vessel will be 400 ft. long, 57 ft. broad, and 28 ft. 1 in. deep, with a dw. of 8,100 tons and a loaded draught of 25 ft. 2½ in. Gross tonnage will be 5,340. Propelling machinery, consisting of a single-screw Diesel engine, developing 3,340 bhp, will be supplied by the firm's engine works.

"Science attaches" at the more important American embassies and an advisory science staff in Washington have been recommended by Dr. Lloyd Berkner, special consultant to the Secretary of State. The chief duties of the "attachés" would be to keep their missions and interested Government agencies in the U.S.A. posted on scientific progress and problems and to provide non-secret information to help both American and foreign scientists to maintain mutually beneficial relationships.

A feature of the recent "Mechanical Handling Exhibition" was the interest aroused by the Sinex patent vibrating beam manufactured by the Sinex Engineering Company, Limited, 2, Caxton Street, Westminster, London, S.W.1. This machine was developed to fulfil a very real need in modern foundry practice—the knocking out of foundry boxes. It can be used in conjunction with the normal lifting tackle employed, and will completely empty the largest boxes in a matter of a few seconds.

Board Changes

Veritys, Limited—Mr. N. C. Hudson has been appointed an additional director.

Slag Reduction Company, Limited—Sir J. Drummond Inglis has been elected a director.

A. B. C. Coupler & Engineering Company, Limited—Mr. A. W. Strudwicke has been appointed a director.

Brightside Foundry & Engineering Company, Limited—Mr. W. S. Richards has been appointed a director.

Sidney Flavel & Company, Limited—Mr. F. M. Rogers has been appointed to the board in the capacity of sales director.

J. Stone & Company, Limited—Mr. A. J. Murphy has resigned his directorship, and Mr. J. T. R. Prestige has been co-opted as a director.

Head, Wrightson & Company, Limited—Mr. Selby T. Robson has been appointed a director. Mr. Robson, who is a director of other subsidiary companies of the Head Wrightson group, has been their London manager for nearly 20 years.

Imports and Exports of Iron and Steel

Board of Trade Returns for May

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in May. Figures for the same month in 1949 are given for purposes of comparison; respective totals for the first five months of this year and of 1949 are also included.

Total Exports of Iron and Steel

Destination.	Month ended May 31.		Five months ended May 31.	
	1949.	1950.	1949.	1950.
	Tons.	Tons.	Tons.	Tons.
Channel Islands ..	1,024	653	5,116	3,481
Gibraltar	336	145	943	751
Malta and Gozo ..	316	245	2,327	2,218
Cyprus..	486	1,098	2,028	3,861
British West Africa ..	5,588	11,016	32,199	42,388
Union of South Africa	13,746	16,071	67,717	68,593
Northern Rhodesia ..	1,321	3,019	7,329	12,308
Southern Rhodesia ..	6,111	6,376	20,213	31,702
British East Africa ..	5,944	10,622	29,966	41,995
Mauritius	467	692	2,038	3,772
Bahrein, Koweit Qatar, and Trucial Oman..	1,790	724	11,889	3,051
India	9,796	7,920	32,980	35,325
Pakistan	5,291	9,335	14,607	33,185
Malaya	4,952	10,535	21,912	36,434
Ceylon	2,117	3,408	7,880	16,044
North Borneo ..	2,280	409	6,949	2,964
Sarawak	17	5	949	650
Hongkong	3,672	4,416	16,587	22,655
Australia	14,802	36,462	59,857	133,147
New Zealand	11,364	16,250	44,583	71,315
Canada	10,112	21,676	30,338	57,073
British West Indies ..	3,245	2,960	26,817	26,271
British Guiana ..	203	1,116	1,475	3,655
Anglo-Egyptian Sudan	842	1,310	5,855	7,323
Other Commonwealth countries	875	768	5,047	5,207
Irish Republic ..	6,259	9,599	29,295	39,220
Russia	38	116	8,346	411
Finland	5,678	7,006	29,956	27,410
Sweden	4,758	8,796	23,195	38,485
Norway	7,275	9,798	32,861	35,754
Iceland	743	559	2,592	2,169
Denmark	8,116	9,207	42,325	62,980
Poland	16	311	544	927
Germany	63	37	307	188
Netherlands	8,188	7,151	51,463	34,332
Belgium	2,107	1,043	5,586	6,071
Luxemburg	1,022	15	2,603	268
France..	2,964	2,673	12,701	10,836
Switzerland	662	970	6,373	5,676
Portugal	1,321	1,401	8,065	8,115
Spain	992	372	4,403	3,733
Italy	398	1,275	1,212	4,044
Hungary	184	43	215	258
Greece	1,165	334	2,968	2,879
Turkey	1,477	770	6,418	4,564
Indonesia*	2,221	594	13,330	7,436
Netherlands Antilles..	598	106	2,326	4,047
Belgian Congo ..	94	106	680	621
Angola	2,793	159	3,313	1,248
Portuguese East Africa	493	650	2,094	2,113
Canary Islands ..	450	53	1,510	800
Syria	138	91	742	546
Lebanon	742	541	10,264	5,270
Israel	1,619	1,822	8,055	7,517
Egypt	5,681	3,616	26,327	28,327
Morocco	393	1,346	562	1,563
Saudi Arabia	515	279	1,738	1,227
Iraq	4,381	4,536	18,414	19,887
Iran	12,716	12,607	57,816	51,842
Burma..	602	966	5,082	4,513
Thailand	311	451	1,877	2,910
China	176	351	2,080	951
Philippine Islands ..	180	561	1,615	5,539
USA	146	3,062	1,979	7,553
Cuba	25	118	194	559
Colombia	174	400	2,312	2,409
Venezuela	3,131	2,241	27,668	16,415
Ecuador	122	316	2,028	1,278
Peru	423	1,374	2,914	4,238
Chile	544	1,537	3,197	7,752
Brazil	1,041	1,773	7,723	12,470
Uruguay	1,168	1,147	4,259	4,359
Argentine	2,946	4,620	20,206	29,746
Other foreign countries	781	1,421	4,758	11,087
TOTAL ..	204,727	275,701	973,092	1,197,911

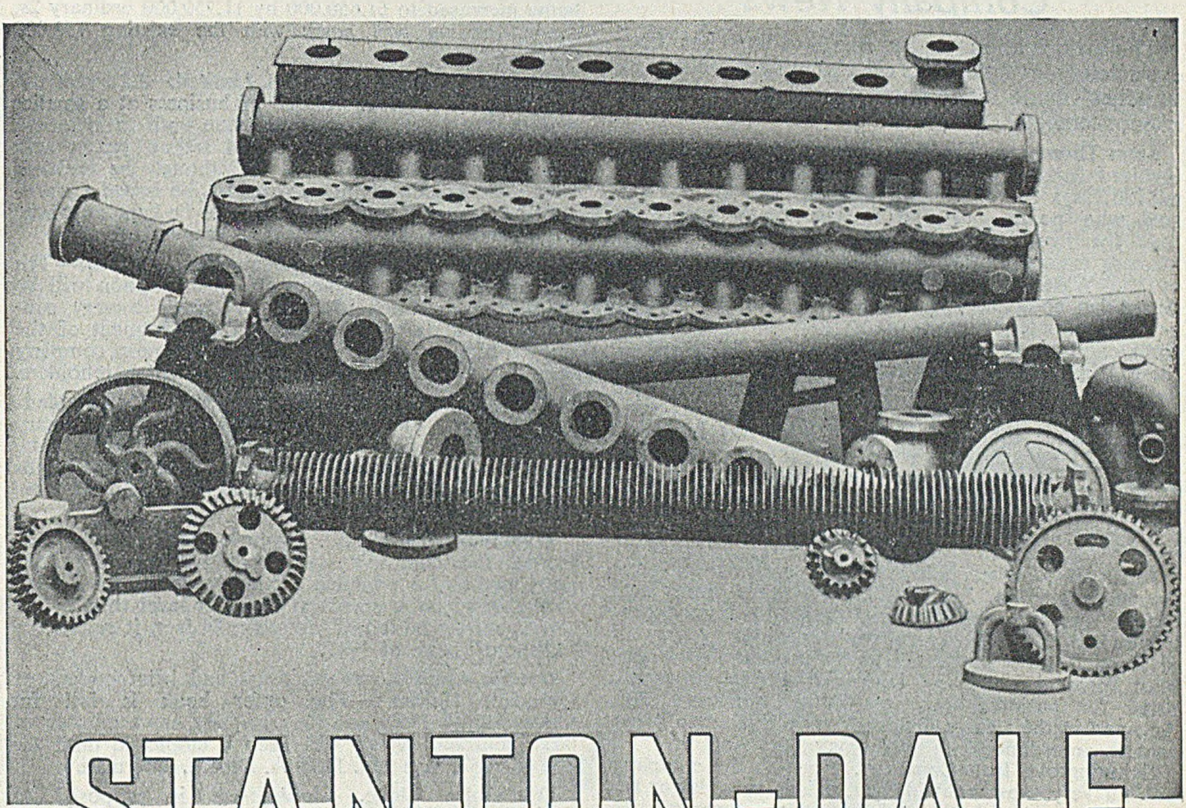
* Includes Netherlands New Guinea n 1949.

Total Imports of Iron and Steel

From	Month ended May 31.		Five months ended May 31.	
	1949.	1950.	1949.	1950.
	Tons.	Tons.	Tons.	Tons.
Australia	1,634	3	1,972	18
Canada	6,014	4,330	27,787	17,386
Other Commonwealth countries and Irish Republic	1,068	113	3,279	23,681
Sweden	825	849	7,705	5,234
Norway	2,424	6,089	14,551	21,229
Germany	1,888	7,745	4,305	39,809
Netherlands	9,194	6,674	38,229	28,479
Belgium	47,469	6,813	177,941	38,271
Luxemburg	24,842	4,887	80,484	17,073
France..	17,269	35,174	77,094	109,473
Austria	8,753	6	16,626	2,261
USA	29,613	5,248	65,635	29,080
Other foreign countries	317	100	1,203	2,740
TOTAL	151,310	78,031	516,811	334,734
Iron ore and concentrates—				
Manganiferous ..	3,550	—	6,550	11,016
Other sorts ..	789,302	761,963	3,153,496	3,494,310
Iron and steel scrap and waste, fit only for the recovery of metal	207,917	207,534	612,817	994,714

Exports of Iron and Steel by Products

Product.	Month ended May 31.		Five months ended May 31.	
	1949.	1950.	1949.	1950.
	Tons.	Tons.	Tons.	Tons.
Pig-iron	867	960	1,893	11,630
Ferro-alloys, etc.—				
Ferro-tungsten ..	89	107	335	508
Spiegeleisen, ferro-manganese ..	1,165	130	3,101	964
All other descriptions	101	81	500	682
Ingots, blooms, billets, and slabs	594	1,299	1,186	2,715
Iron bars and rods ..	278	503	2,820	2,275
Sheet and tinplate bars, wire rods ..	387	72	1,387	1,235
Bright steel bars ..	1,762	3,322	9,621	16,801
Other steel bars and rods	12,342	20,791	68,284	98,312
Special steel	1,265	1,300	6,071	6,132
Angles, shapes, and sections	9,727	12,843	49,474	61,449
Castings and forgings	680	678	3,270	3,860
Girders, beams, joists, and pillars	2,650	6,301	12,050	26,486
Hoop and strip ..	4,050	11,593	20,193	40,790
Iron plate	372	356	1,522	1,258
Tinplates	17,087	26,216	84,717	103,249
Tinned sheets.. ..	272	174	1,805	1,105
Terneplates, decor. tinplates	15	115	153	227
Other steel plate (min. ⅛ in. thick) ..	22,109	30,646	92,247	124,397
Galvanised sheets ..	6,580	9,128	37,037	47,302
Black sheets	9,403	13,817	59,008	57,240
Other coated plates ..	853	1,122	2,966	5,049
Cast-iron pipes, up to 6-in. dia.	6,863	7,592	34,612	32,601
Do., over 6-in. dia. ..	8,674	6,856	34,687	35,441
Wrought-iron tubes ..	24,916	30,274	137,097	146,288
Railway material ..	20,037	31,206	81,371	120,126
Wire	4,003	6,725	20,251	28,503
Cable and rope ..	2,334	2,392	11,462	13,738
Netting, fencing, and mesh	1,575	1,302	8,952	7,296
Other wire manufactures	777	2,219	5,307	9,200
Nails, tacks, etc. ..	566	488	3,222	2,142
Rivets and washers ..	915	856	4,367	3,251
Wood screws	241	389	1,427	1,510
Bolts, nuts, and metal screws	2,249	2,872	10,683	12,829
Stoves, grates, etc. (excl. gas)	777	1,189	4,147	4,549
Do., gas	172	230	1,091	1,073
Baths	926	1,067	3,926	5,997
Anchors, etc.	829	908	4,069	3,856
Chains, etc.	886	950	4,138	4,192
Springs	757	912	3,419	4,175
Hollow-ware	7,055	6,518	33,242	37,580
All other manufactures	27,527	28,602	105,982	109,898
TOTAL ..	204,727	275,701	973,092	1,197,911



Company News

The information under this heading has been extracted from statements circulated to shareholders, speeches made at annual meetings, and other announcements.

John Thompson, Limited:—The amount of work uninvoiced for the group is now between £19 and £20 million, says the chairman, MR. EDWARD W. THOMPSON, who points out that in last year's report he gave the figure as "approaching £15,000,000." The increase mainly represents orders received during 1949 by the Water Tube Boiler Company and the main Australian company for large power station contracts, he says. Some of these orders are not required for completion until 1954. However, after allowing for these "long-term" contracts the work on hand for the other companies remains very satisfactory. The output of the various works is still rising, and during the first three months of 1950 output has increased by over 25 per cent. compared with the corresponding period of 1949, which has enabled the company, in many cases, to reduce the period for delivery in quoting for new work. Export trade has again shown a satisfactory increase.

Pease & Partners, Limited:—All subsidiaries, says the chairman, MR. ANDREW WHYTE, made profits during the year and, with two unimportant exceptions, contributed to the parent company's earnings by way of dividends. The companies operating the Normanby blast furnaces and the Lingdale ironstone mines are listed for nationalisation under the Iron and Steel Act, and in their cases dividends were limited to 4 per cent. in accordance with the terms of the Act.

Skinningrove Iron Company, in which the company holds a very substantial interest, paid dividends for the year in respect of both classes of its share capital. In accordance with its agreement with the Finance Corporation for Industry, Limited, the ordinary dividend was again limited to 5 per cent. Skinningrove Iron Company is also listed for nationalisation.

Baker Perkins, Limited, manufacturing engineers and foundrymen, of Peterborough:—The 1949 turnover was higher than that of 1948 both in money value and in volume, says MR. B. D. BAKER, vice-chairman. Exports were somewhat higher in spite of new import restrictions in some markets, where sterling is almost as difficult to obtain as dollars. The volume of the company's export trade is about four times as large as in 1938, which was a good pre-war year. It has been decided to set up a separate export company with Mr. Harold Crowther as managing director and Mr. H. S. Hargreaves as deputy managing director, both of whom have had considerable experience of export work.

Climax Rock Drill & Engineering Works, Limited:—Orders continue at a high level and very satisfactory progress is being made in the development of certain oversea markets, says MR. ALFRED EWING, the chairman. In order to simplify business transactions with India and Pakistan, the formation of a subsidiary company with headquarters based on Bombay is being arranged. The company's operations abroad have been greatly extended since the end of the war and it is now exporting to about 34 oversea markets, compared with about 10 in pre-war years.

A.P.V. Company, Limited:—The company is capitalising £288,552—part of undivided profits—and distributing it to ordinary shareholders in the proportion of four new 2s. shares for each share held. At the same time, the board intends to consolidate the shares into 10s. denominations. The capital of the business—formerly the Aluminium Plant & Vessel Company—is being increased to £1,650,000 by 11,750,000 ordinary 2s. shares ranking *pari passu* with the existing 750,000 shares.

Imperial Chemical Industries, Limited:—Last year the company did a larger volume of business at a smaller margin, the lower margin being due both to increased costs and reduced or maintained selling prices, said LORD MCGOWAN, chairman. Although he believed total sales would continue to expand, he issued a warning that a most careful watch had to be kept on prices if business was not to be lost to keen competitors.

Kay & Company (Engineers), Limited:—The directors state that a scheme of reconstruction will be submitted to shareholders under which a very substantial cash distribution and a free allotment of the whole of the issued capital of the new company acquiring the business would be made to shareholders.

Harrison (Birmingham), Limited, brassfounders, metal rollers and extruders:—At an extra-ordinary meeting to be held on June 29 shareholders will be asked to approve resolutions making possible the bonus issue of one new ordinary for every five held, as foreshadowed in the annual report.

Worthington-Simpson, Limited:—SIR SAMUEL R. BEALE, the chairman, says that the directors have every reason for confidence with regard to the future, as the order-book stands at a higher level than in the corresponding period of last year; in fact, it equals the "all-time" peak of 1947.

Drakes, Limited, gas engineers and ironfounders, of Ovenden, Halifax:—The order book is full for the whole of 1950, and the company has a number of large contracts which will keep it employed until the end of 1952, says MR. JOHN A. DRAKE, chairman.

Derbyshire Stone, Limited:—It is proposed to capitalise £42,600 and to make a bonus issue of 170,400 ordinary shares of 5s. each in the proportion of one new share for every 25s. nominal ordinary stock held

Hill Top Foundry Company, Limited:—The directors hope that the report and accounts will be posted early in July and that the meeting will be held towards the end of that month.

House Organs

Albion Works Bulletin, Vol. 4, No. 4. Published by John Harper & Company, Limited, Albion Works, Willenhall, Staffs.

The joint production committee is still worrying about breakages in handling. Because the firm specialise in the production of extremely thin-sectioned castings, it is a problem more acute than in most foundries. Loss from this source runs to about a ton a week. Since the shortage of domestic help, housewives are more sympathetic to breakages during the washing-up process. They have discovered that it is not carelessness, but usually the result of nerves. However, at Harper's steps are being taken to halve this wastage.

F.P.A. Journal, No. 9. Published by the Fire Protection Association, 84, Queen Street, London, E.C.4.

This issue contains an interesting article on the machining of magnesium alloys—with, of course, special reference to the fire hazard. Of personal interest to the reviewer is a report on the fire which occurred last December in the Covent Garden Flower Market located below the offices of the FOUNDRY TRADE JOURNAL.

Company Results

(Figures for previous year in brackets.)

VAB PRODUCTS—Dividend of 12½% (5%).

HADFIELDS—Interim dividend of 5% (same).

TRIPLEX FOUNDRY—Dividend of 7½% (10%).

ELKINGTON & COMPANY—Dividend of 8% (same).

SHEFFIELD STEEL PRODUCTS—Dividend of 15% (same).

GEO. ADLAM & SONS—Final dividend of 37½%, making 50% (same).

GEORGE SPENCER, MOULTON & COMPANY—Dividend of 5% (7½%).

KENDALL & GENT—Interim dividend of 5% on increased capital (5%).

CONSETT IRON COMPANY—Final dividend of 7½%, making 12½% (same).

SMETHWICK DROP FORGINGS—Final dividend of 17½%, making 30% (same).

WAILES DOVE BITUMASTIC—Interim dividend of 7½% on larger capital (7½%).

R. A. LISTER & COMPANY—Interim dividend of 2½% (5%) on capital as increased by bonus.

ALLIED IRONFOUNDERS—Final dividend of 7½% (10%), making 12½% (17½%) on larger capital.

WEARDALE LEAD COMPANY—No interim dividend for the year ending September 30 next (4%).

CAKEBREAD, ROBEY & COMPANY—Final dividend of 15% and bonus of 2½%, making 22½% (same).

GARRARD ENGINEERING & MANUFACTURING COMPANY—Final dividend of 12½%, making 25% (same).

HILL TOP FOUNDRY COMPANY—Dividend of 25% on capital increased by 300% bonus issue in August last (100%).

WHESSOE—Final dividend of 15%, making 20%, on £500,000 capital (final dividend of 30%, making 40%, on £200,000).

FULLERS' EARTH UNION—Final dividend of 11% (same) and bonus of 5% (same), making 20% (20% on old ordinary and 16% on new).

JOHN BOOTH & SONS (BOLTON)—Net trading profit to March 31, £107,861; to reserve for income tax, £47,300; general reserve, £23,000; final dividend of 15%, making 25% (same); forward, £77,872.

SANDERSON BROS. & NEWBOULD—Consolidated profit for 1949, £138,478 (£129,676); available for parent company, £35,039 (£38,602); final dividend of 7½% (5%), making 12½% (10%); forward, £95,591 (£78,065).

UNION STEEL & MANUFACTURING COMPANY—Net profit to March 31, £60,361 (£27,102); dividend of 27½% (same); transfer to extension and development account, £20,000 (nil); transfer to general reserve account, £15,000 (nil); forward, £16,635 (£15,794).

GOODLASS WALL & LEAD INDUSTRIES—Net profit for 1949, £1,084,000 (£910,000); retained by subsidiaries, £611,000 (£421,000); dividend of 15% (same); to reserve, nil (£240,000); increase in carry-forward, £304,000 (£80,000).

METAL CLOSURES—First group accounts show balance from trading account for 1949, £114,109; net profit, £51,090; provision for taxation in respect of past years, £4,800; to general reserve, £23,384; final dividend of 20%, making 40% (same); forward, £25,248 (£24,342).

KEITH BLACKMAN—Profit to March 31, £208,736 (£275,766); to taxation, £110,000 (£150,000); reserve for pensions, £30,000 (£75,000); contingencies reserve, £30,000 (nil); deferred repairs, £4,500 (nil); dividend of 20% (same plus bonus of 5%); forward, £59,659 (£58,973).

RANGE BOILERS—Consolidated trading profit for 1949, £101,222 (£109,871); net profit, £40,483 (£43,598, plus £824 share of subsidiary's loss attributable to minority interest); final dividend of 15%, making 20% (same); to general reserve, £20,000 (£40,000); forward, £22,625 (£12,922).

COWLISHAW, WALKER & COMPANY—Trading profit for 1949, £66,397 (£109,349); net profit, £25,750 (£45,333); to capital reorganisation and Note issue expenses, nil (£2,280); reserve for redemption of Notes, £12,000 (same); dividend of 10% (same, also 5%, tax-free bonus); forward, £20,864 (£15,364).

J. STONE & COMPANY—Net group profit for 1949, £423,303 (£352,596); to general reserve, £50,000; replacements reserve, £50,000; reserve to eliminate inter-company profits on stock of subsidiaries, £49,194; contingency reserve, £100,000; final dividend of 7½% (15%) on ordinary and "A" ordinary shares, making 12½% on doubled capital (25%).

INCANDESCENT HEAT COMPANY—Consolidated trading profit for 1949, £42,204 (£36,405); net profit, £16,403 (£12,973); to profits on outside shareholdings, £3,940 (£2,814); parent company's dividends, £7,975 (same); forward, £45,214 (£37,910); parent company's net profit, £10,503 (£9,903); dividend of 10% (same); forward, £29,412 (£26,425).

ANDERSTON FOUNDRY COMPANY—Trading profit for the year to March 31, £91,220 (£50,621); net profit, £42,865 (£21,761); final dividend of 7s. 6d. per share, making 9s. per share (same); to stock depreciation, £2,500 (same); general reserve, £5,000 (£2,500); directors' remuneration, £1,050 (£840); benevolent fund, £200 (same); forward, £58,538 (£31,849).

WORTHINGTON-SIMPSON—Trading profit for 1949, £432,002 (£378,136); net profit, £152,644 (£129,779); profit relating to previous year, less taxation, nil (£8,170); taxation overprovided in previous years, £10,000 (nil); to provision for supplementary retirement benefits, £10,000 (same); general reserve, £80,000 (£50,000); ordinary distribution of 20% (same); forward, £116,172 (£81,987).

BAKER PERKINS—Group net profit to December 27, 1949, £287,521 (£403,387); to replacement of fixed assets reserve, £40,000 (nil); off depreciation and expenditure on leasehold property, £169,104 (£193,525); net profit of parent company, £153,800 (£136,149); to general reserve, £155,000 (nil); final dividend of 1s. 2.2d., making 1s. 8.2d. per £1 unit (15½%); forward, £304,022 (£362,329).

H. & C. DAVIS—Net profit for 1949, including subsidiaries for five months, £26,280 (£32,525); off capital reorganisation expenses, nil (£2,975); off preliminary expenses, £162 (nil); to stock reserve, £10,000 (same); general reserve, £10,000 (£15,000); dividends on preference, £6,050 (£2,433); preferred ordinary dividend, £786 (same); ordinary dividend of 10% (same); forward, £51,360 (£62,851).

RANSOMES & RAPIER—Trading profit with interest and rents for 1949, £393,481 (£268,526); net profit, £110,485 (£65,951); items relating to previous years not required, £3,542 (nil); to general reserve, £70,000 (£32,500); dividend of 7%, tax free (same); the £25,000 new ordinary stock issued in June, 1948, ranked for dividend for six months only in previous year; forward, £19,769 (£7,120).

CLIMAX ROCK DRILL & ENGINEERING WORKS—Manufacturing and trading profit for 1949, £68,582 (£59,934); net profit, £37,320 (£34,721); provisions no longer required, £8,364 (nil); to taxation, £20,000 (£19,000); general reserve, £15,000 (£5,000); final dividend of 5%, making 10% (same); additional remuneration to directors on proposed final dividend, £450 (same); forward, £16,752 (£16,418).

W. N. FROY & SONS—Trading profit for 1949, £78,170 (£104,434); net profit, £77,561 (£100,912); taxation not required, £1,986 (nil); EPT refund, £140 (nil); to taxation after deduction of initial allowances: profits tax £11,039 (£13,634), income tax £29,110 (£41,210); general reserve, £25,000 (£30,000); dividend of 10% on share capital as increased last January (same); forward, £44,495 (£43,157).

SIDNEY FLAVEL & COMPANY—Consolidated trading profit for 1949, £58,671 (£49,061); net profit, £25,039 (£13,360); surplus on sale of fixed assets, £686 (£1,415); profits available for appropriation, £35,766 (£14,991); to reserve for increased cost of plant replacement, £5,000 (nil); dividend at the rate of 6% (3¾% paid as interim); amounts retained by subsidiary companies, £908 (£392); forward in accounts of Sidney Flavel & Company, £21,938 (£9,649).

CONSETT IRON COMPANY—Trading profit for the year ended March 31, £1,476,177 (£1,227,810); interim income for 1949, £147,750 (£175,661); balance, £620,951 (£481,656); provision for taxation no longer required, £264,895 (£114,044); to debenture sinking fund, £45,362 (£5,134); plant improvement and extensions reserve, £450,000 (£400,000); further transfer of income tax on initial allowances, £147,000 (nil); dividend of 12½% (same); forward, £254,169 (£225,185).

FOLLSAIN-WYCLIFFE FOUNDRIES—Trading profit for 1949, £32,978 (£29,915); net profit, £24,527 (£27,479); to income tax for 1950-51, £7,479 (£10,400); profits tax, 1949, £4,300 (£3,800); provision for collections, £250 (£4,750); dividend of 24% (same); commutation of royalty, £250 (nil); general reserve, £4,750 (nil); off shares in subsidiary, £5,000 (nil); share of cost of scheme for merger with Wycliffe Foundry & Engineering, nil (£673); forward, £12,614 (£14,300).

THOS. FIRTH & JOHN BROWN—Group profit for the year ended March 31, £729,234 (£633,594 for previous 15 months); profit attributable to Thos. Firth & John Brown, £727,686 (£612,585); to 6% preference dividend, £13,200 (£16,500 for 15 months); 5% preference dividend, £30,000 (£37,500); final dividend on the "A" and "B" ordinary shares of 7½%, making 10%, tax free (12½%, tax free, for the previous 15 months); consolidated balance forward, £1,550,828 (£1,137,268).

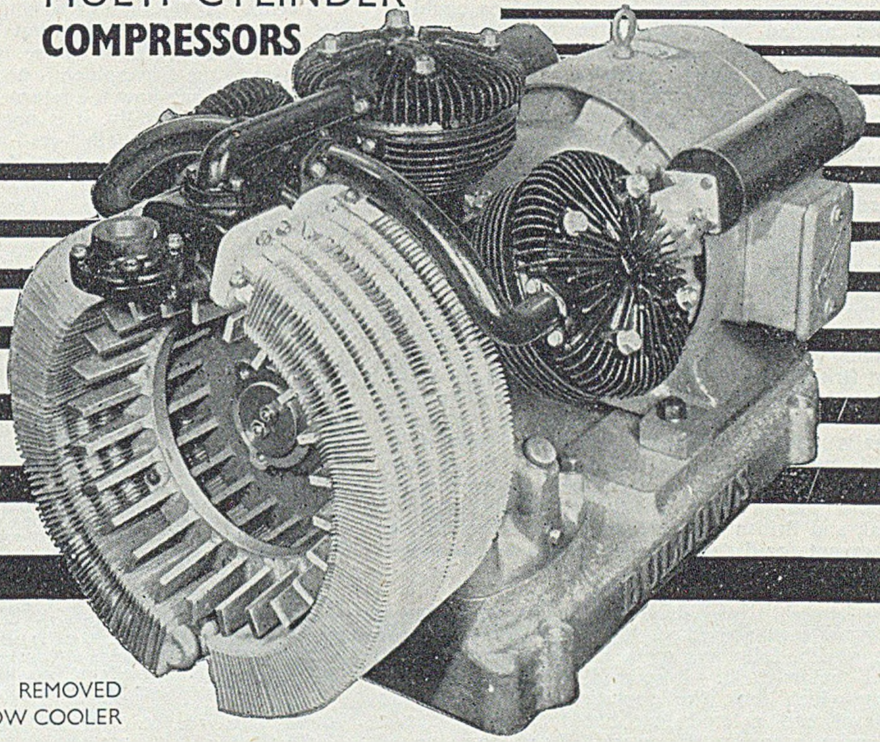
FULLER'S EARTH UNION—Trading profit, etc., for the year to March 31, £186,043 (£257,046); net profit, £140,087 (£212,314); excess taxation, £6,750 (nil); to taxation, £50,000 (£100,000); off investment in subsidiary, nil (£5,999); reserve against subsidiary, nil (£10,792); tax equalisation, £25,000 (nil); pension, £10,000 (same); general reserve, £10,000 (£48,507); final dividend of 11% and bonus of 5%, making 20% (20% on old ordinary and 16% on new); forward, £105,686 (£69,176).

DARWINS—The directors announce that after considering the accounts of the company's financial year ended March 31, 1950, and in consequence of the economies effected and the trading results during the last five months of that year, they feel justified in approving payment of the preference dividend for the six months ended March 31, 1950, which was postponed pending consideration of the accounts. The accounts are now being audited and will be presented as soon as possible.

N. GREENING & SONS—Consolidated income statement—parent company for 11 months ended March 31 and subsidiaries for the year ended March 31—show trading surplus, £153,797 (£183,699); net profit, £75,946 (£87,095); repairs provision no longer required, nil (£4,140); to fixed asset replacement, £29,000 (£22,000); general reserve, £23,000 (£50,000); goodwill, etc., of subsidiary, nil (£480); final dividend of 12½%, making 17½% for 11 months on larger capital (same for previous year); forward, £37,359 (£30,600).

BULLOWS

MULTI-CYLINDER
COMPRESSORS



GUARD REMOVED
TO SHOW COOLER

DESIGNED FOR FOUNDRY NEEDS

Available in sizes up to 108 C.F.M. displacement—one, two or three stages.

Working pressures from 25—350 lb./sq. in.

We shall be pleased to send full particulars or arrange for a representative to call.

IMPERVIOUS TO DUST.—Sealed crankcase and efficient air filters.

DELIVER COOL DRY AIR.—Efficient inter- and after-coolers cool air BEFORE entering air receiver.

PROVED RELIABILITY.—Simple construction, generous working parts. Bullows Patent Valve Gear.

★ *LIGHT · COMPACT · SILENT · FREE FROM VIBRATION*

WE ALSO MAKE A COMPLETE RANGE OF SPRAY PAINTING EQUIPMENT

ALFRED BULLOWS & SONS LTD · LONG ST · WALSALL · STAFFS · TEL : 5401

DEPOTS AT—13 SOUTH MOLTON ST., LONDON, W.1. · TEL. MAYFAIR 2313
55a BRIDGE STREET, MANCHESTER, 3 · TEL. BLACKFRIARS 5670
BULLOWS HOUSE, 9 BURGH QUAY, DUBLIN, EIRE. : TEL. DUB 21152
105, WHITEFIELD ROAD, GLASGOW, S.W.1. : TEL. GOVAN 2668

Raw Material Markets

Iron and Steel

Although several large-capacity blast furnaces are now being built to replace smaller and less efficient units, they are all designed for the service of the steel industry. The resumption of large-scale exports of pig-iron has no place in the five-year development plan of the British Iron and Steel Federation. Nevertheless, modest tonnages of British-made pig-iron could be marketed abroad with advantage to the national economy, and it is regretted that supplies for this purpose are not at present available. Last month the average weekly output increased by about 3,000 tons as compared with the April figures, but supplies of certain grades, such as low- and medium-phosphorus iron, are still rather scarce, and outputs of hematite and Derbyshire high-phosphorus iron are fully absorbed.

Notwithstanding the drastic curtailment of imports of semi-finished steel from the Continent, there are still substantial accumulations, owing to the limited scale of operations in the re-rolling industry. The recent cut in the export prices of small bars and sections has not brought them within measurable distance of Belgian quotations, and until this gap can be narrowed prospects of British re-rollers in overseas markets are bleak.

Activity in the melting shops and heavy rolling mills is maintained at a high level. A steady flow of specifications is reaching the plate and heavy section mills, and rail mills continue to be operated to capacity limits. The pressure on the sheet mills is such that the automobile industry is partially reliant on imported material, and British mills are unable to accept further orders except for distant delivery dates.

Non-ferrous Metals

Last week saw a marked downward turn in the tin market, which, following weak advices from the East, fell well below £600. It seemed, therefore, that the recovery which took the quotation well beyond the £600 level had petered out, but there has been a steady price recovery this week. Lead, too, looked rather sorry for itself and the export price fell below 11 cents, although the producers' quotation on the United States market remained at 12 cents. Here, the price of lead was reduced by £4 to £92. The U.K. price has for some time past ceased to have any apparent direct relationship with the American price, and it seems reasonable to think that before long the Ministry of Supply will again reduce its selling limit more into line with the level ruling on the world market.

Metal Exchange tin quotations were as follow:—

Cash—Thursday, £594 to £594 10s.; Friday, £589 to £589 5s.; Monday, £595 10s. to £596; Tuesday, £604 10s. to £605 10s.; Wednesday, £605 to £605 10s.

Three Months—Thursday, £595 5s. to £595 15s.; Friday, £590 15s. to £591; Monday, £596 10s. to £597 10s.; Tuesday, £605 5s. to £605 10s.; Wednesday, £605 10s. to £606.

A rise, long foreseen, took place last week in the cadmium price, which went up by 1s. to 15s. 6d. per lb. Both zinc and copper were firm and the quotations registered on the futures market in New York showed what the price tendency of these two metals is. Reports from across the Atlantic suggest that consumption of copper is on an excellent scale and that May was a very good month, bringing a reduction, not only in producers' stocks, but also in consumers', too. The call for zinc is persistent and it is difficult to visualise any setback in the price of that metal at the moment. On this side, however, users of copper and zinc are acting with considerable caution and appear to be buying on a hand-to-mouth basis.

A good deal of interest was aroused last week in the statement in the House of Commons on the subject of some possible adjustment in the price basis on which the Government buys copper from Rhodesia. Apparently, the idea is that if the 2 cents duty is reimposed, then the revised basis should be a price no higher than the United States domestic price less the import duty of 2 cents. At the time of writing, it is not certain that the duty will go on again, but it looks very like it. What is also in doubt, of course, is how the mineowners will react to the Government's proposals. Since no-one is prepared to say how the return of the duty will affect copper prices generally, it is not easy to see how the producers can give a plain "yes" or "no" to the Ministry's plan. All this uncertainty has not been good for trade and buying of both virgin metals and scrap has been on a reduced scale. Quotations of secondary metals have been perhaps a little easier, but the change of direction has not amounted to much.

New Patents

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." The Specifications are open for inspection at the Patent Office, 25, Southampton Buildings, London, W.C.2. The numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

629,248 Soffel, P. J. Casting of metal.
629,394 Askania Regulator Company. Control systems for electric-arc furnaces.
629,574 Mond Nickel Company, Limited. Nickel alloy castings.
629,687 Air Liquide Soc. Anon. pour l'Etude et l'Exploitation des Procedes G. Claude. Butt-welding of metal members.
629,710 Electro-Refractaire. Heat casting refractory blocks.
629,879 General Electric Company, Limited, and Dovey, D. M. Robertson, G. G. C. Stone-cutting machinery.
630,070 Mond Nickel Company, Limited (International Nickel Company, Inc.). Cast iron.
630,072 Dowson & Mason Gas Plant Company, Limited, and Carburisation of iron and iron alloys.
630,198 Chaze, P. Centrifugal moulding machines.
630,240 Anderson-Grice Company, Limited, Pate, G., and cast iron.
630,328 Kuniansky, M. Centrifugal casting of pipe.
630,405 Speirs, A. J. Sleeman-. Joining rolled steel beams for use on bridge and other constructional steel work.
630,521 Birdsboro Steel Foundry & Machine Company. Pack-annealing bed.
630,543 Thiemann, W. H. A. (Oesterreichisch-Amerikanische Magnesit Akt.-Ges.). Furnaces of the Siemens-Martin type.
630,560 Forton, H. R. Cooling method and apparatus.
630,566 Holzworth, C. R. Pig-iron producing process.
630,711 K. & L. Steelfounders & Engineers, Limited, and Shaw, C. S. Mobile cranes.
630,767 Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Three-phase electrode system for electric furnaces.
630,797 Soc. Anon. des Etablissements J. Holtzer. Ferrous alloy having a high strength at high temperatures.
630,848 Brown & Sons (Huddersfield), Limited, D., and Tuplin, W. A. Devices for measuring surface roughness.
630,962 Furnace Engineers, Inc. Heat-treating furnace.
630,989 Soc. Anon. des Acieries et Forges de Firminy. Metal rolling mill with set elongation.
630,996 Platon, J. G. Manufacture of cast iron in blast furnaces.
631,235 Soc. d'Electrochimie, d'Electrometallurgie et des Acieries Electriques d'Ugine. Manufacture of steel.
631,362 Metallizing Engineering Company, Inc. Apparatus for conditioning metal surfaces for spray metal bonding.
631,394 Union Corporation, Limited, and Mullins, A. R. Muffle furnace.
631,525 Swindin, N. Method of and means for the purification and revivification of acid pickling liquors for iron and steel products.
631,530 Delaware Engineering Corporation. Electric arc furnace with lift and swing aside roof.
631,548 Pyrene Company, Limited. Smith & Company, Wire Manufacturers, Limited, F., Holden, H. A., and Setterington, J. T. Working of metals.
631,689 Linde Air Products Company. Thermo-chemically removing metal from metals and alloys.
631,875 Hanna, M. O. Forging or upsetting of metal rods or bars using electric resistance heating.

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

(Delivered, unless otherwise stated)

June 28, 1950

PIG-IRON

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

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

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

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

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

Cold Blast.—South Staffs, £16 3s. 3d.

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

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

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

FERRO-ALLOYS

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

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

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

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

Ferro-titanium.—20/25 per cent., carbon-free, £109 per ton.

Ferro-tungsten.—80/85 per cent., 8s. 9d. per lb. of W.

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

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

Cobalt.—98/99 per cent., 13s. 6d. per lb.

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

Ferro-manganese (blast-furnace). — 78 per cent., £28 3s. 3d.

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

SEMI-FINISHED STEEL

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

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

Sheet and Tinplate Bars.—£16 16s. 6d.

FINISHED STEEL

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

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

Alloy Steel Bars.—1-in. dia. and up : Nickel, £36 8s. ; nickel-chrome, £52 16s. 6d. ; nickel-chrome-molybdenum, £59 9s. 6d.

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

NON-FERROUS METALS

Copper.—Electrolytic, £186 ; high-grade fire-refined, £185 10s. ; fire-refined of not less than 99.7 per cent., £185 ; ditto, 99.2 per cent., £184 10s. ; black hot-rolled wire rods, £195 12s. 6d.

Tin.—Cash, £605 to £605 10s.; three months, £605 10s. to £606 ; settlement, £605 5s.

Zinc.—G.O.B. (foreign) (duty paid), £127 10s. ; ditto (domestic), £127 10s.; "Prime Western," £127 10s.; electrolytic, £128 5s. ; not less than 99.99 per cent., £129 15s.

Lead.—Good soft pig-lead (foreign) (duty paid), £92, ditto (Empire and domestic), £92 ; "English," £93 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, all English destinations, £143 15s. ; rolled zinc (boiler plates), all English destinations, £141 15s. ; zinc oxide (Red Seal), d/d buyers' premises, £119.

Other Metals.—Aluminium, ingots, £112 ; antimony, English, 99 per cent., £160 ; quicksilver, ex warehouse, £16 15s. to £17 ; nickel, £386.

Brass.—Solid-drawn tubes, 19⅝d. per lb. ; rods, drawn, 25⅜d. ; sheets to 10 w.g., 23⅞d. ; wire, 24⅜d. ; rolled metal, 22⅝d.

Copper Tubes, etc.—Solid-drawn tubes, 21½d. per lb.; wire, 209s. per cwt. basis ; 20 s.w.g., 217s. 9d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £130 to £136 ; BS. 1400—L.G.3—1 (86/7/5/2), £138 to £143 ; BS. 1400—G1—1 (88/10/2), £181 to £239 ; Admiralty GM (88/10/2), virgin quality, £190 to £237, per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £200-£240 ; L.P.Bl, £140-£154 per ton.

Phosphor Bronze.—Strip, 31¼d. per lb. ; sheets to 10 w.g., 33⅛d. ; wire, 32¾d. ; rods, 30¾d. ; tubes, 36d. ; chill cast bars : solids, 30¾d., cored, 31¾d. (C. Clifford & Son, Limited.)

Nickel Silver, etc.—Ingots for raising, 2s. 1¾d. per lb. (7%) to 3s. 1¼d. (30%) ; rolled metal, 3 in. to 9 in. wide × .056, 2s. 7¾d. (7%) to 3s. 7¼d. (30%) ; to 12 in. wide, × .056, 2s. 8d. to 3s. 7½d. ; to 25 in. wide × .056, 2s. 10d. to 3s. 9½d. Spoon and fork metal, unsheared, 2s. 4¾d. to 3s. 4¼d. Wire, 10g., in coils, 3s. 1¼d. (10%) to 4s. 0¾d. ; (30%). Special quality turning rod, 10%, 3s. 0¼d. ; 15%, 3s. 5d. ; 18%, 3s. 9½d.

Increases of Capital

Details of increased capital have been announced by the following companies:—

CAST-IRON SUPPLIES, LIMITED, Oxford Street, London, W.1, increased by £5,000, in £1 ordinary shares, beyond the registered capital of £1,000.

GEORGE DAMP & SONS, LIMITED, ironfounders, etc., of Leyland, increased by £2,000, in £1 shares, beyond the registered capital of £4,000.

FARRAR BOILERWORKS, LIMITED, Northgate, Newark-on-Trent, increased by £10,000, in £1 ordinary shares, beyond the registered capital of £60,000.

ADCOCK & SHIPLEY, LIMITED, engineers, etc., of Ash Street, Leicester, increased by £25,000, in £1 shares, beyond the registered capital of £50,000.

COXHEADS STRATFORD FOUNDRY, LIMITED, of Martin Street, London, E.15, increased by £500, in £1 ordinary shares, beyond the registered capital of £2,031.

RATCLIFFS (GREAT BRIDGE), LIMITED, metal rollers, of Tipton (Staffs), increased by £150,000, in £1 ordinary shares, beyond the registered capital of £300,000.

SHEEPBRIDGE ENGINEERING, LIMITED, Chesterfield (Derbyshire), increased by £222,670, in 445,340 ordinary shares of 10s., beyond the registered capital of £777,330.

KNOWSLEY CAST METAL COMPANY, LIMITED, Trafford Park, Manchester, 17, increased by £130,000, in £1 ordinary shares, beyond the registered capital of £20,000.

PERMADRAUGHT PRODUCTS, LIMITED, domestic fire-grate manufacturers and fitters, of Blackburn, increased by £300, in £1 ordinary shares, beyond the registered capital of £2,000.

WEBB & SONS (TOOTING), LIMITED, iron and metal merchants, etc., of High Holborn, London, W.C.1, increased by £500, in £1 "A" shares, beyond the registered capital of £1,000.

INTERNATIONAL ELECTRICAL & ENGINEERING TRUST, LIMITED, Aldwych, London, W.C.2, increased by £49,900, in £1 ordinary shares, beyond the registered capital of £100.

A. KIRKLAND & COMPANY, LIMITED, hosiery machinery constructors, of Western Road, Leicester, increased by £11,000, in £1 ordinary shares, beyond the registered capital of £4,000.

ALFRED BRIGGS SONS & COMPANY, LIMITED, loom textile machine makers, of Gomersal, near Leeds, increased by £13,000, in £1 ordinary shares, beyond the registered capital of £7,000.

J. HOBKIRK, SONS & COMPANY, LIMITED, ironfounders, etc., of Ampthill Road, Bedford, increased by £20,000, in £1 ordinary shares, beyond the registered capital of £10,000.

ASHWELL & NESBIT, LIMITED, heating and ventilating engineers, etc., of Barkby Road, Leicester, increased by £65,000, in £1 ordinary shares, beyond the registered capital of £100,000.

IAN ROSS (CASTINGS), LIMITED, of Slough, increased by £10,000, in 2,500 ordinary and 7,500 7½ per cent. cumulative redeemable preference shares of £1 each, beyond the registered capital of £5,000.

WILSON BROS. (LEEDS), LIMITED, manufacturers of woodworking machinery, of Victoria Road, Leeds, 11, increased by £35,000, in £1 ordinary shares, beyond the registered capital of £15,000.

JAMES COLLINS (BIRMINGHAM), LIMITED, general brassfounders, etc., of Cumberland Street, Birmingham, 1, increased by £40,000, in £10 ordinary shares, beyond the registered capital of £30,000.

THOMAS BRADDOCK & COMPANY, LIMITED, meter manufacturers, ironfounders, etc., of Bedford Row, London, W.C.1, increased by £19,900, in £1 ordinary shares, beyond the registered capital of £100.

DURABLE WELDING COMPANY, LIMITED (formerly Durable Engineering Company, Limited), of Seaforth, Liverpool, 21, increased by £4,000, in £1 ordinary shares, beyond the registered capital of £1,000.

FORD MOTOR COMPANY, LIMITED, Regent Street, London, W.1, increased by £3,000,000, in 3,750,000 4½ per cent. cumulative redeemable preference shares of 16s. each, beyond the registered capital of £9,000,000.

SALWAY MORGAN & COMPANY, LIMITED, ironmasters, etc., of Poole, increased by £15,000, in 5,000 5 per cent. redeemable preference and 10,000 ordinary shares of £1 each, beyond the registered capital of £15,000.

BRECKNELL, MUNRO & ROGERS, LIMITED, ironfounders and mechanical engineers, etc., of Pennywell Road, Bristol, 5, increased by £100,000, in 4s. ordinary shares, beyond the registered capital of £150,000.

T. J. THOMSON & SON, LIMITED, iron and steel merchants, etc., of Stockton-on-Tees, increased by £50,000, in 35,000 5 per cent. cumulative preference and 15,000 ordinary shares of £1 each, beyond the registered capital of £3,000.

BRITISH ROTOTHERM COMPANY, LIMITED, manufacturers of instruments for recording temperature, etc., of Merton Abbey, London, S.W.19, increased by £22,500, in 22,400 ordinary shares of £1 and 2,000 "B" shares of 1s., beyond the registered capital of £40,000.

CLASSIFIED ADVERTISEMENTS

SITUATION WANTED

FOUNDRY MANAGER seeks change; 30 years' experience in all classes of loose pattern plate, and expert on mechanised moulding pattern layout and cupola practice, rate fixing and costing.—Box 664, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

APPLICATIONS are invited for the post of ASSISTANT FOUNDRY FOREMAN for Malleable Foundry. Applicants must have previous mechanised foundry experience.—Write, giving full details of experience, age, and salary required, to Box 654, FOUNDRY TRADE JOURNAL.

ENGINEERING Firm requires skilled UNIVERSAL MILLERS, TURRET LATHE SETTER OPERATORS, TURNERS, PLANERS and ENGINEERS' FITTERS.—Apply PLANT MACHINERY & ACCESSORIES, LTD., 136-140, Bramley Road, W.10. LADBroke 3692.

FOREMAN required for Grey Iron Foundry in East Midlands, to take charge of Coremaking Section. Must have wide experience of coremaking practice, together with the organisation and control of male and female labour.—Reply, stating age, experience, and salary expected, to Box 650, FOUNDRY TRADE JOURNAL.

HEAD FOUNDRY FOREMAN wanted. Preference given to man with Pattern Shop experience and modern methods for producing light grey iron castings from moulding machines and plate patterns. Cupola control essential.—Applicants please state age, particulars of experience and salary expected, to Box 642, FOUNDRY TRADE JOURNAL.

BRITISH CAST IRON RESEARCH ASSOCIATION

VACANCIES FOR POROSITY INVESTIGATION.

APPLICATIONS are invited from suitably qualified persons for employment on the research staff of the British Cast Iron Research Association. Three vacancies exist:

(1) RESEARCH WORKER, with good basic scientific training and with some knowledge foundry practice, preferably a Graduate.

(2) PHYSICIST, preferably with an honours degree in physics. Previous knowledge or experience of metallurgical research an advantage.

(3) METALLURGIST, preferably qualified in metallurgy or physics; research experience an advantage.

These three appointments will be required to investigate various aspects of the production of sound castings, involving considerations of metal flow into moulds, solidification rates and mechanisms. The appointments will be in the Scientific Officer or Senior Scientific Officer grades. The Scientific Officer salaries range from £390 to £635 per annum, and Senior Scientific Officer salaries from £685 to £880 per annum. The actual salary and grade will depend on experience and qualifications.

Applicants should submit full details of qualifications, age, and experience, to BRITISH CAST IRON RESEARCH ASSOCIATION, Alvechurch, Birmingham.

SITUATIONS VACANT—*Contd.*

FOUNDRY FOREMAN, accustomed to production of Aluminium Alloy Sand Castings. Must be fully experienced in estimating, and good knowledge of pattern design. Birmingham district.—Box 606, FOUNDRY TRADE JOURNAL.

MANAGER wanted for Non-ferrous Metals Foundry, Manchester district. Must be practical man, good organiser and disciplinarian. State qualifications, experience, wages required, and when at liberty.—Box 618, FOUNDRY TRADE JOURNAL.

MOULDERS and FURNACEMAN required by Ferrous and Non-ferrous Foundry. Only skilled jobbing moulders need apply.—PLANT MACHINERY AND ACCESSORIES, LTD., 135-140, Bramley Road, W.10. LADbroke 3692.

VITREOUS ENAMELLING SHOP FOREMAN wanted, who is fully experienced in processing sheet metal and castings. Knowledge of up-to-date methods, able to control labour and obtain output. Give full details of age, experience, and salary required.—Box 648, FOUNDRY TRADE JOURNAL.

WELL-KNOWN Firm of Malleable Ironfounders in Midlands, employing 500/600, has vacancy of exceptionally attractive nature. The successful candidate will be required to act as ASSISTANT to Works Manager, with possibility of control later. Candidates must be fully qualified and should have sound general engineering and foundry training, age preferably between 35 and 40. Applications, which will be treated in strict confidence, should contain full details of education, practical and technical experience.—Box 656, FOUNDRY TRADE JOURNAL.

WORKING FOUNDRY CHARGEHAND required for Non-ferrous Department of Modern Jobbing Foundry in Liverpool district. All modern conveniences and amenities provided. Applicant must have sound practical and theoretical knowledge of non-ferrous metal, particularly aluminium alloys. The position is on weekly staff basis, with production bonus and payment for overtime. Applicant would be required to join existing pensions, sickness and provident schemes. Housing can be secured for out of town applicants.—Reply to Box 658, FOUNDRY TRADE JOURNAL.

WORKS METALLURGIST required for Engineering Works in India operating large foundries and forge. Applicants should have specialised in grey iron and steel foundry metallurgy, but should have experience of general ferrous metallurgy and heat treatment, etc. Minimum salary Rs. 1,440 per month (sterling equivalent £108 at 1s. 6d. exchange). 4-year agreement, free passages, medical attention, and Provident Fund.—Apply in writing to Box 3514. c/o CHARLES BARKER & SONS, LTD., 31, Budge Row, London, E.C.4.

BUSINESS OPPORTUNITIES

CONTROL of small West Midlands Foundry available for £2,000. Twelve months' work guaranteed. Exceptional opportunity for exploitation.—Box 662, FOUNDRY TRADE JOURNAL.

PROFESSIONAL

E. LONGDEN, M.I.MECH.E., CONSULTING FOUNDRY ENGINEER. AVAILABLE TO ADVISE ON GENERAL FOUNDRY PRACTICE, FOUNDRY METALLURGY AND MECHANISATION - CAST IRONS, MALLEABLE IRON, STEEL AND NON-FERROUS CASTINGS. — "ROSEVILLE," 11, Welton Avenue, Didsbury Park, Manchester, 20.

BUSINESS FOR SALE

FOR DISPOSAL.—Ferrous and Non-ferrous Foundry in South Coast town. Capacity 12 tons weekly. Long leasehold premises, with room for future development, in zoned area.—Box 666, FOUNDRY TRADE JOURNAL.

MACHINERY WANTED

WANTED.—4 ft. 6 in. dia. Cupola. Complete with fan, motor and spark arrester. Good condition essential.—Box 614, FOUNDRY TRADE JOURNAL.

URGENTLY WANTED.—All types of Foundry Plant, including Sand Mills, Cupolas, Blowing Fans, Hand and Pneumatic Moulding Machines, Sand Mixers.

S. C. BILSBY, A.M.I.C.E., A.M.I.E.E.,
Crosswells Engineering Works, Langley Green, near Birmingham. Broadwell 1359

WANTED

MODERN FOUNDRY PLANT, of all descriptions. WE WILL PAY CASH.

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

WANTED

CUPOLAS of all sizes, also Cupolettes; cash waiting.

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

MACHINERY FOR SALE

FOR SALE.

MOTORISED Double Ended Grinding Machine. Wheels 16 in. by 2 in. 400/3/50 Supply. Complete with Dust Extraction Plant.

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

FOR SALE

LANCASHIRE BOILER FLUES, suitable for Cupolas; can be inspected at our works; cheap.

MARKLAND SCOWCROFT, LTD.,
Cox Green Works, Bromley Cross, near Bolton.
Tel. No. Eagley 600/1/2