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Shakespeare emphasised that a name, *per se*, meant very little. A Kommissar and a mediæval Duke probably are very similar sort of persons, but are accorded different names. On the other hand, there are a number of words which different people interpret differently. "Democratic" is an outstanding example. It matters but little if there is nothing to be done about it, but the danger arises when governments decide to legislate around one word. Our early experience of this was during the first world war, when apples were controlled at ninepence a pound, whether they were Cox's orange pippins or green cookers entering the classification of windfalls.

In more recent times, legislation has been applied to the catering industry and as the units range from the Ritz Carlton down to a seaman's doss-house, the practical results have obviously been chaotic and have brought the law of the land into disrepute. The above has been written as a warning as to what might happen if the Government decides to use the word "foundry" for legislative purposes—even if they use a qualifying adjective. The difference between "Cox's orange pippins" and "cookers" is readily recognised by the man in the street, but the varieties of foundries are to most people unknown. Legislation, unless created with supreme intelligence, would bring out the same sort of chaos as now exists in the catering industry. Size apart, there is a difference in the speed of working in the various classes of foundry. For instance, in a mechanised shop the parting powder bag may be used every minute or so, whereas in the jobbing shop the frequency of use diminishes with the increasing size of the job being made. Because of the former conditions, legislation controlling the composition of parting powder has been introduced which affects every ironfoundry. This was not serious in its impact, however. It should be realised, nevertheless, that some notions being discussed and which are well worthy of introduction into the larger concerns have no real worth when applied to the smaller shops. For instance, we are not convinced that concrete floors are invariably advantageous. They are dirty, they give rise to excessive fatigue in a working place, and they can be slippery—especially when sprinkled with pellets of metal. Fumes from cores can be objectionable when, as in some motor-car castings shops, the whole mould is an assembly of cores, but in a jobbing shop the problem is virtually unknown. Similar remarks apply to the knocking-out of castings, where in the case of a mechanised foundry it is continuous and in a small jobbing shop it may be bi-weekly.

Because the "big shots" in the industry go into solemn conclave with their opposite numbers in the trade unions reinforced by "high ups" in the Ministry, it is imperative, if "foundry" is to have proper interpretation, that the smaller fry join their appropriate employers' organisation and make their voices heard, otherwise they will be forced to buy "windfalls" at ninepence a pound.

Contents

Midland Ironfounders Productivity Meeting

CLOSE ON THE HEELS of the Productivity conference of the Council of Ironfoundry Associations held in London, the previous week, was a meeting of the Midland constituent associations held at the Queen's Hotel, Birmingham, on September 27. The meeting was arranged at short notice to honour the presence of Mr. H. P. Good, president of the Gray Iron Founders' Society of America (who was over here in connection with the recently issued Grey Ironfounders' Productivity Report), and Colonel Holmes, of the Industrial Advisory Committee of the U.S. Military Supply Board. Col. Holmes was in Europe to assist military productivity among the 12 signatory nations of the North Atlantic Treaty and he had with him a propaganda film on the malleable ironfoundry industry in the States, which was shown later in the afternoon. Members of the Automobile Ironfounders' Association, the Shropshire Ironfounders' Association, the Ironfounders' National Confederation and the National Association of Malleable Ironfounders, joined the American guests and the Midland Ironfounders' Association at a luncheon which preceded the business of the afternoon.

Following the luncheon, the president introduced the guests to the meeting and made two presentations to Mr. Good. The first was an artistic filligree cast-iron dish of great intricacy, produced at the Coalbrookdale Iron Company, Limited, and presented by the Shropshire Ironfounders' Association, and the second was an album of photographs of the National Foundry Craft Training Centre at West Bromwich, and its hostel, which Mr. Good had visited that morning.

Mr. Good, after thanking the company for the gifts, then addressed the meeting on the general subject of productivity. Topics included the need in this country for publicity on founding directed to the general public, the necessity to fight back against competition; the ultimate responsibility of management for all angles of productivity; labour organisations; the formation of cost groups and good housekeeping.

The meeting was then opened for discussion, and several questions both of a particular and general nature were put to Mr. Good. In his replies, while dissociating himself from any detailed knowledge of the British way of life, the American society's president showed a remarkably shrewd grasp of essentials. Towards the conclusion of the meeting, Mr. K. Marshall (director of the J.I.C.) enumerated points from the policy of the ironfounders towards implementing the findings of the Productivity Report.

THE SCOTTISH SECTION of the British Steel Founders' Association are sponsoring a mass radiography examination of steelworkers and foundrymen in Glasgow, Lanarkshire, Dumbartonshire, and Stirlingshire. Their mobile X-ray unit has already toured other areas. Thousands of workers have agreed to the check-up.

Forthcoming Events

NOVEMBER 11.

Institute of British Foundrymen.

Newcastle Branch:—"Cast Iron and the Development of Heavy Machine Tools," by L. Walker, at the Neville Hall, Westgate Road, Newcastle-upon-Tyne, at 6 p.m.

Scottish Branch:—"Brassfoundry Production Methods in the U.S.A.," by F. Hudson, F.I.M., followed by film "The Brass Trail," at the Technical College, George Street, Glasgow, at 3 p.m.

NOVEMBER 13.

Institute of Production Engineers.

Sheffield Section:—"Mechanical Handling," by A. Roebuck, M.I.Mech.E., and members of the Productivity Team, at the Royal Victoria Station Hotel, Sheffield, at 6.30 p.m. (Joint meeting with the Institution of Works Managers.)

Institute of Metals.

Scottish Local Section:—Symposium on "Corrosion Experiences," at the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow, C.2, at 6.30 p.m.

NOVEMBER 13 to 18.

Public Works and Municipal Services Congress and Exhibition, at Olympia, London.

NOVEMBER 14.

Institute of British Foundrymen.

Lancashire Branch:—"Mechanical Charging of Cupolas," by W. J. Driscoll, at the Engineers' Club, Albert Square, Manchester, at 7 p.m.

Coventry Students' Section:—"Malleable Cast Iron—the Essential Difference between Whiteheart and Blackheart," by H. G. Hall, F.I.M., at the Coventry Technical College, at 7.15 p.m.

Institution of Production Engineers.

London Graduate Section:—Visit to Vickers-Armstrong, Limited, Weybridge, Surrey, at 2.30 p.m.

Birmingham Graduate Section:—"Steel Production—with Special Reference to Alloy-steel Manufacture," by E. Booth, at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7 p.m.

Sheffield Society of Engineers and Metallurgists.

"Geology in the Service of Iron and Steel," by W. Davies, Ph.D., at the Grand Hotel, Sheffield, at 7 p.m.

NOVEMBER 15 and 16.

Iron and Steel Institute.

Autumn Meeting, at 4, Grosvenor Gardens, London, S.W.1.

NOVEMBER 16.

Institute of British Foundrymen.

Burnley Section:—"Non-ferrous Founding," by T. Freeman, at the Municipal Technical College, Ormerod Road, Burnley, at 7.30 p.m.

Institution of Production Engineers.

London Section:—"Research in Relation to Production Engineering," by Dr. D. F. Galloway, at the Royal Empire Society, Northumberland Avenue, London, W.C.2, at 7 p.m.

NOVEMBER 17.

Eastern Counties Section:—"Mechanical Handling," by W. J. T. Dimmock, at Ipswich Public Library, at 7.30 p.m.

NOVEMBER 18.

Institute of British Foundrymen.

Bristol and West of England Branch:—"Casting Inspection," by J. H. Williams, at the Grand Hotel, Broad Street, Bristol, at 3 p.m.

Duplicate Conference on Productivity

To cater for those who were prevented because of limited accommodation or other reasons from attending the recently-held B.C.I.R.A. Conference on Productivity at Ashorne Hill, nr. Leamingtaon Spa, a duplicate Conference is to be held. This is scheduled for November 16 and 17 at Ashorne Hill, and again the technical aspects of the Grey Iron Founders' Productivity Report will be considered; members of the Team will be present. Intending participants should write to Mr. G. R. Woodward at the British Cast Iron Research Association at Alvechurch for details.

Testing the Metal or Testing the Casting*

Some Notes on the New Swedish Grey-iron Specification

By Erik O. Lissell, M.Sc.

Generally speaking, a specification enunciates the rules and regulations according to which the quality of a product is to be judged. In the case of castings, most specifications include:—(1) *The types of tests to be performed;* (2) *Methods of preparing the test-pieces for mechanical tests;* (3) *Dimensions of test-pieces;* (4) *Procedure to be followed in testing;* (5) *Classification of castings on the basis of the test results; and* (6) *Regulations regarding surface finish, dimensional accuracy and freedom from defects.*

A SPECIFICATION is drawn up for the mutual benefit of both producers and consumers. The interests of the producer as well as the consumer are two-fold. The producer needs the specification to provide a means for:—(*a*) Technical and production control, and (*b*) inspection control.

The consumer, on the other hand, is much interested in the specification for:—(*a*) Design purposes, and (*b*) inspection control.

Thus, the interests of manufacturer and user meet in one point even if the two parties consider the problem from different viewpoints.

The three basic functions of a specification for an engineering material just listed are most important and should, if possible, be provided for in all standard specifications. When it comes to cast products, this is very difficult to accomplish, the reason being that, in the casting process, the manufacturer starts out with one material—molten metal—and ends up with another physically quite different one—solid metal in cast form. No other metal-forming process includes such a drastic change in the state of matter.

Testing

The main portion of most cast-iron specifications is devoted to different kinds of tests to determine the quality of the primary product (the metal used) and the finished product (the casting). Whether specifications in different countries adequately cover both of these aspects will be discussed later. For the time being it is proposed to leave the specifications and deal only with the data and relationships on which they are based.

From a specification point of view, cast iron is generally tested for tensile and transverse strength. To be able to carry out tests, a test specimen of some kind is needed The molten metal in the ladle can only be tested with respect to quality from a mechanical point of view after having been cast into a suitable shape, *e.g.*, a cylindrical bar.

The mechanical properties of the metal in the casting in terms of tensile strength, etc., cannot, on the other hand, be determined directly in any other way than by cutting test specimens from the casting itself, but such direct tests offer almost insuperable difficulties from a commercial and practical viewpoint. The solution is to discover a test casting or several such castings of limited size which will truly represent the original casting.

Thus, the properties of both the iron itself and the properties of the iron in the casting will be determined with the help of a test bar.† The test-bar becomes the link between molten metal and casting. A test-bar may be cast in four different ways:—(1) Separately; (2) attached to the ingates of the casting; (3) joined to the casting by means of runners, and (4) directly attached to the casting (coupon).

Correlation between Molten Metal, Test-bar and Casting

In order to fulfil the requirements of a specification, *i.e.*, to yield satisfactory information for production control, inspection and serviceability, the test-bar has to be adequately correlated both to the molten iron and to the casting. In this respect the test-bar becomes the fundamental factor in all testing of castings.

Much research work has been carried out to establish the two relationships just mentioned. The problem of the cast test-bar is far from solved, and is a major question in the drafting of specifications for other alloys also, as has been pointed out by Kondic.[1] Fig. 1 is an attempt to represent the situation graphically. In the figure, the test specimen (it may be a tensile-test specimen or any other test specimen) is the link between metal quality to the left and casting properties to the right. On one side there is the correlation of metal quality to test specimen (A) and on the other side the correlation of casting properties to test specimen (B).

* Paper presented at the Buxton Conference of the Institute of British Foundrymen. The Author is attached to the Foundry Division, Federation of Swedish Mechanical Engineering Industries.

† The word test-bar will be used to designate an unmachined bar cast for testing purposes. The machined test piece will be called test specimen.

Testing the Metal or the Casting

Correlation of Quality of Metal and Properties of the Test Specimen (*Case " A "*)

Let it be assumed for the time being that the test specimen directly represents the test-bar, *i.e.*, no factors affect the test values other than those of the properties of the test-bar. The properties of the test-bar are a function of how the test-bar is cast. Broadly speaking, the test-bar may be cast either separately or in some way or other joined to the casting, as previously mentioned. It is generally realised that the test values obtained on test specimens from separately-cast bars indicate the quality of the iron in the ladle from which the bars were cast. If the bars are cast under standardised conditions (*i.e.*, shape and size of bar, gating, mould position, mould material, casting temperature, etc., are kept constant), it may be stated quite safely that the test values represent directly the properties of the iron as such and that correlation " A " is true.

If, on the other hand, it is left to the foundryman to decide for himself how to cast the bars, the universal applicability of the specification is lost. In this case, the factors just mentioned are apt to vary considerably and correlation " A " becomes uncertain. This was clearly indicated by a contribution[2] by Mr. H. J. Young to a discussion following a Report of Sub-committee T.S.18 of the I.B.F. Under such conditions it is no longer the inherent qualities of different grades of iron that are tested under identical conditions, but the qualities of different irons under varying conditions. It is doubtful whether in such a case the cast iron can be looked upon as being actually specified.

The properties of the test-bar in some way or other joined to the casting will no doubt be quite different from those of the separately-cast bar. The difference can be expected to be greater the closer the test-bar is attached to the casting. Cooling conditions and other factors will change and become more akin to those of the casting, as has been shown by several investigators.[3,4,5,6] Since the modifying factors vary from casting to casting, the correlation " A " of metal quality and test specimen can safely be branded, in this case, as unknown.

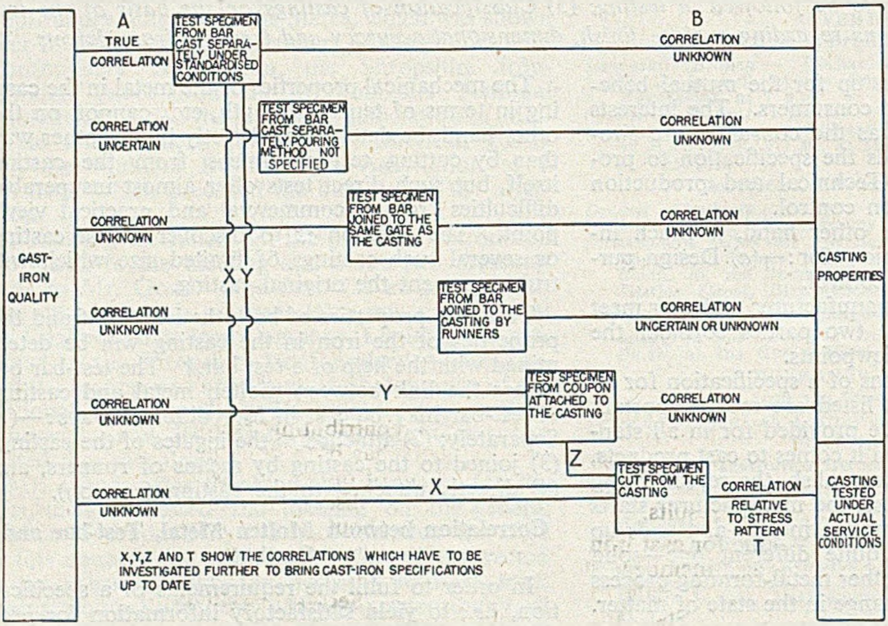

FIG. 1.—*Schematic Relationship between Cast-iron Quality, Test-bar and Casting Properties.*

Correlation of Casting Properties and the Properties of the Test Specimen (*Case " B "*)

The service properties of a casting cannot be determined satisfactorily in any other way than by exposure of the casting to the strains and stresses of actual service. This is the only positive and final test, as pointed out by Bolton.[7] All other tests, even tests on the entire casting carried out in the laboratory, will yield a distorted picture due to difference in the stress pattern. The difficulties of carrying out service tests or full-scale laboratory tests prevent their use except in special cases. Mass-produced castings, such as motor-vehicle castings, are sometimes tested in this manner.

A somewhat simpler way to determine the properties of a casting is to cut specimens from the casting and test these statically or dynamically in the laboratory. These tests will not disclose how the casting *per se* will withstand the hardships of service, but they undoubtedly give a good picture of the properties in different parts of the casting. If the stress pattern under service can be roughly determined by means of strain gauges, it may be possible to predict the serviceability of the casting fairly satisfactorily (correlation " T," Fig. 1).

For production control and inspection, this method of testing sections of the casting is too involved, too time-consuming and too expensive, besides being destructive with respect to the casting. The important thing is to find a test-bar or a set of test-bars which can be directly correlated to the properties of the metal in different sections of the casting. This relationship is designated " B " in Fig. 1.

How should such a test-bar be cast—separately or joined to the casting? If it be maintained that the bar shall fulfil its dual function of indicating the properties of both molten metal and casting, it is quite obvious that only the separately-cast bar will answer. A cast-on test-bar or test-bar in some other way cast integrally with the casting can be regarded as yielding more reliable information as to the properties of the casting. However, if this course be chosen, it will become very difficult to establish the relationship between the test-bar and the molten iron.

The opinion of different investigators is quite divergent. Needham,[8] in discussing the 1928 British Standard Specifications for Grey Cast Iron, states that the use and interpretation of test coupons has been perfunctory and casual and has been abandoned in favour of separately-cast bars. MacRae Smith[3] advocates a different opinion, but considers the coupons awkward to handle in the machine shop. He suggests test-bars attached to the runner as being more advantageous. Léonard[4] has tried the runner-attached test-bars in quality-control work and found it difficult to obtain them as sound as the castings. He prefers cylindrical coupons added at important points of the casting with a diameter proportional to the thickness of the casting. Jungbluth[6] cast a number of irons in the shape of open square boxes with a runner-attached test-bar on one side. The attached bars did not seem to give a better correlation than those separately cast. Thum, Sipp and Petri[9] cast similar cast-iron boxes, but with coupons added, similar to those suggested by Léonard.[4] They found that the coupons did not yield reliable results.

The question is by no means unique for cast iron. It has been discussed at length amongst members of many other bodies. The Non-Ferrous Metals Industry Standards Committee of the British Standards Institution seems to have taken up a most realistic attitude to the problem of test-bar properties *versus* casting properties. The following quotations from B.S. 1367:1947[10] for sand-cast copper-base alloys clearly indicate this:—

> " It is emphasised that neither integral test-pieces on the casting nor separately-cast test-bars normally exhibit mechanical properties which are representative of the properties of the casting."

Regarding " cast-on " test-pieces, it is further stated:—

> " Integral test-pieces ' cast-on ' the casting in general do not give more information about the mechanical properties of the casting than separately-cast test-bars. The properties of the metal vary from place to place in the casting in accordance with the local conditions of rate of cooling and access of feeding metal. In these circumstances the ' cast-on ' bar is as much a special case as the separately-cast bar, when considered in relation to the properties throughout the casting."

Even if copper-alloy castings and iron castings are not fully comparable with respect to casting properties, the statements of B.S. 1367 are undoubtedly applicable to cast-iron castings. This seems to be also the position taken by the standardising institutions in most countries. The separately-cast test-bar has therefore become the backbone of cast-iron testing.

After having discussed the problem how to cast the test-bar, one has now to tackle the question of how to determine the relationship " B " between test-bar properties and properties of the metal in the casting. The natural way to investigate a problem of this kind is obviously to cut test specimens from different sections of castings and compare the properties obtained from such specimens with those of the test-bar. To most metals, such a procedure would be readily applicable. Cast iron is, however, an exception. As is generally recognised, the sectional thickness of a grey-iron casting affects the properties in different parts of the casting. This " section sensitivity " is most characteristic of grey cast iron; it has, however, also been found to exist in other alloys, *e.g.*, aluminium alloys.[11]

The fact that the thickness of section influences the properties of a cast iron has attracted the interest of foundrymen all over the world to such a degree that other factors (which from a practical viewpoint might be just as important) have been virtually overlooked. The Author ventures to say that the picture of the properties of cast iron generally presented is quite distorted and gives a wrong impression of the relative importance of different factors affecting strength and other properties in iron castings. A contributing factor is that too much research work has been done under laboratory conditions instead of on actual castings. It is, however, not possible to discuss the correlation of test-bar and casting without paying some attention to the question of section sensitivity.

Section Sensitivity

The question of section sensitivity has earlier been treated quite extensively in British literature.[12] It is therefore not necessary for any detailed account of earlier research work. Some points will, however, be recalled. The investigations carried out to clarify section sensitivity have mainly concerned test-bars, but some work has also been done on simple castings.

(*a*) *Section Sensitivity in Test-bars*

The first records of a systematic study of the relationship—section-thickness *versus* strength—are dated as early as 1888.[13] From the turn of the century up to about 1940, a number of investigations on test-bars have been published. The earlier workers like Reusch,[14] Keep,[15] Russell[16] and Beeny,[17] tested only transverse bars, round or square. The specimens were all " natural," *i.e.*, they were tested " as-cast " without machining except in one case. Beeny machined his specimens down to one standard size.

Testing the Metals or the Casting

In the investigations from about 1930 onwards, both transverse and tensile tests were carried out. The tensile specimens were either machined with as large a gauge diameter as possible with respect to the test-bar, or turned down to one predetermined gauge diameter. The first type will be called "natural" tensile specimens, the second standard-gauge specimens. McRae Smith[3] and Bornstein[18] used one size standard-gauge specimens, and Dübi[5] "natural" specimens. Heller and Jungbluth[19] studied both. The data observed were generally presented in tables or in linear diagrams showing the relationship between test-bar size and strength. The first attempts to correlate strength and bar size mathematically were done by F. B. Coyle.[20] Coyle found that the curves showing the relationship between average tensile strength of test-bars of various diameters were of the type: $y = c.x^m$ where y is tensile strength, c a constant, x the diameter of the bar, and m an exponent. In logarithmic form, the equation changes to $\log y = m \log + \log c$. When the data are plotted on logarithmic cross-section paper, straight lines are obtained and $m = tg\alpha$ stands for the slope of the lines. This system of representing such data will be used throughout this Paper.

Coyle was of the opinion that the constant c, which he found to vary with the iron quality, indicated the grade of iron, while the exponent m remained constant. Thus, Coyle's curves for various grades of iron were parallel. This was later proven to be wrong. Jungbluth and Heller[21] showed that both c, and m, vary considerably with the quality of the iron. It was shown that this exponential function as an indication of section sensitivity, was valid for all kinds of cast irons.

Average tensile strengths for three qualities of iron plotted as a function of test-bar size, on logarithmic paper, confirms the findings of Jungbluth and Heller (Fig. 2). The diagram shows that the slope of the curves is a good indication of section sensitivity.

(*b*) *Section Sensitivity in Castings*

Investigations of the section sensitivity in castings have been confined to castings of simple shape. In more complicated castings, other factors enter into the picture and render the interpretation of the test results rather difficult. The types of castings which have been subject to investigation are slabs, square open boxes, a step-wedge and a specially designed wheel-like casting.

The box-shaped casting was originally suggested by Dübi.[5] It resembles a square box without bottom or top with four sides of different thicknesses. Similar types of castings have been used by Hugo, Piwowarsky and Nipper,[22] Jungbluth,[6] and Thum, Sipp and Petri.[9] In some cases "natural" test specimens were used; in other cases such specimens as the one gauge diameter were used. Schwarz and Väth[23] investigated slabs; Varlet [24] a step wedge, and Pfannenschmidt[25] a wheel-like casting with varying section thicknesses in spokes and rim. It was clearly indicated by these investigators that the heavy sections were weaker than the lighter. The logarithmic law was further shown to be valid for castings of simple shape. In a great many cases, the section sensitivity appeared, however, to be rather small.

In connection with the tests carried out on test-bars and castings to study the section sensitivity, it was pointed out that the test specimens could be "natural," *i.e.*, varying in size according to wall or bar section, or be machined to one standard size. There are three good reasons for such a distinction, since other factors (such as the section sensitivity just discussed above) affect the test results. These factors will be briefly touched upon in the following sections.

(*c*) *Section Sensitivity confined to the walls of a casting*

The fact that the overall strength in a heavy section is lower than that of a thinner section, *i.e.*, the section sensitivity, is explained by the slower cooling rate and, hence, the coarser structure of the heavy section. The cooling rate, however, not only varies from section to section in a casting, it also varies within the section itself, being generally highest at the surface and lower further towards the centre. Thus, as is well known, one obtains a denser and finer-grained iron at the surface and a softer iron in the middle of the section.

This "inner-section sensitivity" is most pronounced in heavier sections. It has been studied in several ways, but most investigators, such as Varlet,[24] Hugo, Piwowarsky and Nipper[22] and Leonard,[4] have utilised shear tests. The curves showing the "inner-section sensitivity" vary in shape between an inverted-bell shape, bell shape and combinations of these to basic configurations.

It is obvious that the tensile strength determined on test specimens taken from a heavy section will be quite different, depending on the gauge diameter

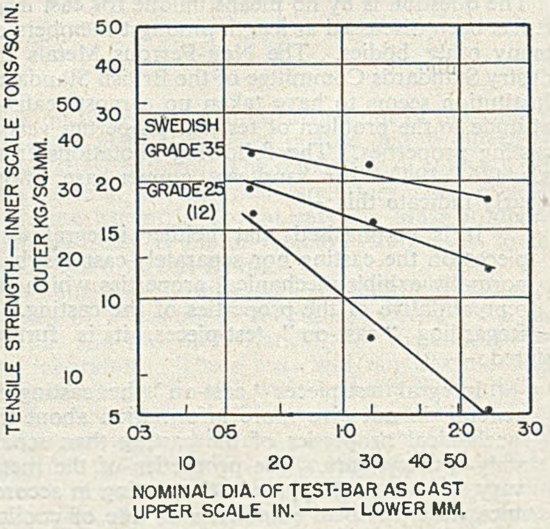

FIG. 2.—*Relationship between Average Tensile Strength and Nominal Diameter of Tensile Test Specimens for Three Different Grades of Grey Cast Iron.*

of the specimen and from which part of the section the specimen was cut. A "natural" test specimen will contain the weakest and some of the diameter will give higher values if trepanned close to the surface. A specimen of smaller gauge diameter will give higher values if trepanned close to the surface than if cut from the centre of the casting. Fig. 3 shows a section

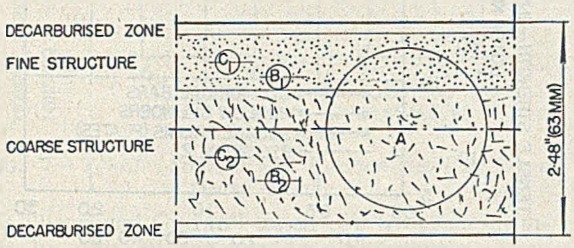

FIG. 3.—*Structural Regions in a 2.48 in. (63 mm.) Slab Casting and Locations of Tensile Test Specimens Trepanned from the Slab.*

of 2.48-in. (63-mm.) slabs cast for research purposes[26] from an iron containing about 3.25 per cent. C and 2.35 per cent. Si. Three different regions can be distinguished. Tensile test specimens were cut from the slabs as illustrated. The circles indicate the gauge diameters. Table I shows the tensile values obtained.

TABLE I.—*Tensile Strength Values Obtained in Test Specimens of Different Gauge Diameters Trepanned in Different Ways from the Slab Casting Shown in Fig. 3.*

	Test specimen. Gauge diameter.		Average tensile strength.	
	in.	mm.	Tons per sq. in.	Kg. per sq. mm.
A	1.85	47	9.91	15.6
B_1	0.275	7	11.24	17.7
B_2	0.275	7	8.83	13.9
C_1	0.275	7	11.24	17.7
C_2	0.275	7	9.59	15.1

Exact values of tensile strength are consequently very difficult to obtain on heavy sections, due to the "inner-section sensitivity."

Volume Sensitivity

It has been known for a long time (as pointed out by Meyersberg[27]) that, if a great number of tests is carried out on two test-bars of the same shape, but different size, prepared from the same material, two separate groups of data will be obtained. In some way or other, the dimensions as such have a bearing on the properties. It was not until Weibull[28] presented his statistical theory of the strength of materials that a solution to the problem was found. No metal structure is perfect. There are always imperfections in the crystal structure, points of weakness which give an impetus to rupture, some at the higher stress and others at lower stress. Statistically, the number of such points of weakness increases as the volume under stress increases. Hence, the probability of rupture increases with volume, which means that the strength is reduced.

Weibull showed that the relationship between volume and strength is an exponential function. Meyersberg deduced the following equation to express this relationship:—

$$T = B \cdot V^{a}$$

where T is the strength, B a constant, V the volume under stress, and a an exponent (negative).

By expressing this equation logarithmically, the following equation is obtained:—

$$\log T = a \log V + \log B$$

This is the equation for a straight line where a indicates the slope. The equation is similar to the one which is valid for the relationship section size *versus* strength.

On the basis of extensive experiments carried out on specimens of the same structure, Meyersberg[29] has found that the correlation of volume and strength is valid for all kinds of stresses. Fig. 4 shows one of his curves plotted by data from 46 transverse tests on round specimens of constant

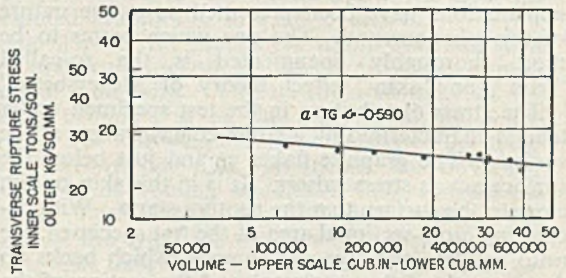

FIG. 4.—*Relationship between Transverse Rupture Strength and Volume indicating the Volume Sensitivity.*

diameter, but with varying distance between supports.

TABLE II.—*Transverse Rupture Strength Obtained in Round Test Specimens Tested with Different Diameters and Varying Distance between Supports (G. Meyersberg).*

Group of data.	Number of specimens in group	Transverse rupture stress		Volume.	
		Tons per sq. in.	Kg. per sq. mm.	Cub. in.	Cub. mm.
G_1	3	15.70	24.73	36.14	592.570
G_2	3	15.94	25.10	30.93	507.120
G_3	8	16.22	25.54	26.01	426.370
G_4	10	16.15	25.44	18.63	305.340
G_5	10	16.68	26.26	12.95	212.260
G_6	3	16.76	26.39	9.67	158.480
G_7	3	17.27	27.20	6.47	105.990
G_{11}	3	15.45	24.33	39.07	640.460
G_{12}	3	16.43	25.87	28.50	467.190

All specimens were controlled as to Brinell hardness before being accepted. The sensitivity factor is −0.0903.

The consequence of the volume sensitivity is that test-bars of different size are not comparable even if the properties of the metal itself are otherwise identical. A smaller test specimen will, due to the influence of volume under stress, yield a higher strength than a larger one. Under these conditions it is not without importance that the test specimen be a "natural" one or be machined to a predeter-

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mined constant size. The numerical value of the sensitivity factor has been shown to vary with the nature of stress.

Rim Effect or Skin Effect

Besides the two factors just discussed, *i.e.*, section sensitivity and volume sensitivity (which tend to raise the strength in thin sections and small test specimens respectively), there is another test-specimen factor to take into consideration. This new factor works in the opposite direction to the other two. It has been found that the strength obtained in test specimens of gradually diminishing section size and made from the same iron first increase as can be expected from the law of volume sensitivity. Below a certain size, however, the increase in strength gradually flattens off and sometimes is transformed into a decrease in strength. The latter phenomenon was observed by Oberhoffer and Poensgen[30] and Pinsl,[31] and has been thoroughly investigated by Meyersberg.[29] Several explanations have been presented as to the nature of this phenomenon. The one which seems to be most thoroughly documented is the so-called "rim" or "skin" effect theory of Meyersberg.[27]

The stress distribution in the test specimen under load is characterised by a stress concentration at the surface. The graphite flakes at and just below the surface act as stress raisers. It is in this skin or rim close to the surface that the rupture starts. With decreasing cross-sectional area of the test specimen, the ratio between the area of the core (which backs up the strength of the specimen) and the section of the rim decreases. At some characteristic ratio, the detrimental effect of the rim becomes predominant and the strength of the specimen will be influenced in an unfavourable direction.

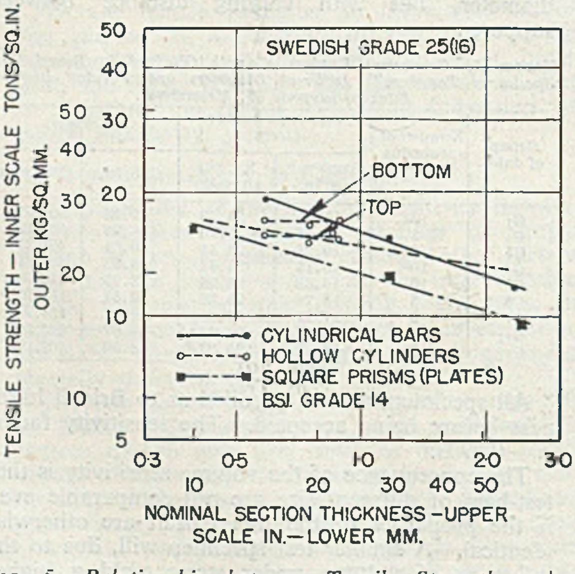


FIG. 5.—*Relationship between Tensile Strength and Nominal Section Thickness of Cylindrical Bars, Hollow Cylinders and Square Prisms. Cast Iron Grade* 16.

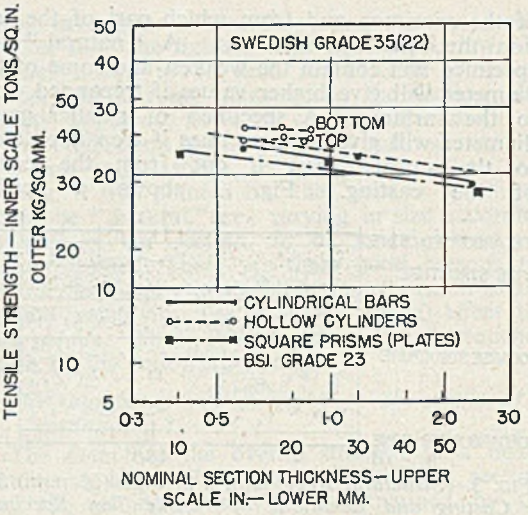


FIG. 6.—*Relationship between Tensile Strength and Nominal Section Thickness of Cylindrical Bars, Hollow Cylinders and Square Prisms. Cast Iron Grade* 22.

In testing, the "rim" or "skin" effect is characterised by a decrease in strength when the cross-section of the test specimens becomes smaller. Often the rate of increase in strength only is diminishing. The most important effect is, however, that the spread in test values is appreciably increased. The skin effect renders unreliable tests carried out on specimens with a gauge diameter below about 0.8 in., especially when the iron is on the soft side.

Correlation of Test-bar and Casting

Bolton[7] enumerates the causative factors determining the physical properties of castings as follow:—

(1) Chemical composition—initial, incidental and final.
(2) Structural and mechanical make-up of charge.
(3) Melting process.
(4) Thermal and mechanical history—furnace spout to cooled casting.
(5) Design and workmanship.

For a given heat, to be poured into test-bars and castings, factors (1), (2), and (3) are alike for both castings and bars. Bolton is of the opinion that factor (4) can be simulated to a large degree for bar and casting and that factor (5) also can be allowed for.

The present Author is of a somewhat different opinion. The statements made by Bolton are probably true for very simple castings cast under closely-controlled conditions, provided the method of testing does not affect the results. Such factors as section sensitivity, volume sensitivity and skin factor must, however, not be overlooked. The thermal and mechanical history of a casting is, on the other hand, a function of so many variables that it seems virtually impossible to establish any reliable relationship between test-bar and castings when the design becomes more complicated.

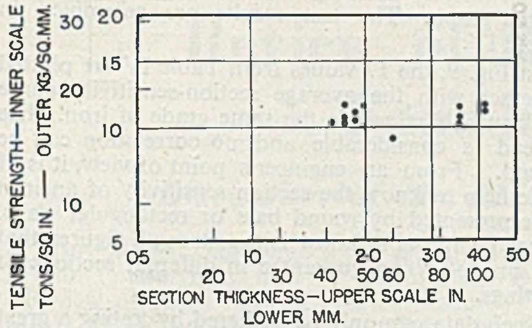


FIG. 7.—*Tensile Strength in Various Sections of a Heavy Casting.*

Gilligan and Curran[32] tested two hydraulic cylinders by means of trepanned tensile specimens. They also cast and tested square bars of varying sectional thickness in order to correlate test-bar properties and casting properties. Due to the fact that the cylinders were castings of very simple shape, the sections heavy, and the test specimens of the same size and sufficiently large, a good correlation was obtained. Schwarz and Väth[33] cast slabs and round test-bars from the same heats. They showed that for such simple shapes the following relationship could be established:—

$$D = 2{\cdot}T,$$

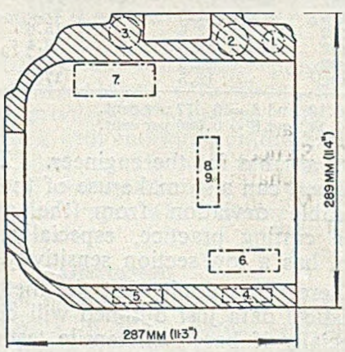
where D is the diameter of test-bar, and T the thickness of the slab.

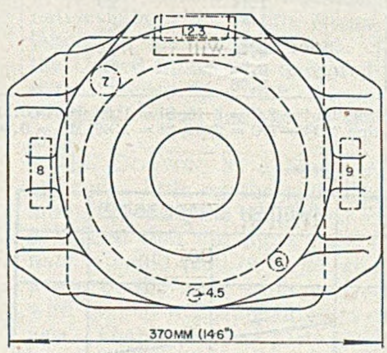
Similar investigations on simple shapes carried out in Sweden confirm that satisfactory correlations can be established as long as the castings are simple and cool in a manner similar to that of the bars. Table III contains data of tensile properties found in cylindrical bars, hollow cylinders and slabs. The irons tested are motor-vehicle iron:—T.C. = 3.25 per cent., Si = 2.35 per cent.; and a high-strength iron: T.C. = 2.90 per cent., Si = 2.65 per cent. The tensile specimens were of the "natural" type, *i.e.*, they conformed to the section size. The data are presented graphically in Figs. 5 and 6.

TABLE III.—*Tensile Strength* versus *Section Size for Various Simple Shapes of Castings.*

Type of casting.	Section size.		Tensile strength.			
			Swedish grade 25. British grade 16.		Swedish grade 32. British grade 22.	
	in.	mm.	Tons per sq. in.	Kg. per sq. mm.	Tons per sq. in.	Kg. per sq. mm.
Cylindrical bars	0.59	15	19.1	30.0	23.4	36.9
	1.18	30	15.5	24.5	21.8	34.3
	2.36	60	12.0	18.8	17.8	28.0
Hollow cylinders (top)	0.59	15	15.9	25.1	24.6	38.8
	0.75	19	15.1	23.7	25.1	39.6
	0.85	21.5	16.2	25.5	24.0	38.8
	0.87	22	15.6	24.6	24.9	39.2
Hollow cylinders (bottom)	0.59	15	17.3	27.2	26.6	41.9
	0.75	19	16.8	26.4	25.8	40.7
	0.85	21.5	15.6	24.6	23.6	37.1
	0.87	22	16.3	25.7	25.7	40.4
Square prisms (slabs)	0.39	10	16.1	25.4	22.5	35.4
	0.98	25	12.5	19.7	21.6	34.0
	2.48	63	9.7	15.2	17.9	28.2

The slope of the graphs for round bars and slabs are practically identical, which indicates similar thermal conditions. The section sensitivity of the hollow cylinders is, on the other hand, quite different. The fairly small inner diameter of the cylinders, between one and two inches, has obviously equalised the cooling conditions and rendered the castings fairly independent of section size. The height of the cylinders, which were top poured, was 3.5 in. This fact, coupled with the difference in ferrostatic head at top and bottom, probably explains the difference in strength at those two points. Thus, even in simple shapes, a reliable correlation cannot always be anticipated.





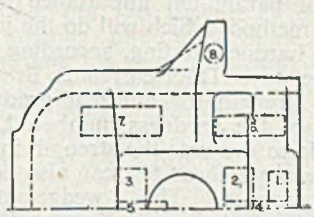


FIG. 8.—*Grey Cast-iron Journal Box. Locations of Test Specimens Trepanned from the Casting.*

Very little is published on the properties found in various sections of more complicated castings. The scanty data available confirm that considerable difficulties will be encountered in trying to correlate

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test-bar and casting properties. Struk[33] cut out tensile test specimens from the spokes of a mower wheel. In a wheel cast from a low-grade iron, the tensile strength varied from between 11.2 and 12.3 tons per sq. in., the lowest value being observed close to the ingate. Jungbluth and Heller[21] report the tensile strength found in a heavy casting produced by the Krupp Works. The analysis showed a carbon content between 3.0 and 3.2 per cent. and a silicon content of about 1 per cent. The sectional thickness of the casting varied between 1.6 and 4.1 in. Fig. 7 shows the tensile strength plotted as a function of section size. The spread in strength at different wall thicknesses is very striking. Similar tests have been carried out by the Author on two castings, the shape of which is shown in Fig. 8. The castings were made of a high-duty iron, British grade 22, that is, the same iron as was used in the other Swedish tests reported. "Natural" tensile-strength specimens were cut from various points of the casting, as shown in the graph. The test results are assembled in Table IV.

In Fig. 9, the 17 values from Table IV are plotted together with the average section-sensitivity curve for round bars cast in the same grade of iron. The spread is considerable and no correlation can be found. From an engineer's point of view, it is of little help to know the section sensitivity of an iron as represented by round bars or rectangular slabs. What he wants to know is the strength figures that the producer can guarantee in different sections of castings.

Such data can only be gathered by testing a great number of castings (preferably scrap castings with minor defects) with respect to strength in different sections. By treating the test figures statistically, frequency curves may be plotted which show the statistical minimum strength and the spread of the data. Information of this kind will undoubtedly be

TABLE IV.—*Data on Tensile Tests Made on Specimens Cut from Scrap Castings.*

Casting.	Test specimen.	Sectional thickness.		Gauge diameter of tensile specimen.		Tensile strength.	
	No.	In.	Mm.	In.	Mm.	Tons per sq. in.	Kg. per sq. mm.
A	1	1.22	31	0.492	12.5	12.1	19.1
B	1	1.22	31	0.787	20	18.7	29.4
A	2	1.97	50	0.787	20	17.5	27.5
B	2	1.97	50	0.787	20	18.2	28.6
A	3	1.97	50	0.787	20	17.2	27.1
B	3	1.97	50	0.787	20	19.4	30.5
A	4	0.77	19.5	0.315	8	17.1	26.9
B	4	0.77	19.5	0.315	8	24.0	37.8
A	5	0.77	19.5	0.315	8	—	—
B	5	0.77	19.5	0.315	8	25.3	39.9
A	6	0.71–1.58	18–40	0.492	12.5	18.5	29.2
B	6	0·71–1.58	18–40	0.492	12.5	17.5	27.6
A	7	1.14	29	0.787	20	19.1	30.1
B	7	1.14	29	0.492	12.5	21.8	34.4
A	8	0.98	25	0.492	12.5	15.6	24.6
B	8	0.98	25	0.492	12.5	18.4	29.0
A	9	0.98	25	0.492	12.5	13.4	21.1
B	9	0.98	25	0.492	12.5	17.8	28.0

Casting "A"—T.C = 3.10, Si = 1.90, Mn = 0.81, P = 0.13, and S = 0.077 per cent.
Casting "B"—T.C = 3.04, Si = 1.89, Mn = 0.80, P = 0.14, and S = 0.080 per cent.

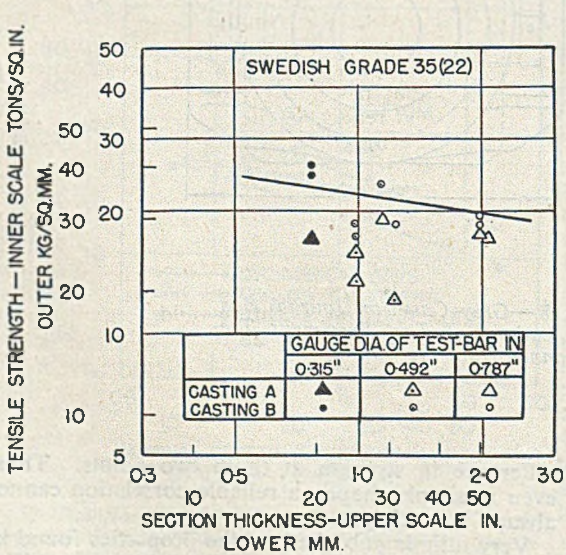

FIG. 9.—*Tensile Strength in Various Sections of the Journal Box shown in Fig. 8.*

very valuable for the engineer. The foundryman, however, can also make use of the spread. A considerable deviation from the average indicates poor casting practice, especially if the iron, as such, has a low section sensitivity.

There is no doubt that the method of collecting statistical data just outlined will be very expensive, especially if based on tensile testing. It is, therefore, of paramount importance to discover other testing methods which will do the job more cheaply. Brinell hardness testing, according to Dübi,[5] is one possible way. Dübi correlates Brinell hardness and tensile strength for different grades of irons. By means of the hardness number, Dübi considers it possible to evaluate the strength in various sections. The Frémont shear test can also be utilised for the same purpose. The "wedge-cutting" test suggested by Ludwik and Krystof,[34] which has been experimented with parallel to the tensile test by the Swedish Grey-iron Standards Committee, has proved very promising and offers another possible solution to the problem. This test will be described in detail in a later section of the Paper.

(*To be continued*)

Review of the South African Foundry Industry

Discussion of Mr. H. G. Goyns' Conference Paper

AT THE ANNUAL CONFERENCE of the Institute of British Foundrymen held at Buxton the Paper "Review of South African Foundry Industry," by Mr. H. G. Goyns, was presented by Mr. J. Gardom in the absence of the Author, with the president, Mr. J. J. Sheehan, in the chair.

MR. GARDOM said his first impression on reading the Paper was that in South Africa, founders were not unacquainted with visitors who seemed to descend from the skies and after a brief consideration seemed to produce volumes on industrial conditions. That, he thought, was typical of his own life. He was generally expected to walk round a foundry and say exactly what was wrong. It just could not be done. The Author of the Paper, Mr. Goyns, had been in South Africa for about three years and he set out to prepare a Paper to bring South Africa and the United Kingdom into relative perspective. He indicated some of the difficulties in the Union and this country, and showed that for the most part the South African foundry was of a jobbing nature which left little room for mechanisation.

(Here followed the presentation of the Paper*.)

THE CHAIRMAN, opening the meeting for discussion, said he thought it an excellent Paper and very well presented.

MR. GRAY, before the discussion, presented a verbal picture of Mr. Goyns, with whom, he said, he had had the privilege of working. He was a man who undertook with enormous enthusiasm anything he set his hand to. He was, further, a man of high principles, and he thought he was to be congratulated on his Paper which showed his way of setting about a job.

Discussion

MR. D. SHARPE having had considerable experience of foundrywork in South Africa said he had been greatly impressed by the manner in which the Paper had been laid out. He thought anyone starting to prepare a similar one on the home industry would find great difficulty in accumulating the data that had been so clearly expressed.

His own observations confirmed many of the statements made. There were a few foundries that were up to date and were producing remarkably good castings, but at a high price. The chief difficulty was that the bulk of the work was hand work. The co-operation by labour left much to be desired. Fortunately, they had a lot of native labour which they kept exclusively on non-skilled work, and were not allowing the native to get higher training. He feared they might have to modify that attitude to some extent because the Belgian foundries to the north of Northern Rhodesia were encouraging the training of natives as skilled men. It seemed that there was a need for foundrymen in this country to become more conscious of their interests in South Africa. It was a country which had a big future, but he would warn any young man going to South Africa that he would have a wet shirt and wet pants all through the year working in a foundry there.

Native Labour

MR. GARDOM, dealing with the subject of native labour, questioned whether it was really any different from our "native labour." He felt that from the experience he had been able to get of the South African native labour and the American coloured labour, that all had the same problem. Foundry labour was capable of doing certain sections of the work, and if foundrymen would realise that and apply it only to those sections, they would be much happier, instead of having discussions on how it should be trained.

MR. J. J. SHEEHAN, from the chair, pointed out that care should be exercised in comparing the native labour in South Africa with the coloured labour in the United States. The black labour in the United States was educated labour, whereas the native labour in South Africa was not very well educated as yet, and there were language difficulties also.

MR. GODWIN, as a South African, was able to enlarge a little on the native problem. The native labourer was quite unlike the English labourer. He estimated that not more than five per cent. of the natives could read or write, and the average intelligence of the male adult native could be compared with that of a European child of about 10 years of age. That had been particularly brought home to him while visiting one or two foundries over here. He noticed a number of small notices about—"this space to be kept open," "ashes to be dumped here," and so on. If only they could have something like that in South Africa, life would be made much easier for foundrymen. Over there, if they put up such notices, the boys would not understand them and would still dump things—probably right under the notices.

Regarding the use of steel moulding boxes instead of cast iron, that again, he thought, was typical of South Africa. The native labourer was the man who knocked out the mould boxes, at night, as Mr. Goyns had said. It was quite an event to watch them. They used considerable violence and had more difficulty in breaking steel boxes than cast-iron ones. On the more highly mechanised plant,

*Printed in the Journal, October 26, 1950

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they were endeavouring to keep to steel boxes because they found that apart from technical advantages a native labourer using a shake-out wanted something to help him to break the boxes. Instead of dropping them on to the floor he now dropped them on to the shake-out, of the vibratory type, and the danger of breakage was greater.

About the most technical job the native labourer did in the foundry was closing a moulding box. In the Union, the native was not allowed to become a tradesman, again largely because of his education and the colour bar. The difficulty of educating the native was that there was only a total European population of 2½ millions as compared with roughly 9 million natives, and of the 2½ million Europeans not all were taxpayers, and after all said and done it was the European taxpayer who had to pay for the native education. Some said that was a heavy load to put on possibly a million people to educate 9 million up to the standard of a European in, say, one generation. In time to come they would no doubt go forward, but it would take some time.

MR. GARDOM on behalf of the Institute thanked Mr. Godwin. His remarks, he thought, were very useful. He felt that in England we were not paying quite sufficient attention on the management side to what the particular individual could do, or was capable of doing.

Moulding boxes, he agreed, got knocked about, but the point was cast-iron boxes were broken, but steel ones only distorted and caused unending trouble when the pins did not register. Personally, he favoured a broken box to a distorted one.

Raw Materials and Equipment

MR. POLLOCK thought it very unfortunate that they had not got Mr. Goyns with them to present his Paper and to answer any questions that arose from it. Presumably, the cost of pig-iron in South Africa as compared with this country was to some extent due to the cheaper labour, or was there any other factor? With regard to coke, were detailed figures and analyses available? He was also interested to know whether there was any bias towards the use of United States' manufactured plant. The question of dollars would, obviously, be a big factor in South Africa as it was in any " sterling " country.

From the technical point of view, there was the question of heating by the use of electricity. Again, presumably, that was due to low charges for current but was any more information available? In the Sudan, electricity was used on a large scale. But even there, he understood, they seemed to be getting towards a top limit.

Lastly, there was in the report a paragraph about silicosis. Was not more information available? Possibly it might be a little sketchy as yet for two reasons; one, silicosis was usually associated with steel foundries, and he had no idea of the proportion of steel to iron foundries; and, secondly, the time factor entered into it. The authorities in South Africa might be a little optimistic in not making some provision for the future.

MR. GARDOM thanked Mr. Pollock for his discussion, but thought much of what he had said would have to be replied to by Mr. Goyns.

Moulding Boxes

MR. J. L. FRANCIS commented on the box-part question and thought a good case could be made out for each type of box. But in favour of the cast-iron one it could be urged that it did have a much longer life where moulds had to go into an oven for drying. Steel ones deteriorated rapidly to a paper thickness in the finish. For large boxes, he thought cast-iron ones were undoubtedly better than steel because of their greater rigidity. Steel boxes with a heavy load of sand in would distort under the weight of the sand. He knew from personal experience of steel boxes that trouble with mis-matching and misalignment of pin holes occurred due to rough handling and distortion. Where steel boxparts were used, it seemed there should be a maintenance staff constantly overhauling and checking to see that they were kept true.

MR. GARDOM agreed with most all of the speaker's remarks. If one handled steel boxes mechanically then there was very little knocking about and the lightness of the steel or aluminium box was undoubtedly an advantage, but the rigidity of cast iron was, in his opinion, the most important factor in favour of producing good castings.

MR. D. H. SMITH thought it some form of compliment that one of their members who had gone out quite recently to South Africa should be chosen to prepare the South African exchange Paper. He supposed Mr. Goyns had been selected because it was thought he would spare no effort to put the true situation before the conference. It was most difficult for anyone going to a new country to attempt in any way to criticise it or to fully discuss it, and the same applied to the Paper.

On the question of imports, did it pay South Africans to import coke or pig-iron, or did they just have to make do with an inferior article?

MR. GARDOM agreed that is was a compliment for an Englishman to be selected to give the South African exchange Paper. As to imports, he had little information, but relied on what Mr. Goyns had said were the comparative costs of coke and pig-iron. Perhaps Mr. Goyns would be able to add to the information on this question.

Long-term View

THE CHAIRMAN (Mr. Sheehan) said it was important that they should get the question of the status of native labour in its right perspective. Every rise in wages and status of native labour helped us as a country, in Great Britain. When the wages of native labour in South Africa were raised, we sold more bicycles from Coventry. It was the first thing the native liked, particularly in a country such as South Africa, where distances were great. Unfortunately, or fortunately for us, the African native was not very mechanically inclined and if the bicycle broke down he bought another. But he could not buy it unless he was given the wages. He also thought that taken in reverse, and with due regard to altered circumstances, the same was true of our country. There was a time when an agricultural labourer here was paid from 14s. to 22s. a week and when it rained it did not matter if he stood in a barn sucking a straw. Now that he was paid a higher wage, it was necessary to see that he worked, and the only way they could see that he worked was to give him a tractor. And as castings were required for tractors he was in favour of that. He would like to convey to Mr. Goyns that they were all on the side of the gradual introduction of a better standard of living for what was called "native labour."

MR. CLARK said that on the question of moulding boxes, many founders would be surprised if they took as much notice of their outgoings on moulding boxes as they ought and appreciated the heavy drain it constituted in their bills for maintenance and repairs. He hoped that in the near future nodular-iron moulding boxes which would have the virtues of both steel and cast iron and the vices of neither would be made.

As regards native labour, the only native labour he knew of was our own natives and they were tough enough for him! The best advice he could give their South African friends was that they should treat their coloured labour as he was sure they would wish to be treated, as fellow human beings, and to train them better. He was sure that if they could get to that state of affairs there would not be much wrong with foundry developments in the Union.

Advantages of Open-air Working

DR. DADSWELL said he read the Paper with interest as he had recently been in South Africa for a few days, and felt that he had some appreciation of the problems which Mr. Goyns had expressed.

One or two points were interesting. Little was said in the Paper of the problem of silicosis, which in this country, and in other countries where steel foundries had been operating for some time, had been more of a problem. He wondered whether it was because most of the fettling shops in South Africa were out in the open air. They had the sort of weather in South Africa which permitted them to work without a roof for the major part of the year. One could not say that being out of doors really made the difference because, as Mr. Gardom, who had been doing a lot of work in that connection, would very well know, the question was to find out whether the dust which caused the trouble came from the dust arising from actual working on a steel casting or was due to the atmosphere in the shop.

He would like to give credit to the South African foundries where they had taken up some of the casting specialities which had previously been done in this country and which we used to like to export, but owing to economic circumstances were now manufactured in South Africa. Companies in England had given technical aid to producers in South Africa, and he had been surprised at the rapidity with which they had learned there to make those particular products.

On the subject of native labour, he thought we ought to be careful in making comment. It was very difficult to judge, and it was very well to talk about selling bicycles to an increasing native market. Here, we were very tolerant towards all peoples, but if one had been in a country whose economy was dependent on native labour to some extent, and where there were other problems that could arise, one realised that it was unwise to make sweeping statements from many miles away.

On the question of imports, they were very fortunate in South Africa in having cheap coal and therefore, presumably, if their coal was coking coal, they had there a very cheap source of coke; coal cost under £1 per ton. There were two power stations near Johannesburg and the power houses were right on the coalfield, the coal coming straight from the mine to the power station. Prices of raw materials and labour costs are such that current prices of steel castings are about 50 per cent. of those in Great Britain.

Small Units

Another interesting thing about the foundry industry in South Africa, and he was talking of steel founding but understood his remarks applied equally to iron founding, was that it was made up of a considerable number of small units. There were hardly any big concerns at all. One was mentioned in the Paper by name as having a very modern plant, associated with an engineering corporation. It was designed and equipped by an American firm and was an interesting foundry although they might criticise it for certain shortcomings in its layout.

A particular point which had perhaps not so much to do with South Africa, but was a personal opinion on the question of moulding boxes—he did not think one could dogmatise on whether one used cast steel or cast iron, or aluminium. It depended to some extent on whether it was a steel foundry or an iron foundry. Obviously, the steel foundry would use steel boxes. For years his firm had used cast-iron boxes or box parts, but they had decided some years ago to have nothing to do with cast-iron boxes because they were liable to break.

MR. GARDOM, closing the discussion, thought, as Dr. Dadswell had indicated, they could not truly assess native labour. He had the feeling that the native labour about which they had been speaking was not a much greater problem than our own labour problems. That was all he could say, and he looked forward to seeing Mr. Goyns' remarks on the matter.

Mr. Clark had drawn attention to the cost of maintenance of moulding boxes and said they would be surprised if the cost of that work was taken into account. He himself was not surprised because he had done it, and it was one of the reasons why he was so concerned about moulding-box problems and maintenance. It was not so much the cost and the many hours spent in repair, but the cost of moulding-boxes against scrap castings.

The case for the fettling shop out of doors was very interesting. There was, however, a fettling shop in this country that was out of doors and they still had silicosis. He did not know the reply to that; it seemed obvious now that it was the disturbance of the sand and the very fine particles, whether of sand or steel, that gave silicosis.

In conclusion he thanked the meeting for the way it had received the Paper. It had been a good Paper and, he thought, a good discussion. He proposed a very hearty vote of thanks to Mr. Goyns.

This was carried by acclamation.

WRITTEN REPLIES

Mr. Goyns has replied to the discussion by correspondence as follows:—

South African Foundry Industry

Thanks are due to Mr. Gardom, who from the excellent discussion has, by his method of presentation, transformed a rather dry and dusty subject into an interesting one.

Statistics

As this was the first attempt, as far as the Author is aware, to review the present ramifications of the industry in South Africa, he was naturally reluctant to claim scientific accuracy for the statistics given in the Paper. They were largely the result of personal investigation. However, he thought that they were reasonably accurate, though he could not vouch for the figures quoted on the numbers employed in the industry.

Native Labour

Mr. D. Sharpe and subsequent speakers, at an early stage in the discussion, touched upon one of the biggest problems in South Africa's efforts to increase productive man-hours—the question of native labour. While there are certain comparisons to be made with the labourer at home, the comparison is limited inasmuch as many of the odd jobs which the British moulder himself carried out, are done by natives, and, in many cases, a white man stands around while the native does certain operations, and *vice versa*. This is particularly noticeable, to quote a typical instance, where a machine has been installed without sand or handling facilities; no provision being made for lifting boxes on to the machine, or removing completed moulds; cast-iron boxes are being used with thick-section sides and massive bars. A production moulder operates the machine. He has two boy helpers, and needs another two boys to help him to lift the heavy moulds to the floor. For every day of 9 hours, 45 man-hours are booked against the machine. An analysis of the man-hours involved will reveal the extent to which the native labour is utilised in productive effort or otherwise. In many cases it will be found that the extra labour needed for intermittent operation in the cycle is not fully utilised in between times. The solution is obvious—adequate sand and handling facilities are required. Failing this, provision of the lighter box parts made of steel does help.

One could dilate on this subject at great length, but in the Author's opinion, the fault does not lie so much with the native himself, but with the system which prevents the full utilisation of his efforts and capabilities. The native is considered to possess a primitive intellect. Rather, could the position be diagnosed, it is that, due to unfamiliar environmental conditions, lack of vocational training or guidance of even the most elementary nature, he does not understand sufficient to bring what intelligence he does possess to bear on the job. What chance has the native who, raw and uncivilised, without adequate training, is pitchforked into the totally foreign atmosphere of the foundry?

Native labour has been, and is being fully utilised in certain allied industries, and the results point a certain moral. No man-made force can stay the progress of evolution, which operates on the industrial as well as the organic level, and it follows that the African native will evolve with or without help from the white men. Is it not better to re-direct the stream than try to dam the flow?

Box Parts

Considerable discussion had taken place on the subject of box parts, and the relative merits of iron and steel for this purpose. When the Author said that he favoured steel box parts, he should have mentioned that he had in mind green-sand moulding. To offset breakages through rough handling, cast-iron boxes are made with thick walls and in many cases, heavy bars are favoured. One of the main factors is the weight involved in handling cast-iron boxes which are perhaps twice as heavy as a similar size of steel box. The point about a broken cast-iron box being better than a distorted steel box is somewhat controversial. A broken cast-iron box certainly is scrap, but insofar as it must be replaced, it is a capital loss; the properly designed steel box with strategically placed bars can be repaired, if it does distort. The weight question is paramount, however. It will be apppreciated that it may require four boys to handle a cast-iron box as against two boys to handle its equivalent in steel.

For large dry-sand work built-up boxes are used in many cases, similar to British practice, but generally speaking, medium-size dry-sand work up to approximately 6 or 7 ft. square is made in one-piece cast-iron boxes. As Mr. Francis pointed out, these cast-iron boxes have the great advantage of rigidity. Cast-steel boxes, though they have much to recommend them, are fairly rare, the general attitude being that every ounce of metal melted should go into saleable castings.

Pig Iron

Regarding the cost of pig iron and raw materials in South Africa, the Author would make the following comments. This is an instance where the utilisation of native labour is reflected in the ultimate cost, as South African pig iron is at present about £8 10s. per ton as against £10 or £12 per ton in Britain. In addition, it must be remembered that the grades of pig iron are relatively few, and of much wider analysis range.

Coal and Coke

The search for suitable coking coals is constantly being pursued by the relevant authorities, and recent developments have increased the tonnage available. The price of South African coal is very low compared with overseas despite the fact that due to transportation charges over the tremendous distances involved the price per ton varies from 4s. at Witbank (in the middle of the coalfields) to 28s. 6d. at the Cape which is 1,000 miles from the source of supply. The wide, horizontal seams, at shallow depths, allow room and pillar working on a large scale, and there is a high degree of mechanisation. Native labour in this instance is again fully utilised and is the chief factor contributing to the low selling prices, and the overall cost per native being 4s. to 5s. per shift including overheads. A comparative figure should be obtainable in Britain.

Typical analyses of South African coke and coal are given in Table I.

TABLE I.—*Grades and Properties of South African Coal and Coke.*

Grade.	District.	Moisture. Per cent.	Ash. Per cent.	Volatiles. Per cent.	Fixed carbon.	Sulphur. Per cent.	C.V. B.Th.U. × 1000	Ash fusion. Temp. deg. C
Nuts (− 1¼ + ¾)	Witbank	2.2	14.0	26.5	57.3	—	12.6	1,400
	Ermelo	2.5	14.5	30.5	52.5	—	12.2	1,400
	Vereeniging	7.0	18.0	28.0	47.0	—	10.5	1,400
Rounds and cobbles (+ 1¼)	Witbank	2.0	12.0	28.0	58.0	—	12.9	1,400
	Ermelo	2.5	14.0	31.0	52.5	—	12.3	1,400
	Vereeniging	7.0	18.0	28.0	47.0	—	10.5	1,400
Coke	Vryheid	0.2	0.6	15.0	84.2	0.7	—	—
	Dundee	0.5	0.5	14.2	84.8	1.2	—	—

Foundry Plant

As regards plant, as Mr. Pollock observed, the present financial position has favoured the importation of plant from sterling areas—when it is obtainable. On the relative imports in previous years, the Author would hesitate to comment, other than say that American moulding machines and Sandslingers appear to have been more popular, but that Britain and Germany are both well represented.

Use of Electricity

There are many examples of electrically-operated heat-treatment plants in engineering shops, but apart from an occasional core stove, the use of electricity for foundry heating purposes has not been developed. This is partly due to the fact that coal is cheap and readily available, and while there is an unquestionable advantage with electricity, the high capital cost of new installations has hindered developments of this nature. The cost of electricity varies and is largely dependent on the cost of coal, which in turn depends on transport charges. Table II is extracted from the 26th annual report of the Electricity Supply Commission for year ending April, 1949, to whom acknowledgment is made.

TABLE II.—*Consumption and Cost of Electricity in South Africa.*

Location.	Coal/ton.	Unit consump., million.	Average unit cost.
Cape	28s. 6d.•	200	0.787d.
Durban	16s: 4d.	450	0.384d.
Colenso	11s. 6d.	308	0.455d.
Witbank	4s. 0d.	633	0.2196d.
Klip	4s. 1d.	1,207	0.1177d.
Vaal	5s. 1d.	435	0.1387d.

Silicosis

The subject of silicosis involves many considerations. Mr. Pollock was correct to the Author's knowledge in saying that it was usually associated with steel, rather than iron foundries. While there is little published information on this aspect of the subject, the Author would like to make one or two remarks which from his study of the conditions involved, would appear to be relevant. The high temperatures associated with steelfoundry practice, as distinct from iron foundries, did perhaps result in a finer breakdown of the silica grain on and adjacent to the mould face. This in turn was aggravated by the greater amount of shot-blasting required to obtain a reasonable finish with the resultant further breakdown of silica particles adhering to the face of the steel casting. In ironfoundry practice where lower casting temperatures obtain and where carbonaceous and non-siliceous coatings are used, these factors do not occur to the same extent. It would appear logical to assume that the atmospheric concentration of the microscopic particles in the dangerous range (0.5 to 5.0 microns) will be less in the case of ironfoundry cleaning and grinding shops than in their steelfoundry counterparts. Again, the time factor is of great importance, as it would appear that the insidious nature of the disease makes detection difficult in the early stages.

One point which should be borne in mind was that moulding shops have, generally speaking, dusty atmospheres as a whole, but seldom did one find the local concentration of fine particles in a moulding shop which was found in the atmosphere of cleaning and fettling shops. The danger of the concentration was reflected in the relatively few cases of silicosis which have been recorded as emanating from moulding shops. Where South Africa is concerned, the fact that no case has been recorded means comparatively little. For one thing, steel foundries are of comparatively recent origin, the first steel castings being made as recently as the first world war. Secondly, the fettling operations are carried out by natives, few of whom are subject to periodical examination for this or any other pathological condition. It would be difficult at this stage to say whether outdoor fettling shops make much difference; there are so many other variables which require to be taken into consideration, though lack of walls should certainly take care of the necessary changes of air.

General Comments

In Dr. Dadswell's contribution to the discussion, he mentioned the price levels of South African raw materials. Certainly the raw materials are cheaper in the main, and naturally affect the selling price of the castings, but whilst steel castings in certain grades are sold at 50 per cent. of the United Kingdom price, it does not follow that they are made for 50 per cent. of the cost. The low selling prices involve consideration of many additional factors such as the lack of co-ordination as regards sales policy, the type of castings produced, the attitude regarding feeding or lack of feeding necessary, and the resultant high yields which are obtained. Actually, there are about half-a-dozen steel foundries producing more than 200 tons per month of castings and a few iron foundries producing big tonnages, but generally speaking, the foundries are small and as mentioned already, almost " owner-driven."

(*Continued on page* 370)

Iron and Steel Transfer

Corporation meets to decide Policy

THE FIRST MEETING of the Iron and Steel Corporation was held on October 2, since when several meetings have taken place. It is thought likely that a statement outlining the broad principles of policy to be pursued after the vesting date will be issued before long. After consultation with the corporation, the Minister of Supply has made an order—The Iron and Steel Act, 1949 (Alteration of General Date of Transfer Order, 1950)—substituting February 15, 1951, for the date in the Act. The new order came into operation on October 10.

Sixty-three-year-old Mr. A. R. McBain was appointed for a period of six months as a temporary part-time member of the Iron and Steel Corporation to take the place of Mr. R. A. Maclean, who agreed to serve as a part-time member, but later withdrew. On October 2 the Minister of Supply appointed seven members of the corporation, in accordance with his earlier announcement in the House of Commons. The list is the same as that previously published, with the substitution of Mr. McBain's name for that of Mr. Maclean.

The address of the corporation for the time being is Shell Mex House, Strand, London, W.C.2. Mr. S. S. Wilson, who since 1948 has been an under-secretary to the Ministry of Supply, has been seconded for service as secretary of the corporation.

List of Companies

The 92 companies whose securities will vest in the corporation are:—

Arthur Lee & Sons (Hot Rolling Mills), Limited; Bairds & Scottish Steel, Limited; Barrow Ironworks, Limited; Beckermet Mining Company, Limited; Birchley Rolling Mills, Limited; Briton Ferry Steel Company, Limited; Brown Bayley's Steel Works, Limited; Brymbo Steel Works, Limited; Burnell & Company, Limited; Byfield Ironstone Company, Limited; Bynea Steel Works, Limited; Cargo Fleet Iron Company, Limited; Colvilles, Limited; Consett Iron Company, Limited; Cranford Ironstone Company, Limited; Crosby Ironstone Company, Limited.

Darlington & Simpson Rolling Mills, Limited; Darwen & Mostyn Iron Company, Limited; District Iron & Steel Company, Limited; Dixon's Ironworks, Limited; Dorman, Long & Company, Limited; Elba Tinplate Company, Limited; English Steel Corporation, Limited; Etna Iron & Steel Company, Limited; Gjers, Mills & Company, Limited; Glamorgan Hematite Iron Ore Company, Limited; Glynhir Tin Plate Company, Limited; Goldendale Iron Company, Limited; Gorse Galvanising Company, Limited; Guest, Keen & Nettlefolds (South Wales), Limited; Guest Keen Baldwins Iron & Steel Company, Limited.

Hadfields, Limited; Hadfields Steels, Limited; Hallamshire Steel & File Company, Limited; Hodbarrow Mining Company, Limited; Irchester Ironstone Company, Limited; James Pain, Limited; J. J. Habershon & Sons, Limited; John Bagnall & Sons, Limited; John Baker & Bessemer, Limited; John Lysaght's Scunthorpe Works, Limited; John Summers & Sons, Limited; Kettering Iron & Coal Company, Limited; Lanarkshire Steel Company, Limited; Lancashire Steel Corporation, Limited; Lilleshall Iron & Steel Company, Limited; Llanelly Steel Company (1907), Limited; Loddington Ironstone Company, Limited; London Works (Barlows), Limited; Millom & Askam Hematite Iron Company, Limited; Monks. Hall & Company, Limited; Naylor Benzon Mining Company, Limited; Neath Steel Sheet & Galvanising Company, Limited; New Cransley Iron & Steel Company, Limited; Oxfordshire Ironstone Company, Limited.

Park Gate Iron & Steel Company, Limited ; Partridge Jones & John Paton, Limited; Patent Shaft & Axletree Company, Limited; Pease & Partners Lingdale Ironstone Mines, Limited; Pease & Partners Normanby Iron Works, Limited; Raine & Company, Limited; Renishaw Iron Company, Limited; Richard Hill, Limited; Richard Thomas & Baldwins, Limited; Round Oak Steel Works, Limited; Samuel Fox & Company, Limited; Santon Mining Company, Limited; Sheepbridge Company, Limited; Sheffield Forge & Rolling Mills Company, Limited; Shelton Iron, Steel & Coal Company, Limited; Skinningrove Iron Company, Limited; Smith & McLean, Limited; South Durham Steel & Iron Company, Limited; Stanton Ironworks Company, Limited; Staveley Iron & Chemical Company, Limited; Steel Company of Scotland, Limited; Steel Company of Wales, Limited; Steel Company of Wales (Lysaght Works), Limited; Stewarts and Lloyds, Limited.

Taylor Bros. & Company, Limited; Templeborough Rolling Mills, Limited; Thos. Firth & John Brown, Limited; Ullcoats Mining Company, Limited; United Steel Companies, Limited; Upper Forest & Worcester Steel & Tin Plate Works, Limited: Wellingboro' Iron Company, Limited; Whitehead Iron & Steel Company, Limited; Whitehead Thomas Bar & Strip Company, Limited; William Beardmore & Company, Limited; Wolverhampton Corrugated Iron Company, Limited; Wolverhampton Steel & Iron Company (1946), Limited; W. Wesson & Company, Limited.

Securities which are owned by listed companies or their wholly owned subsidiaries will not vest in the corporation.

Safeguarding Stockholders' Interests

Simultaneously with the announcement of the vesting date the Iron and Steel Corporation posted letters to the firms to be nationalised, inviting them to name stockholders' representatives to deal with the corporation concerning the change-over.

Valuation has commenced of securities in iron and steel companies scheduled for nationalisation on February 15 next and which do not come within the definition of " quoted securities " under the terms of the Steel Act. The Ministry of Supply has made contact on this point with some companies, but negotiations are in a preliminary stage. Many companies have yet to appoint their stockholders' representative.

The Stationery Office has published a statement of guarantee given by the Treasury, in pursuance of Section 34 (1) of the Iron and Steel Act, 1949, on loans proposed to be raised by the Iron and Steel Corporation. It shows that on October 6 the Treasury guaranteed in respect of principal and interest temporary loans from the Midland Bank to the extent of £100,000.

Review of South African Foundry Industry

(*Concluded from page* 369.)

In reply to Mr. D. H. Smith's remarks, there are adequate resources of practically every raw material required, and it would certainly not pay to import either coke or pig iron as the prices of these materials are already much higher in Britain without even considering the additional transport costs, which in the case of No. 3 pig would amount to at least £5 per ton to foundries in the Witwatersrand.

In conclusion the Author sends greetings from South Africa and reiterates his thanks to Mr. Gardom and the gentlemen who contributed to what appears to have been an interesting and spirited discussion.

A WORKING MODEL demonstrating "whole-house" warming will be a feature on the stand of Radiation, Limited, at the Fuel Efficiency Exhibition, to be held in Manchester from November 22 to Deecember 2. The display will take the form of a section of a London County Council house and will show parts of the kitchen, living room, dining room and two bedrooms. The complete installation, including the unit source, ducting, registers and grilles, will be on view.

Metal Penetration into Moulds

Physical Conditions Controlling the Incidence and Severity

FUNDAMENTAL RESEARCH work on the physics of molten-metal penetration into sand moulds, which has considerable practical significance to founders, is revealed in a Paper before the Iron and Steel Institute by Dr. T. P. Hoar* and Mr. D. V. Atterton. The Paper is entitled "Penetration of Molten Metal into Compacted Sand." The Authors first examine existing data, industrial reports and samples. Next, they give full information as regards their experimental methods and detail the results of a large number of tests, supported by numerous microphotographs. In general, the head of pressure either expressed as mercury or iron required to produce metal penetration is used as an index of the resistance of the mould surface. Some of the data regarding various mould coatings are reproduced in Table I. Finally, the Authors discuss their findings in the following statement and list a number of conclusions:—

Discussion of Results

From experimental results and theoretical considerations it is possible to obtain a picture of what happens at the metal/mould interface during steel casting, and to see how the incidence and extent of metal penetration are influenced by the various factors involved. As the metal is poured, it comes into contact with cold sand; a very thin metal layer in contact with the sand may solidify momentarily, but it quickly re-melts because the rate of heat extraction by the warming sand soon becomes less than the rate of heat supply from the metal bulk. Since molten metal does not wet silica, no penetration occurs until the metallostatic pressure (together with any very small extra pressure due to the kinetic energy of the falling metal) reaches a critical value, namely, the penetrating pressure investigated, but the sand mould continues to heat up in depth as it extracts heat from the metal.

If and when, for the particular conditions existing, the penetrating pressure is reached—it will be of the order of 50 cm. of metal for steel in average moulds —metal penetrates in a fraction of a second to the depth of sand heated to the solidification point of the metal, and there solidifies. If the sand continues to heat through (as it will while the degree of metal superheat remains large enough) and especially if the rate of heat extraction by and through the sand is small enough, the penetrating metal extremities re-melt and a further slow penetration occurs, dependent in rate and extent on the heat flow in the mould, and not on metal viscosity.

The penetrating pressure, p dynes/sq. cm., the attainment of which is a necessary condition for penetration, is determined by the surface tension, σ dynes/cm., of the molten metal, the contact angle θ it makes with silica, and the effective pore radius, r cm., of the compacted sand, in accordance with the usual formula $p=-(2\sigma cos\theta)/r$. For ferrous materials at casting temperatures, it is probable that the surface tension and contact angle are substantially constant; the penetrating pressure is thus determined by, and is approximately inversely proportional to, the effective pore radius.

Effective Pore Radius

The effective pore radius is defined as a quantity related to the dimensions of the larger pores, since it is into only these that metal flows when the penetrating pressure as measured by the present technique is reached. It is initially determined by the sizes of the sand grains, the composition of the sand mix, and the other physical characteristics of the sand as compacted; it may also be markedly modified by sintering and fusion at the high temperature involved in steel casting, and by slagging of the sand particles with oxides present at the metal/mould interface.

The effective pore radius increases with general increase of sand grain size, and is also markedly influenced by the size distribution; the common practice of mixing coarse and fine sand to obtain good packing probably leads to an effective pore radius near to that which the finer sand would give if compacted alone. It has been shown that both the air permeability and the penetrating pressure for sand compacts having constant sand composition vary considerably, and in a like manner, with the proportion of bentonite added as binder, but that the variations of air permeability and of penetrating pressure between compacts of different sand compositions are not parallel. This is because the total porosity for air permeation, when the size distribution of the pores is not constant, bears no simple relation to the effective pore radius for metal penetration, since air permeation is limited by viscous flow of air in all the pores, whereas metal penetration is limited by surface forces at the larger pores.

Modification of Pores by Heat

The extensive modification of the effective pore radius of sand compacts by heating is evidently of great importance in practical casting. The present experiments have shown that there is a small decrease in effective pore radius as the compact is heated to about 1,200 deg. C., probably caused by expansion of binder; this has a favourable influence in hindering penetration, which partly offsets the unfavourable influence of the decrease of metal surface tension with increasing temperature However, between about 1,300 deg. C. and 1,650 deg. C.—which includes the usual range of steel casting temperatures—incipient sintering of the compact leads to a considerable increase in the effective pore radius

* Dr. Hoar is lecturer in metallurgy and Mr. Atterton is attached to the department of metallurgy at Cambridge University.

Metal Penetration into Moulds

because a few large pores are formed. The great decrease of effective pore radius found above 1,650 deg. C., owing to the closing up of pores by further sintering and softening, occurs at temperatures outside the useful casting range. Such heat modification of the mould as occurs during steel casting is therefore unfavourable, tending to make metal penetration less difficult.

Use of Special Washes

Silica washes, long used in practice, have been shown in the present investigation to have little influence on penetrating pressure, because they crack and thus scarcely alter the effective pore radius. However, their use reduces the number of penetrating metal "fingers" per unit area of metal/mould interface, so that sand adherence is lessened when such washes are used, even though there may be considerable penetration beneath the wash because of metal spreading sideways from the "fingers" formed at the cracks.

Metal oxidation at the metal/mould interface can lead to the production of iron silicates viscous enough to remain there and not float up through the metal. These slaggy materials wet silica and thus penetrate pores without any applied pressure; it has been shown that the extent of this penetration is limited by solidification rather than by viscosity, and hence by the thermal diffusivity of the sand compact. Slag penetration can greatly reduce the effective pore radius, probably in favourable cases to zero, and it is clearly a very important practical factor preventing metal penetration and leading to clean-peeling sand.

If iron oxides are deliberately applied to the surface of the sand compact as a wash, molten oxide can react with silica within the pores and actually increase the effective pore radius. Washes made from mixtures or compounds of iron oxides or lime with silica can, however, be very effective in sealing the sand pores and entirely preventing metal penetration (Table I). Further systematic work on

TABLE I.—*Influence of Mould Washes Applied and Tested (as far as possible) under Constant Conditions.*

Metal: Armco iron; Temperature: 1,600 deg. C.; Penetrating pressure of unwashed sand at 1,600 deg. C.: 37.2 cm. of Hg. All washes applied by painting.

No.	Wash.	Details of application.	Penetrating pressure, cm. of Hg.	Remarks.
1	Lloyd's* silica wash	Single coat on the green-sand surface	37.0	Wash cracking—confirmed by macro-section.
2	Lloyd's silica wash	Single coat on the green-sand surface. Flame-dried, resulting cracks filled in with further wash	39.6	Wash cracking—penetrated layer of adhering sand could be prised off.
3	Lloyd's silica wash	Two coats, the first flame dried before application of the second	39.0	,, ,, ,, ,,
4	FeO composition wash	Single coat on the green-sand surface	19.8	Uniform penetration. Increase of effective pore radius due to slagging.
5	FeO composition wash	Single coat on the green-sand surface	20.8	,, ,, ,, ,,
6	Fe_3O_4 wash	Single coat on the green-sand surface	20.2	,, ,, ,, ,,
7	Fayalite composition wash A	Single coat on the green-sand surface Flame-dried, cracks filled in	22.0	,, ,, ,, ,,
8	Fayalite composition wash A	Two coats, the first flame-dried before application of the second	40.2	Uniform penetration.
9	Fayalite composition wash B	Two coats, the first flame-dried before application of the second	51.2	Penetration at a few points; some blockage of larger pores by wash.
10	Fayalite composition wash C	Single coat on the green-sand surface. Very difficult to apply	30.4	As for 4.
11	Fayalite wash	Single coat on the green-sand surface	25.6	,, ,,
12	Silica-rich iron-silicate wash	Single coat on the green-sand surface. Flame-dried	22.5	,, ,,
13	Silica-rich iron-silicate wash	Two coats, the first flame-dried before application of the second	38.0	Uniform penetration.
14	Silica-rich iron-silicate wash	Three coats, each flame-dried before application of the next	No metal penetration	Metal peeled cleanly from slagged sand surface
15	Double wash of silica and fayalite composition wash B	Silica wash on the green-sand surface, then fayalite composition wash B	37.0	Wash cracking.
16	Double wash of silica and fayalite composition wash B	Two washes of silica, and then two washes of fayalite composition wash B; each wash flame-dried before application of the next	50.2	As for 9.
17	Lime wash	Single coat on the green-sand surface	32.0	As for 4.
18	Lime wash	Three coats, each flame-dried before application of the next. Wash dried at about 800 deg. C.	47.4	Penetration by slag at zero pressure—few grains of adhering and penetrated sand.
19	Lime/silica wash A	Three coats, each flame-dried before application of the next. Wash dried at about 800 deg. C.	No metal penetration	Penetration by slag at zero pressure—the metal peeled from the slagged sand surface but a few grains adhered to its surface.
20	Lime/silica wash A	As for 19, but slightly thicker coats	No metal penetration	Penetration by slag at zero pressure—the metal peeled cleanly from slagged sand surface.
21	Lime/silica wash B	Two coats, the first flame-dried before application of the second. Wash dried at about 800 deg. C.	No metal penetration	The metal peeled cleanly but had a furrowed surface; furrowing probably due to very viscous wash.
22	Lime/silica wash C	Two coats, the first flame-dried before application of the second. Wash dried at about 800 deg. C.	40.0	Wash cracking.
23	Alumina/silica wash	Two coats, the first flame-dried before application of the second	39.0	Wash cracking.

* F. H. Lloyd & Company, Limited collaborated with the Authors in the provision of samples, etc.

Metal Penetration into Moulds

such washes, aiming at the production of a continuous, non-porous mould surface such as sand itself would give at about 1,700 deg. C., but at the lower temperatures obtaining in casting steel, might have considerable interest. It should be emphasised that their action is quite different from that of the commonly-used silica washes which, as explained above, limit metal penetration to a few points where cracks occur, and remain relatively unfused.

Effect of Differing Metals

The present penetrating-pressure results, for a few steels differing mainly in carbon content, indicate a lowering of penetrating pressure with increase of carbon content; this may well be caused by a reduction of surface tension. The assumption of substantially the same contact angles with silica for all the non-ferrous metals used is justified (for the metals under nearly oxygen-free conditions) by the near-proportionality of penetrating pressure and surface tension; for iron, there is no evidence of any great change of contact angle even when a substantial amount of oxidation of the metal has occurred. While there is nothing inconsistent with physical theory in these assumptions, further fundamental work on metal surface tensions and contact angles with silica and oxides at high temperatures is clearly desirable, and the Authors hope to begin it in the near future.

Rapidity and Depth of Penetration

The present experiments have only incidental bearing on the rate and extent of metal penetration, although the reproducibility of the penetrating pressure values, coupled with micro-examination of penetrated sand compacts, has indicated that penetration, once it occurs, does so within a fraction of a second and to a depth of the order of a few millimetres. Theoretical calculations confirm these magnitudes, and the depth of penetration found is also in agreement with practical experience. Thus the attainment of the penetrating pressure is usually both the necessary and sufficient condition that undesirable penetration should occur. Of course, if other considerations make it possible to pour a casting with a small degree of superheat, so that rapid final solidification of the metal at the metal/mould interface occurs before the penetrating pressure is reached, there will be no penetration. From the point of view of preventing penetration, therefore, a large casting ought to be poured with as small a degree of superheat, and as slowly, as possible.

Conclusions Summarised

(1) Molten metals do not wet silica.

(2) Molten metals penetrate into sand compacts only when the metallostatic pressure at the metal/sand-compact interface exceeds a critical value, the "penetrating pressure." For iron and steel with average sand compacts, it is of the order of 20 to 60 cm. of Hg, or 35 to 110 cm. of iron or steel.

(3) For a given sand compact, the penetrating pressures for copper, tin bronze, tin, lead, mercury, and antimony are proportional to the surface tensions of the metals.

(4) The penetrating pressure for iron increases with decrease of sand grain size, since this gives a decrease of effective pore radius.

(5) The penetrating pressure for iron and steel is decreased by sand sintering at normal casting temperatures for steel, but increased by the considerable fusion induced at higher temperatures.

(6) The penetrating pressure for iron at 1,600 deg. C. (and for tin at 750 deg. C.) is nearly proportional to the air-permeability time at 20 deg. C., for sand compacts having the same grain-size distribution and differing only in binder (bentonite) content; each shows a maximum at about 2 per cent. bentonite.

(7) The penetrating pressure for iron increases with increasing surface oxidation of metal, owing to the formation of ferrous silicates that partially plug the pores in the sand compact.

(8) The penetrating pressures for three steels under non-oxidising conditions are somewhat lower than those for iron under similar conditions, and decrease with increase of carbon content.

(9) Silica mould washes crack and have little influence on penetrating pressure, but localise penetration and tend to reduce sand adherence.

(10) Washes made of mixtures or compounds of lime or iron oxide with silica melt to a viscous slag that wets silica and enters pores without application of pressure; if thick enough, the slag completely seals the pores and covers the sand grains with a continuous viscous layer that prevents metal penetration and sand adherence.

(11) Sand compacts are penetrated in a fraction of a second by molten metals and slags to depths determined by the thermal diffusivity of the compact and the degree of superheat of the fluids and not by their viscosities.

Valve Manufacturers' A.G.M.

The British Valve Manufacturers' Association recently held its eleventh annual general meeting in Sheffield. Before the meeting, Guest & Chrimes, Limited, invited members of the Association to visit their Rotherham works.

In the course of his speech at the meeting, the chairman, Mr. E. Bruce Ball (Glenfield & Kennedy, Limited) mentioned the great expansion in the value of industrial valves produced in 1949, the value being treble that of 1946. When referring to the co-operation which existed between valve manufacturers and the British Standards Institution, he stated that it was highly desirable that this close contact should be maintained, for whilst a good standard was beneficial to user and manufacturer alike, a poor one was something to be avoided at all costs. Both the chairman and the vice-chairman, Mr. J. M. Storey, were re-elected.

LAST TUESDAY a productivity team representing the manufacturers of steel, iron and non-ferrous valves left for America under the ægis of the Anglo-American Council on Productivity.

Foundry Equipment and Supplies Association

Progressive Policy Attracting Increased Participation

IT IS JUST 25 years ago since the Foundry Equipment and Supplies Association was established—mainly with the object of organising an exhibition for manufacturers of foundry plant and supplies. The Association had a poor start, for the first exhibition to be held under its auspices was marred by the General Strike. The show was staged at the Agricultural Hall, London, and was not too well attended, in spite of the fact that the Conference of the Institute of British Foundrymen was held contemporaneously. Later it was decided to incorporate the "Foundry" exhibition with the "Engineering and Marine Exhibition." This collaboration continued for many years and next year another joint exhibition is to be held.

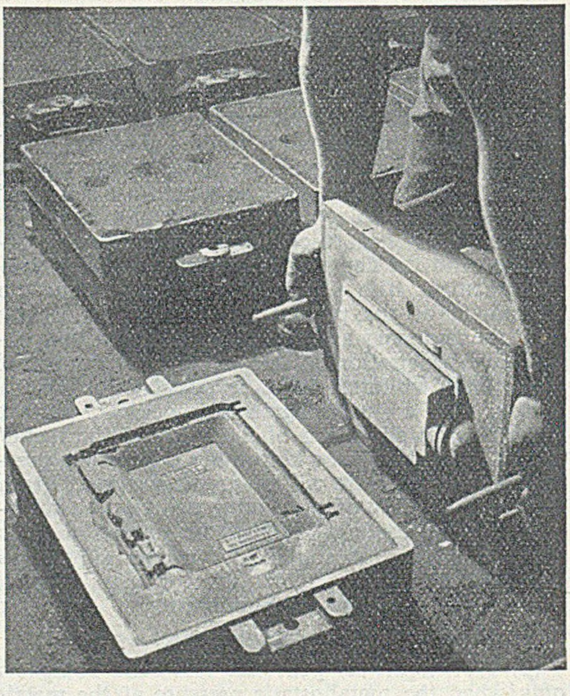
During the war, the Association undertook the allocation of dextrine to the foundry industry under the ægis of the Ministry of Food. In the immediate post-war period, the activities of the Association began to grow. The "Supplies" section became much more active and appointed representatives to serve on official bodies. These delegates have made very useful contributions to discussions on fumes arising from core oils and from drying plant in foundries. Help has been given in the standardisation of chilled grit sizes. On the "Equipment" side there has been prominent participation in the work of the standardisation of moulding boxes. The Association is constantly in touch with Government departments in connection with raw-material allocations and matters concerned with exports and imports.

At the Annual General Meeting, held recently, the Report of the Ironfounders' Productivity Team was discussed. As several members of the Association had also visited the States, additional views were expressed, of which some of the more interesting were:—(1) If the British workman ate a beefsteak and half a dozen eggs per day as does his American counterpart, then conditions would materially improve. (2) Most of the foundries visited were rightly of the best-organised type and, if visits had been made to a similar number of our best establishments, equally startling results could have been reported. (3) British foundry machinery is every bit as good as American with one exception. (4) One American plant was turning out apparently poor-looking castings at the knock-out, but which, after being treated to an extra-high-speed cleaning process, using malleablised rounded shot, the appearance of these castings at the despatch department had a surface comparable with our best Black-country finish. (5) The British foundry industry requires a change in taxation policy before it can implement the recommendations of the Report.

The general atmosphere at the annual general meeting was a combination of forthright criticism, given in the friendliest of spirit. At a council meeting following this Mr. Wm. Aske, of Hull, was elected president and Mr. W. Rawlinson the vice-president. Tentatively a policy was fixed of having future presidents drawn from the "equipment" and "supplies" side of the Association in alternate years. By so doing a better balance will be established. There are still a large number of firms which could benefit themselves by taking up membership of the Association, and to those an appeal is addressed in order that ever-increasing services can be given to this progressive industry.

Before the meeting, Mr. T. A. Hammersley, the retiring president, presented an inscribed bookcase to Miss H. M. Dolman, who before her recent appointment as secretary to the British Hydromechanics Research Establishment, was the secretary of the Association. The presentation was made on behalf of all the members of the Council. After her "thank you" speech, Miss Dolman asked the members to join her in an *apéritif*.

THE INSTITUTION OF GAS ENGINEERS and the Joint Committee on Materials and their Testing have organised a joint discussion on heat insulation which will be held at and by permission of the Institution of Mechanical Engineers, Storey's Gate, London, S.W.1, on November 30.



Although this picture has lost some of its brilliance in reproduction, it demonstrates the application of the art of photography to industrial subjects. It shows a switchbox mould prior to casting and is reproduced by permission of the Institute of British Photographers. The picture was taken by "Saga" and shown at an exhibition recently held in Birmingham.

National Physical Laboratory

Annual Report for 1949

Details of the work of the National Physical Laboratory, which ranges from the testing of field glasses to the construction of the most advanced electronic calculating machine, are given in the Annual Report* for the year 1949. It is divided into reports from each of the divisions of the laboratory and the following have been abstracted as being of interest to foundrymen:—

Engineering

The major work of the engineering division has been on the fatigue and creep of metals. A new method of testing completed structures under repeated loading has been devised. The demand for knowledge of this kind is urgent, particularly in relation to aircraft, but also applied to vehicles, bridging and ships. The method has been used to test to destruction, among other things, aircraft-wing segments and a helicopter blade. This division has also completed a new standard dead-weight hardness testing machine.

Pure Iron

The outstanding development in the metallurgy division is the regular production of iron of 99.96 per cent. purity. Ingots of pure iron and of alloys with manganese, silicon, nickel and chromium containing up to 5 per cent. of the added element have been made. The ingots are of 25 lb. each, but the process could easily be operated on a larger scale. Testing of the material over a temperature range from 200 deg. C. to −196 deg. C. has begun. Pure iron will behave in a perfectly ductile manner at −16 deg. C. The pure iron is, in tensile, ductile at −73 deg. C. but brittle at −186 deg. C. The addition of manganese of up to two per cent. lowers the transition temperature in a notched-bar impact test from −15 deg. C. to about −50 deg. C. but addition of five per cent. of manganese raises it to over 100 deg. C.

* Published by H.M. Stationery Office, price 1s. 9d. (45 cents U.S.A.), by post 1s. 11d.

Dinner

Joint Iron Council

In connection with the annual convention of the Joint Iron Council a dinner was held at the Connaught Rooms, London, W.C.2, in September, the chairman being the president, Mr. F. Scopes. Amongst those present were Lord Bruce of Melbourne; Sir Frederick Bain; Mr. J. D. Carmichael; Sir Archibald Forbes; Mr. Lincoln Evans; Mr. H. P. Good (U.S.A.); Mr. G. H. Johnson; Major F. D. Ley; Sir G. Maginnes; Mr. K. Marshall; Mr. T. A. McKenna; Mr. N. P. Newman; Sir R. Pease; Sir Alexander Ramsey; Mr. S. H. Russell; Mr. H. V. Skelton; Mr. D. O. Sillars; Sir Robert Sinclair; Mr. C. C. Booth; Mr. V. Elkington; Mr. V. C. Faulkner; Mr. Ambrose Firth; Mr. J. W. Gardom; Mr. M. J. Glenny; Mr. P. L. Gould; Mr. C. Gresty; Mr. R. L. Handley; Dr. J. E. Hurst; Mr. J. E. V. Jobson; Mr. G. B. Judd; Sir Norman Kipping; Mr. A. B. Knowles; Col. Lindop; Mr. T. Makemson; Mr. F. A. Martin; Mr. W. B. Parkes; Mr. A. E. Peace; Mr. J. A. Prior; Mr. J. H. Redhead (U.S.A.); Mr. P. A. Russell; Mr. J. J. Sheehan; Mr. Roy Shone; Mr. J. K. Smithson; Mr. J. Stannier; Mr. R. B. Templeton; Mr. W. G. Thornton; Mr. F. A. Wilson; Mr. P. H. Wilson; and Mr. A. Young.

Minibition

Concurrently with their annual conference, the Purchasing Officers' Association staged an exhibition at the Hotel Metropole, Brighton, from September 28 to October 1. This show, called the Minibition, to convey the idea of stand size limitation, was well patronised by the heavy industries, and founding was represented by a number of firms amongst the eighty-seven exhibitors. The stands, with few exceptions, were arranged as tables 5 ft. wide by about 3 ft. 6 in. deep with side partitions between, the whole comprising standard units which could be dismantled, stored in small compass and re-erected on a subsequent occasion. The displays were grouped in the hotel rooms and corridors adjacent to the conference room.

In the space available, the exhibits generally were distinctive and tastefully arranged and the wide field enhanced the sales potential of each. This aspect also drew virtue from necessity in space economy. In place of the confused array one often sees at larger exhibitions, the confining of the models shown to one or two items, with literature to cover the rest, has much to commend it. At a minimum valuation, the show was "easy on the feet" and at conservative estimates, to a gathering of purchasing agents representing a buying capacity of perhaps £millions, its potential was enormous.

The organisation, grouping and individual arrangements of the stands alike were excellent and we congratulate the persons responsible. It is thought that there is a definite field for shows of the Minibition type and future organisers in other spheres could do no better than emulate the example of the P.O.A.

Management Conference

The annual conference of the British Institute of Management will be held at Harrogate from November 16 to 19. Included in the very full programme of Papers, panel debates and discussion sessions is a talk on November 17 by Mr. K. Marshall, director of the Joint Iron Council on the question whether comparisons between different manufacturing units in the same industry on the basis of cost and physical-performance ratios can be of use to management. The panel debates and discussions cover such topics as the report of the Anglo-American Council of Productivity on packaging; the ways of reducing cost of maintaining plant and machinery; the organisation of product research in a small firm and a case study of the introduction of an individual-assessment bonus scheme. The speaker on maintenance is Mr. F. L. Griffiths, works engineer of Fraser & Chalmers Engineering Works.

A Whirlwind Tour

Mr. H. P. Good, president of the Gray Ironfounders' Society of America, visited a number of foundries during his stay in this country in connection with the issuing of the Gray Ironfounders' Productivity Report. The list includes British Bath Company, Limited, Qualcast (Ealing Park), Limited, and Renshaw Foundry Company, Limited, in the London area; Stanton Ironworks, Limited, the Beevor Foundry of Ruston & Hornsby, Limited, and S. Russell & Sons, Limited, in the Midlands, and Newman, Hender & Company, Limited, in Gloucestershire. This last visit was on September 28, when Mr. Good also addressed the West of England ironfounders at Bristol. The next day he left on a trip to Germany and on October 6 returned to the States. He was accompanied on a number of the visits by Mr. K. Marshall, director of the Joint Iron Council.

News in Brief

CHURCH BELLS became exempt from purchase tax on October 16.

PLANS HAVE BEEN PREPARED by Ariston Alloys, Limited, to erect a new foundry and offices at Mill Lane, Croydon, Surrey.

NEWCAST FOUNDRIES, LIMITED, have had plans approved to carry out further extensions to their premises in Newcastle-under-Lyme, Staffs.

IT IS ANNOUNCED by the American Foundrymen's Society that the International Foundry Congress & Exhibition is to be held in Atlantic City in May, 1952.

THE BRITISH WELDING RESEARCH ASSOCIATION is building and equipping a new fatigue research laboratory at its premises at Abington Hall, near Cambridge.

AT A MEETING of the Victorian division of the Institute of Australian Foundrymen, held in Melbourne on September 20, Mr. W. Walsh, of the Australian Meehanite Metal Company, gave a Paper on the feeding and gating of iron castings.

A NEW FACTORY, costing £500,000, is to be erected in the Transvaal by Babcock & Wilcox, Limited, Renfrew. When it is ready to go into operation, key men from the Renfrew works will be transferred. About 550 personnel will be employed.

THE WORSHIPFUL COMPANY OF FOUNDERS has appointed the following as officers for the ensuing year:—Master, Mr. J. L. Wheeler; Upper Warden, Mr. H. C. Bradbrooke; Under Warden, Major L. E. Cotterell; and Clerk, Mr. H. Wilson Wiley.

SMITH & WELLSTOOD, LIMITED, Bonnybridge, have now largely completed their work on a fully mechanised section and have run preliminary trials. It is hoped that the unit will go into full operation later this year when final technical details have been settled.

THE BONDACTOR spraying machine and gun for patching cupolas is to be manufactured in this country by British Ronceray, Limited, Moorhead, Sheffield. This equipment was referred to in our issue of July 27, 1950, and in the Grey Ironfounders' Productivity Report recently issued.

ELECTRO-HYDRAULICS, LIMITED, of Warrington, announce that their well-known range of conveyancer fork trucks are henceforth to be marketed by a separate division of their company, which has been registered as the Conveyancer Fork Truck Company, at Liverpool Road, Sankey, Warrington.

THE BRITISH WELDING RESEARCH ASSOCIATION have awarded the 1949 Welding Research Prize of £100, donated by the British Oxygen Company, Limited, to Dr. K. Winterton, Mr. J. G. Ball and Mr. C. L. M. Cottrell for their joint Paper entitled "A New Weldability Test for Magnesium Alloy Sheet."

A. C. WICKMAN, LIMITED, of Tile Hill, Coventry, announce that they have recently assumed the sole agency in Great Britain for a number of German machine-tool manufacturers. Amongst the machines covered which are of interest to our readers are the Heller universal foundry saws and cold-sawing machines.

THE ANNUAL GENERAL MEETING of the *Nederlandsche Vereeniging van Geelerij-Technici* (the Netherlands Foundry Technical Association) was held on Friday, October 27, at the Hotel "Het Vergulde Paard," 67, Dam, Alblasserdam. After luncheon the works of the Nederlandsche Kabelfabrick were visited. Mr. F. W. E. Spies presided.

HIGH-SPEED PHOTOGRAPHY as an aid to understanding industrial processes was an important part of the theme of an exhibition of electronic flash photography which was held in the Engineering Centre, Glasgow, from October 16 to 28. The exhibition was organised by Ilford, Limited, in collaboration with Mullard Electronic Products, Limited.

LT.-COL. M. W. BATCHELOR, J.P., president of the 1950 appeal fund of the Royal Commercial Travellers' School of which H.M. the King is patron asks our support in bringing to the notice of readers the urgent need for this non-state aided school. Donations should be sent to Col. Batchelor at Batchelors Peas, Limited, Wadsley Bridge, Sheffield.

STERLING FOUNDRY SPECIALTIES, LIMITED, have just received an order from India, the value of which is approaching £10,000. This is probably the largest single order for moulding boxes that has ever been placed at one time in this country. An additional point of interest is that the order has to be despatched before the end of November in order to comply with the conditions of the Import Licence.

A SPECIAL GOODS TRAIN left Earby, near Skipton, recently, with a consignment of agricultural tractors made at the Earby factory of Bristol Tractors, Limited, of Soughbridge, Earby, and formerly of Idle, Bradford. They were destined for the London docks, 24 to be shipped to New Zealand and the rest to the Canary Islands. They formed part of a consignment of 250 tractors ordered by New Zealand, at a total cost of £125,000.

THE NORTHAMPTON POLYTECHNIC, St. John Street, London, E.C.1, is organising a course of lectures on "Some aspects of Metal Finishing." These will be delivered on Tuesday evenings at 7 p.m., commencing on December 12, 1950. This course is organised to provide a detailed and up-to-date survey of some selected methods of metal finishing. Many of the processes to be described have not, as yet, received much attention in this country and, in view of the necessity for increasing productivity, are to be considered of utmost importance. The fee for the course, 20s., is payable in advance on enrolment.

DIFFICULTIES ENCOUNTERED in securing suitable engineering apprentices were emphasised by Mr. W. D. Lorimer, joint managing director of the North British Locomotive Company, Limited, when a new film, "The Right Choice," dealing with the firm's apprenticeship scheme, was shown recently at their works in Springburn, Glasgow. His firm had met with considerable success in operating a pre-apprenticeship training scheme during the past 14 months. The number of boys coming forward had increased, and it had been found that, as a result of careful selection, very few boys now changed their trades in the middle of apprenticeship.

Siliceous Parting Powders

The Minister of Labour and National Service has made regulations under the Factories Acts entitled the Foundries (Parting Materials) Special Regulations, 1950, which come into operation on December 1. The regulations prohibit the use of various kinds of parting powder which involve substantial risk of silicosis. Natural sand and various specified substances (for instance, zircon and sillimanite) are not included in the prohibition. The regulations, S.I. 1950, No. 1700, are obtainable from H.M. Stationery Office, or through booksellers, price 1d.

Personal

MR. W. S. STEEL, B.SC.(ENG.), M.I.E.E., has been elected a director of the British Thomson-Houston Company, Limited.

DR. F. C. LEA, D.SC., M.INST.C.E., M.I.MECH.E., has retired from the board of directors of Edgar Allen & Company, Limited.

MR. R. E. WINTER, A.M.I.MECH.E., has been appointed manager of the fan department of Air Control Installations, Limited, Ruislip.

MR. M. SOLOMON, F.C.G.I., M.I.E.E., is retiring from the board of the General Electric Company, Limited, on account of continued ill-health.

MR. SAMUEL BOWLEY, foundry foreman to Wootten Brothers, Coalville, has retired after 60 years service and was the recipient of a present from the board of directors.

MR. ALFRED DUDLEY EVANS has retired at the age of 78, after 42 years as secretary of the Birmingham Iron Exchange. He has been succeeded by his assistant, Mr. Stanley Owen.

MR. W. SLOAN SMITH, deputy chairman and managing director of W. Arnott, Young & Company, Limited, iron and steel merchants, has been appointed Collector of the Trades House of Glasgow.

MR. G. R. WEBSTER, past-president of the London branch of the Institute of British Foundrymen, has just returned from a business visit to Italy; he participated in the Italian foundry congress.

MR. A. J. KIRK has recently joined the staff of the industrial department, Philips Electrical, Limited. He was on the staff of the Morgan Crucible Company, Limited, in the capacity of technical sales assistant until 1940.

DR. J. E. HURST, J.P., F.I.M., M.I.MECH.E., has been appointed deputy chairman of Bradley & Foster, Limited; Bradleys (Darlaston), Limited; and Bradleys (Concrete), Limited. He will retain his position as managing director.

MR. F. SQUIRES, a past-president of the West Riding branch of the Institute of British Foundrymen and until recently manager at H. Burnley, Limited, Bradford, is now managing The Foundry, Aberdeen Avenue, Trading Estate, Slough.

MR. W. FINDLAY SEIVEWRIGHT, formerly sales and publicity manager of the International Meehanite Metal Company, Limited, has been appointed research director of Townend-Smith, Limited, advertising agents and marketing consultants, of London.

MR. GEORGES DELBART, the director of the French metallurgical research institute, has been created a Chevalier of the Legion of Honour. Mr. Jean Gélain, assistant director of research at the *Centre Technique*, has been created an "officer" in this order.

MR. W. A. M. ALLAN, A.C.G.I., M.I.C.E., who has held the position of honorary secretary to the Engineers' Guild for the past eleven years, has been compelled to relinquish his appointment owing to pressure of professional and private business. Mr. J. H. W. Turner, B.SC.(ECON.), A.M.I.C.E., has been appointed in his stead.

MR. ISAAC MONK, former chief engineer of David Brown-Jackson, Limited, Manchester, has retired after 52 years' service. Although the firm, formerly known as P. R. Jackson, Limited, was founded as long ago as 1840, only three men have held the position of chief engineer. Like Mr. Monk, all completed 50 years' service with the company.

MR. R. LINDSAY, a member of the staff of Bradley & Foster, Limited, Darlaston, Staffs, has been awarded the Buchanan Silver Medal of the Institute of British Foundrymen in connection with his examination successes in foundry practice and science. Mr. Lindsay has recently been appointed by his firm as technical representative for Yorkshire and the Northern counties.

MR. S. G. KING, A.M.I.E.E., has been appointed London manager of Birlec, Limited, with offices at 35, Park Street, London, W.1. Mr. King has had 20 years' experience of electric-furnace work, particularly in connection with the development and sale of arc and high-frequency melting equipment. He has recently returned from a four years' stay in South Africa and has gained experience in many European countries.

MR. ANDREW MITCHELL, buyer for John Lang & Sons, Limited, Johnstone, has retired after 54 years' service. At a presentation ceremony Mr. A. R. Brody, secretary, presented him with a gold wrist watch, suitably inscribed, from the employees, and a cheque from the directors. Mr. Mitchell, in turn, presented Mr. Brody with a diary he had kept from 1907 to 1950, of the principal happenings in the firm over that period.

Foundry Apprentices' Hostel

On Friday, October 27, with due ceremony, Mr. Fred Lee, the parliamentary secretary to the Ministry of Labour, opened the residential club, illustrated in our October 26 issue, which is to be used by the apprentices attending the National Foundry Craft training centre at West Bromwich. As souvenirs he was presented by the trustees with a silver key and by Mr. Forbes Baird (secretary of the Ironfounders' National Confederation) with a beautifully-bound book of photographs. The club is situated in Beeches Road, West Bromwich, and has accommodation for twelve boys. It has been splendidly equipped with shower baths, television, radio and games (including badminton in the rear garden). A competent warden and his wife look after the welfare of the boys. The kitchen is particularly well equipped through gifts which have been made by various foundry concerns. The cost of the club (£7,000) has been borne mainly by the Joint Iron Council.

Before the ceremony, a luncheon party was held at the Queens Hotel, Birmingham, over which Mr. S. H. Russell presided. Speeches were delivered by Mr. Lee, Mr. F. Scopes, the chairman of the Joint Iron Council, and by Mr. Forbes Baird, one of the trustees. He pointed out that since the war the industry had spent £8,000,000, of which £2,000,000 was for amenities. Mr. Scopes in his address said he had been assured that when the iron and steel industry was converted into a state monopoly, the existing financial arrangements between iron producers and ironfounders would not be disturbed.

Prices of Oils and Fats

The Minister of Food announces that the following changes in the prices of unrefined oils will apply during the four-week period ending December 2. (All prices per ton "naked," ex-works.)

Linseed oil, from £134 to £136; Sunflower acid oil, from £92 to £94; Soya acid oil, from £92 to £94, and Maize acid oil, from £92 to £94.

The entry relating to Linseed-oil Foots is deleted from the list of prices. The prices of all other unrefined oils and fats and technical animal fats allocated to primary wholesalers and large trade users will remain unchanged.

Raw Material Markets

Iron and Steel

The gradual extension of pig-iron production continues. By greater attention to the preparation of iron ores, blast-furnace men have achieved a sensible reduction in fuel consumption and have increased outputs. It is hoped that one or more additional units will shortly be available for operation. Meanwhile, the current output of pig-iron is eagerly absorbed and barely suffices for current needs. The melting shops require more iron because there is less imported scrap coming in, and activity in the foundries can only be sustained on the basis of increased pig-iron consumption. The call for low- and medium-phosphorus grades is particularly keen, and heavy as is the aggregate make of hematite it is all taken up.

Restored to full-scale activity by a spate of export orders, the re-rolling industry is indenting for big tonnages of steel semis. This increased demand has synchronised with a sharp contraction in the volume of imports from Western Europe. From this source there are no expectations of any bigger tonnages and, consequently, consumers are pressing for early deliveries of billets, sheet bars, and slabs from home sources. Billets of 3 in. and over are more readily obtainable than the smaller sizes.

The activity of the market extends over the full range of finished steel products. The sheet mills are most heavily over-weighted with orders and nothing can be done about it until new plant becomes available for operation—probably in the early months of next year. Plate mills also have heavy rolling programmes and for new orders extended delivery dates are now indicated. Similar conditions are now developing in other directions. Big export orders for rails and sleepers are in hand, there is a regular flow of specifications for joists, channels, and sections, and it is almost impossible to keep pace with the call for wire and wire products.

Non-ferrous Metals

Those who at the beginning of the war in Korea ventured to prophesy that the price of tin would eventually climb to £1,000 per ton have now seen their forecasts take shape. Last week both positions achieved four figures, though not at the same time. The prices reached may be deemed fantastic, but it would be wrong to assume that the top of the climb has yet been reached. Actually everything points to the contrary, for there is a local scarcity and in the Far East values are very firm. On Wednesday, tin reached the new peak level of £1,280 to £1,300. That day also witnessed the disappearance of the backwardation.

Metal Exchange official tin quotations during the past week were as follow:—

Cash—Thursday, £1,030 to £1,035; Friday, £1,055 to £1,060; Monday, £1,125 to £1,135; Tuesday, £1,280 to £1,300; Wednesday, £1,290 to £1,300.

Three Months—Thursday, £992 to £995; Friday, £1,025 to £1,030; Monday, £1,100 to £1,110; Tuesday, £1,280 to £1,290; Wednesday, £1,270 to £1,275.

According to figures issued by the Bureau of Non-ferrous Metal Statistics, Government stocks of tin at September 30 were 6,390 tons and consumers' 1,806 tons. At the end of May the Government held twice as much tin as the September figure. Consumption in September was 1,841 tons and is steady at about that figure. Other details given by the bureau show that stocks of copper at September 30 were 121,388 tons, about 5,300 tons down on August. Consumption was good—31,712 tons of virgin and 14,426 tons of secondary. Stocks of zinc declined from 54,662 tons at August 31 to 48,414 tons a month later. Consumption of virgin zinc in September was 23,334 tons. Lead usage in September was 21,201 tons. Stocks declined by about 10,000 tons.

Following a rise of 1 cent in the United States' price of lead to 17 cents, the official quotation here advanced last week to £136 per ton. A further increase would not occasion any surprise. Other metals all showed a firm front. Quicksilver in New York moved up to a new record at $93.50 per flask. Copper may advance beyond the present "held" price of 24½ cents. In the United Kingdom and, indeed, all over the world, the zinc shortage continues and the prospects of relief are slight. One result of the scarcity here is that brass-makers have been bidding keenly for brass scrap, all grades of which have advanced sharply in value. Copper scrap, too, has moved up and is now undoubtedly at a record high level.

British Castings Exported to U.S.A.

A consignment of 20 tons of sewing-machine arms and bases last week left the works of John Harper & Company, Limited, Willenhall, for the United States. The fact is of real interest in view of the report of the Ironfounders' Productivity Team on their visit to the States. Amongst the selling points which helped to gain this contract were surface finish and machinability. It behoves other founders to explore the possibilities of similar business. At one time, American and Swiss malleable tube fittings were regularly sold on the British market as well as Belgian white iron castings. Continental steel castings also found a ready market both here and in the Dominions. British cast-iron pipes have long been exported in quantities all over the world. Yet amongst all these international movements of castings, it was rare to hear of any country breaking through the American tariff barriers and congratulations are due to the Harper organisation for their pioneer efforts.

National Foundry College

The foreword to the prospectus for the session 1950-51 has been re-written and a new section giving advice to oversea students is included. An addition to the board of directors is Mr. P. D. Crowther, representing the British Non-ferrous Metals Research Association. Some of the illustrations are new, whilst others have been re-arranged. From these, there seems to be a high percentage of oversea students. The report on the Diploma Course includes a note on a visit by the Minister of Education and a course of instruction for teachers of foundry practice is announced. Other facts revealed by the prospectus are that the list of visiting lecturers now numbers 54. The number of works visits undertaken has risen from 40 to 71.

I.A.E.S.T.E. Report

These letters stand for the International Association for the Exchange of Students for Technical Experience, an organisation operating from the Imperial College, South Kensington, London, S.W.7. The third annual report, prepared by Mr. J. Newby, the secretary, shows that substantial progress has been made. Last year, no fewer than 1,672 students—an increase of 436 over 1949, have benefited by the system inaugurated in 1948.

From the list of concerns which receive students in this country are many foundries. As many readers receive requests to place oversea students in British industry, it is suggested that they bear in mind this organisation, which has the advantage of being reciprocal.

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

(Delivered, unless otherwise stated)

November 8, 1950

PIG-IRON

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

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

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

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

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

Cold Blast.—South Staffs, £16 3s. 3d.

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

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

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

FERRO-ALLOYS

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

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

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

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

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

Ferro-tungsten.—80/85 per cent., 15s. 4d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 16s. 10d. per lb. of W.

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

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

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

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

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

SEMI-FINISHED STEEL

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

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

Sheet and Tinplate Bars.—£16 16s. 6d.

FINISHED STEEL

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

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

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

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

NON-FERROUS METALS

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

Tin.—Cash, £1,290 to £1,300; three months, £1,270 to £1,275; settlement, £1,300.

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

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

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

Other Metals.—Aluminium, ingots, £120; antimony, English, 99 per cent., £225; quicksilver, ex warehouse, £25 15s. to £26 5s.; nickel, £386.

Brass.—Solid-drawn tubes, 21⅝d. per lb.; rods, drawn, 28¼d.; sheets to 10 w.g., 26d.; wire, 26⅝d.; rolled metal, 24¾d.

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

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £187 to £192; BS. 1400—LG3—1 (86/7/5/2), £193 to £202; BS. 1400—G1—1 (88/10/2), £270 to £285; Admiralty GM (88/10/2), virgin quality, £285 to £316, per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £295 to £310; L.P.Bl £200 to £215 per ton.

Phosphor Bronze.—Strip, 34d. per lb.; sheets to 10 w.g., 35⅝d.; wire, 36d.; rods, 33½d.; tubes, 38¾d.; chill cast bars: solids, 34½d., cored, 35½d. (C. Clifford & Son, Limited.)

Nickel Silver, etc.—Ingots for raising, 2s. 2¾d. per lb. (7%) to 3s. 2½d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 2s. 8¾d. (7%) to 3s. 7½d. (30%); to 12 in. wide × .056, 2s. 9d. to 3s. 7¾d.; to 25 in. wide × .056, 2s. 11d. to 3s. 9¾d. Spoon and fork metal, unsheared, 2s. 5¾d. to 3s. 4½d. Wire, 10g., in coils, 3s. 2½d. (10%) to 4s. 1d. (30%). Special quality turning rod, 10%, 3s. 1¼d.; 15%, 3s. 5¾d.; 18%, 3s. 10d. All prices are net.

Iron and Steel Institute

Autumn Meeting

The Autumn General Meeting of the Iron and Steel Institute will be held on Wednesday and Thursday, November 15 and 16, at 4, Grosvenor Gardens, London, S.W.1. The president, Mr. J. R. Menzies-Wilson, O.B.E., will be in the chair.

Morning Session, First Day.

10.0 to 10.15 a.m.—Formal business. 10.15 to 11.30 a.m.—Joint discussion on "The Thermodynamic Background of Iron and Steel Making Processes: II—Deoxidation," by F. D. Richardson, and "Studies in the Deoxidation of iron: Deoxidation by Aluminium," by H. A. Sloman and E. L. Evans. 11.45 a.m. to 1.0 p.m.—Discussion on "Thermodynamic Aspects of the Movement of Sulphur between Gas and Slag in the Basic Open-hearth Process," by F. D. Richardson and G. Withers.

Afternoon Session, First Day.

2.30 to 5.0 p.m.—Discussion on "The Effect of Cold-work on Steel," by J. H. Andrew, H. Lee, P. L. Chang, B. Fang and R. Guenot.

Morning Session, Second Day.

10.0 to 10.45 a.m.—Discussion on "Atlas of Isothermal Transformation Diagrams of B.S. En Steels" (Special Report No. 40, 1949). 11.0 a.m. to noon—Discussion on "The Transformations Alpha-to-Gamma and Gamma-to-Alpha in Iron-rich Binary Iron-nickel Alloys," by N. P. Allen and C. C. Early. Noon to 1.0 p.m.—Joint discussion on "The Acceleration of the Rate of Isothermal Transformation of Austenite," by M. D. Jepson and F. C. Thompson, and "The Breakdown of Austenite below the M_s Temperature," by F. C. Thompson and M. D. Jepson.

Obituary

SIR JOHN JARVIS

Sir John Jarvis, Bt., D.C.L., chairman, Sir W. G. Armstrong Whitworth & Company (Ironfounders), Limited, died on October 3. In addition to holding the chairmanship of this company and its two associates, Armstrong Whitworth & Company (Pneumatic Tools), Limited, and Jarrow Metal Industries, Limited, Sir John was also chairman of Jarrow Tube Works, Limited, J. & A. Churchill, Limited, and J. Jarvis & Sons, Limited. He was Member of Parliament for Guildford, Surrey, for 15 years. In addition to his parliamentary career and business interests, Sir John was also extremely well known for his activities in connection with the breeding of racehorses.

MR. ROBERT BLACKWOOD, late foundry manager of John Lang & Sons, Limited, Johnstone, has died at the age of 82. He retired over 16 years ago.

WE REGRET to announce the death of Mr. P. Gabriel, who from 1924 until his retirement in 1948 was the secretary of the *Association Technique de Fonderie*.

MR. R. B. DEELEY, B.SC., A.R.S.M., a director of Light-alloys, Limited, died on October 16, in his fiftieth year. Mr. Deeley joined the company in 1927 as works metallurgist and, after a few years, undertook the further appointment of foundry superintendent. In 1948 he was appointed technical director. He represented the company on a number of technical committees in the aluminium industry.

Wills

SUTCLIFFE, THOMAS DESMOND, joint managing director of Richard Sutcliffe, Limited, conveyor manufacturers, Horbury, and the Sutcliffe Moulded Rubber Company, Limited, Ossett £16,681

EWING, ALFRED, late managing director of Sanderson Bros. and Newboulds, Limited, tool manufacturers, Sheffield £69,506

SITUATIONS WANTED

MERSEYSIDE.—PATTERN MAKER, Wood and Metal, desires local change. Conscientious, good timekeeper. —McCarthy, 14, Apollo Street, Liverpool.

FOUNDRY FOREMAN (39) desires change; 25 years' experience all classes of work. Motor cylinder and aero work. Expert knowledge core blowing and all mechanical plant. Present position 12 years.—Box 192, Foundry Trade Journal.

FOUNDRYMAN, after 14 years' intensive training from apprentice to Works Manager, now desires to take up position with reputable firm. Must be permanent and progressive, any position considered that offers the right opportunities for a young and capable man. All letters answered.—Box 200, Foundry Trade Journal.

QUALIFIED ACCOUNTANT (35), 13 years' extensive experience in the foundry trade (mechanised and jobbing foundries), cost accounting, budgetary control, preparation of final accounts, etc., seeks progressive appointment, preferably with company in Midlands. Salary £800 p.a.—Box 198, Foundry Trade Journal.

SECRETARY / ACCOUNTANT (35) desires change; 18 years experience Foundry Accounting. Preparation of final accounts to balance sheet, monthly trading accounts, costing, commercial administration and secretarial practice.—Box 202, Foundry Trade Journal.

WILL Iron or Steel Manufacturer requiring MANAGER to improve on present results appoint Technician with sane progressive ideas and no scope at present to use them. Private Enterprise only.—Write BM/LLKL, London, W.C.1.

SITUATIONS VACANT

YOUNG DESIGN ENGINEER required, age 28-35, capable of designing and supervising the production of a mechanised plant for a precision moulding process. Metallurgical knowledge would be an asset but not essential. This post offers excellent opportunities. Salary £650-£850, according to experience.—Box 214, Foundry Trade Journal.

A VACANCY has arisen for a CHIEF PROCESS LAYOUT ENGINEER in a South Wales light engineering factory. Applicants must have served a recognised apprenticeship in mechanical engineering, have been educated up to Ordinary National Certificate standard, and have had at least five years' experience in layout work. Housing accommodation will be made available. Salary in accordance with age and qualifications.—Write Box 238, Foundry Trade Journal.

A LIGHT Engineering Company in South Wales requires a DEVELOPMENT ENGINEER. Applicants should be men between 25-45 years of age and possess a good all round knowledge of Engineering Process Layout, Tool Design and Mechanical Handling. Salary approx. £600, according to age and qualifications. Housing accommodation made available.—Write Box 208, Foundry Trade Journal.

A LIGHT Engineering Company in South Wales requires a CHIEF DRAUGHTSMAN. Applicants should be men between 30-45 years of age, possessing a complete knowledge of Press and Jig and Fixture Design. Salary approx. £650, according to age and qualifications. Housing accommodation will be made available.—Write Box 206, Foundry Trade Journal.

SITUATIONS VACANT—*Contd.*

A LIGHT Engineering Company in South Wales requires a TOOL DESIGN CHECKER. Applicants should be men between 30-45 years of age and possess a complete knowledge of Press Tool and Jig and Fixture Designs. Salary approx. £600, according to age and qualifications. Housing accommodation made available.—Write Box 210, Foundry Trade Journal.

ASSISTANT to Chief Metallurgist required for large general engineering works in East Midlands. Applicants should have wide experience of chemical and metallurgical work involved in general engineering practice, including steel, cast iron, non-ferrous materials, fuels, heat-treatment, etc.—Applications, stating age, full details of experience, qualifications and salary required, to Box 228, Foundry Trade Journal.

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

ESTIMATOR AND RATEFIXER required for a jobbing, hand and mechanised Foundry situated west of London. Previous experience and knowledge of Time-study essential.—State salary required to Box 168, Foundry Trade Journal.

FURNACEMAN required for Small Iron Foundry casting 20 tons weekly. Must be fully experienced in Cupola Practice. Good conditions, etc.—Apply in writing, giving full details and salary required, to Swan Foundry (Banbury), Ltd., Swan Close Road, Banbury, Oxon.

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

FOUNDRY FOREMAN required for Grey Iron Jobbing Foundry. State age, experience and salary required.—Apply to Carter, Wilkinson, Ltd., Kingsfield, Hooley Lane, Redhill, Surrey.

GOVERNMENT OF IRAQ

FOUNDRY SHOP MANAGER required by the Iraqi Railways for one tour of 3 years in the first instance. Salary Iraqi Dinars 70 a month (I.D.1. = £1). High cost-of-living allowance between I.D.10 and I.D.14 a month, according to dependants. Free passages. Liberal leave on full salary. Candidates under 45 must have served an apprenticeship in an up-to-date foundry and be covering ferrous and non-ferrous metals. They must be capable of operating cupolas and tilting furnaces, have some knowledge of operating metallurgy, and be able to control and train staff.—Apply at once by letter, stating age, full names in block letters, and full particulars of qualifications and experience, and mentioning this paper to the Crown Agents, 4, Millbank, London, S.W.1, quoting quoting M/N/25167(3B) on both letter and envelope. The Crown Agents cannot undertake to acknowledge all applications, and will communicate only with applicants selected for further consideration.

SITUATIONS VACANT—*Contd.*

FOUNDRY Organisation, increasing output with new foundry coming into operation shortly, has opening for TECHNICAL SALES REPRESENTATIVES, one Midlands, one Home Counties. Salary, expenses, commission. Essential have first-class connection these areas.—Apply in detail, strict confidence, Box 254, Foundry Trade Journal.

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

FOREMAN required, to supervise production at Grey Iron Foundry. Age 30-40. Sound knowledge of floor, machine and mechanised production essential. Applicant must have proved himself in similar capacity and should preferably have experience of cupolas, metal and sand control.—Write, stating age, experience and full history of employment, to Jones & Attwood, Ltd., Stourbridge, Worcs.

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

FOUNDRY MANAGER, to take complete charge of recently reconstructed Iron and Non-ferrous Foundry making a wide range of general engineering castings from a few pounds in weight to an average weight of 20 tons, but up to a maximum weight of 50 tons. The Foundry is at present producing approximately 70 tons of castings per week, but it is anticipated the production will be expanded to more than double this figure. Applicants should have sound technical and practical knowledge of Iron Foundry practice, and preferably experience in producing small batches of castings at economic prices using Sandslinger and moulding machines. House will be available for successful applicant.—Please state age, details of training and experience and salary required, which will be treated in strict confidence to Personnel Officer, Davy & United Engineering Co., Ltd., Park Iron Works, Sheffield, 4.

BRITISH STEEL FOUNDERS' ASSOCIATION

RESEARCH AND DEVELOPMENT DIVISION.

THE Division intends shortly to make further staff appointments at Senior Executive level, and applications are invited from candidates who have specialised experience in steel foundry technology, particularly in the following branches :—

FOUNDRY PRACTICE,
PLANT ENGINEERING.

Successful candidates, who should preferably be of graduate standard, will report personally to the Director of Research and will be responsible for the efficient operation of one or more of the major sections of the organisation.

Salaries will depend upon individual ability and experience, and the posts are pensionable. Assistance will be given if so desired in finding living accommodation in the Sheffield area.

Applications, which will be treated as strictly confidential, should be addressed, together with details of experience and qualifications, to :—

THE DIRECTOR OF RESEARCH,
British Steel Founders' Association,
20A, Collegiate Crescent, Sheffield, 10.
October 13th, 1950.

SITUATIONS VACANT—*Contd.*

FOREMAN for Brass Foundry, competent to supervise approx. 8 moulders, 2 coremakers, furnaceman and 3 labourers producing small and medium jobbing work in various alloys. Experience of similar job desirable. Sheffield.—Box 218, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN for Malleable Foundry in Midlands. Practical knowledge of power moulding machines essential. Good opportunity for right man. Full particulars of experience, age, and salary required.—Apply Box 190, FOUNDRY TRADE JOURNAL.

METAL PATTERNMAKER is required with experience of grates and ranges. He must be able to carry out new designs and tests on new appliances.—Apply to A. KENRICK & SONS, LTD., West Bromwich, stating experience.

LIGHT Engineering Factory in South Wales require the services of a TRAINING AND EDUCATION OFFICER, to organise all branches of training. Applicants should hold a Degree in Mechanical or Electrical Engineering, have some teaching or industrial experience, and should be between 25-35 years of age. Salary £650 per annum.—Applications, giving fullest details, should be sent to Box 250, FOUNDRY TRADE JOURNAL.

METALLURGICAL CHEMIST, experienced in the routine analysis of copper base alloys, light alloys and white metals, required by Foundry in the London area. Salary in accordance to qualifications and experience.—Write, giving full particulars, to Box 182, FOUNDRY TRADE JOURNAL.

METALLURGIST required in Laboratory attached to Non-ferrous Foundries in the London area. Applicants with experience in copper base materials will be preferred. Salary in accordance with qualifications and experience.—Write, giving full particulars, to Box 184, FOUNDRY TRADE JOURNAL.

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

MECHANISED Foundry in South Wales requires a man to act as a "Trouble-Shooter." Must be experienced in all sections of Mechanised production. This position carries excellent prospects for the man having the necessary ability.—Reply, stating experience and salary required, to Box 226, FOUNDRY TRADE JOURNAL.

MIDLAND Iron Founders require the services of an experienced WORKS ENGINEER, who will be responsible for the design and development of new plant and machinery—must have good drawing office experience. This is a good opening for the right man.—Apply, stating age, experience, etc., in strict confidence, Box 196, FOUNDRY TRADE JOURNAL.

JUNIOR METALLURGIST required Manchester district. Must be prepared to share night work. Some experience of metallurgical Analysis and Arc Steel Melting preferred.—State age, wage, and experience to Box 256, FOUNDRY TRADE JOURNAL.

SALES ENGINEERS—calling on Foundries and desirous of additional lines—invited to apply for representation of progressive Company handling the full range of foundry plant on behalf of a famous German manufacturing firm. Four REPRESENTATIVES required, South, Midland, Northern England, and Scotland.—Send details of experience, age, terms, etc., to Box 188, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

ENGLISH Company, refining a new range of special Non-ferrous Foundry Alloys, requires AGENT for Cheshire, Yorkshire, and north to the border. One with existing foundry connection preferred.—Box 518, DORLAND ADVERTISING, 18/20, Regent Street, London, S.W.1.

NORTHERN REPRESENTATIVE for Aluminium Die Casting Foundry. Technical training and experience required. Resident Lancashire or Yorkshire area.—Box 252, FOUNDRY TRADE JOURNAL.

SALES ENGINEER for Foundry Drying Equipment, Heat-Treatment Furnaces and Light Steel Construction for London and Home Counties, required by two associated firms. London office may be provided.—Apply fully, Box 172, FOUNDRY TRADE JOURNAL.

WORKS ENGINEER required for a Midlands Steel Foundry. Must be capable of taking charge of Maintenance Department and all future development work. Assistance with a house may be available if necessary.—Full details of training and experience to Box 230, FOUNDRY TRADE JOURNAL.

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

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

SPECTROGRAPHIC ASSISTANT, Birmingham district, required for handling wide range of Non-ferrous Alloys. Previous experience essential. Preference given to applicant having additional chemical or metallurgical experience. Good prospects.—Full particulars of salary required, etc., Box 248, FOUNDRY TRADE JOURNAL.

RICHARDS (LEICESTER), LTD., Phoenix Works, Leicester, have vacancy in their Mechanised Ironfoundry for HEAD FOREMAN MOULDER. Will consider Moulder or Patternmaker, or Engineer with Foundry experience. Also vacancy for FOREMAN COREMAKER, with experience of Coreblowing.

VACANCY for HEAD FOREMAN in Iron and Steel Foundry situated in South-East Essex. Only those used to strict cupola control need apply. Good prospects for the right man.—Box 222, FOUNDRY TRADE JOURNAL.

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

OWING to Works expansion, a vacancy occurs for a first-class CORE SHOP FOREMAN. Applicants must be fully conversant with the latest methods of core blowing and also the making of hand-made cores. It is essential that applicants have a thorough knowledge of Piece Work pricing on all types of cores. Coremaking for the Automobile, Agricultural and General Engineering Industries.—Please state age, experience, and salary required to GENERAL WORKS MANAGER, Gloucester Foundry, Ltd., Emlyn Works, Gloucester.

SITUATIONS VACANT—*Contd.*

SKILLED MOULDER, conversant with all types of non-ferrous castings, required for position holding excellent prospects with a company in the South of England. Position ideally suited for young man about 28.—Box 242, FOUNDRY TRADE JOURNAL.

PROFESSIONAL

CONSULTANT ENGINEER, University degrees, specialised in layout, methods, costing and organisation of light-metal foundries, more than 20 years' practical experience in largest foundries, offers his services.—"PRECIMA" INSTRUMENT Co., 20, Temple Court, Birmingham, 2.

MR. J. FLINT WOOD, B.Sc., A.M.Inst.C.E., M.I.B.F. (late of The United Steel Co., Ltd.), is now established at 46, Thurloe Square, London, S.W.7, and will be pleased to advise ironfounders on technical and commercial aspects of their business.

BUSINESS WANTED

A FIRM of Engineers wish to purchase a small Iron Foundry as a going concern.—Box 938, FOUNDRY TRADE JOURNAL.

BUSINESSES FOR SALE

FOR SALE, as going concern, General Engineering Works, comprising Foundry for Iron and Non-ferrous, with Machine Moulding Plant and Pattern Shop. Machine shop completely equipped with all necessary machines, including 9-16 in. centre lathes, miller, slotter, and oxy acetylene cutting and welding equipment. Good reasons for selling. Situated South Wales.—Box 232, FOUNDRY TRADE JOURNAL.

FOUNDRY AND ENGINEERING WORKS—FOR SALE IN ESSEX

GROUND floor premises of 36,000 sq. ft., covered area of a Freehold site of 5 acres. Offices, Canteen, Stores, Foundries, Pattern, Fettling and Core Shops. Fully equipped with Foundry plant and machinery, to be sold complete as a going concern. Price £60,000.—Further details from CHAMBERLAIN & WILLOWS, Surveyors, 23, Moorgate, London, E.C.2. (City 6013.)

FINANCIAL

WANTED an interest in a good class Pattern-making Concern in the Midlands area. Advertiser in position to place a considerable amount of business and also introduce new ideas and methods, etc.—Box 224, FOUNDRY TRADE JOURNAL.

ADVERTISER WITH CAPITAL up to £15,000 AVAILABLE would be prepared to finance straightforward, wholesale or export transactions on a 50-50 per cent. profit sharing joint account basis.—Write Box 260, FOUNDRY TRADE JOURNAL.

ADVERTISER wants to purchase or take interest in a Metal Smelting or Metal Merchant's business. No objection to a firm at present working at a loss or in need of capital if future prospects sound. Advertiser is only willing to consider and pay for real assets. Capital involved up to £25,000. No intermediaries. Offers will be treated as strictly confidential.—Write Box 258, FOUNDRY TRADE JOURNAL.

PATENT

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

NOTICE

J. STONE & CO., LTD., have purchased the whole of the Shareholding in the Coleman Foundry Equipment Co., Ltd., of Stotfold, Bedfordshire, and this Firm therefore now joins the J. Stone Group of Companies. It will be directed and administered by Stone-Wallwork, Ltd., and the policy will be to continue to manufacture and sell the Coleman range of products.

NOTICE is hereby given that Magnesium Elektron, Ltd., seeks leave to amend the Complete Specification of the Letters Patent No. 511,137 for an invention entitled "Improvements in and Relating to Magnesium Alloys."

Particulars of the proposed amendments were set forth in the Official Journal (Patents), No. 3217, dated 11th October, 1950.

Any person may give Notice of Opposition to the amendment by leaving Patents Form No. 36 at the Patent Office, 25, Southampton Buildings, London, W.C.2, on or before 13th November, 1950.

J. L. BLAKE,
Comptroller-General.

AUCTION NOTICE

By order of the Receiver and Manager, E. S. Foden, Esq., F.C.A., Re: H. D. Evans Foundries, Ltd., COMMERCIAL WORKS, ROATH BASIN, CARDIFF.

HENRY BUTCHER & CO. are instructed to offer for SALE BY AUCTION, at COMMERCIAL WORKS, on THURSDAY, 16th NOVEMBER, 1950, at ELEVEN a.m., AS A FIRST LOT, THE LEASEHOLD FACTORY, containing a FLOOR SPACE OF 16,000 SQ. FT. and a SITE AREA OF 1,650 SQ. YDS., to be followed by the SALE IN LOTS in DETAIL of the MACHINE TOOLS & EQUIPMENT, FOUNDRY PLANT & STORES, including "CHURCHILL REDMAN" 11 in. CENTRE S.S. & S.C. LATHE. "CINCINNATI" No. 2 VERTICAL MILLER. S.S. & S.C. LATHES up to 16 in. CENTRES, by "Mitchell," "Willson" and "Lang." RADIAL AND PILLAR DRILLING MACHINES. D.E. Grinders. Hacksaw and Screwing Machines. "ALBA" SHAPERS UP TO 24 IN. STROKE. "POLFORD" 5-CWT. BATCH MIXER. 4 ft. Loam Mill. Electric Sieves. "Adaptsqueeze" Moulding Machines. SEVERAL TONS MOULDING BOXES. Luminous Flame Type Gas Burner Gear. "C.P.T." COMPRESSOR. BLOWING AND CIRCULATING FANS. 3-Tons per hour Cupola. Sand Mixers and Foundry Tools. OVERHEAD ELECTRIC AND HAND CRANES UP TO 10 TONS. "METALCLAD" WOOD SAWING AND PLANING MACHINES. "MORRIS" 1946 30-CWT. LORRY. "MORRIS" 1938 8 H.P. SALOON CAR. OFFICE FURNITURE AND EQUIPMENT.

NOTE.—The Receiver is prepared to entertain offers for the Lease of the Premises, together with the Plant and Equipment, up to within one week of the date of the Sale.

Combined Particulars and Conditions for the Property and Catalogue of the Plant and Equipment may be obtained of Messrs. R. H. MARCH, SON & CO., Chartered Accountants, BALTIC HOUSE, MOUNT STUART SQUARE, CARDIFF; of Messrs. ALLEN PRATT & GELDARD, Solicitors, MOUNT STUART SQUARE, CARDIFF, and of Messrs. HENRY BUTCHER & CO., Auctioneers, Valuers and Surveyors of Factories, Plant and Equipment, 73, CHANCERY LANE, LONDON, W.C.2. Telephone: HOLborn 8411 (8 lines).

MACHINERY FOR SALE

CUPOLA—erected but never used. Internal diameter of shell 5 ft. 4 in. Height from ground level to: Charging platform, 22 ft. 2 in.; top of cupola shell, 30 ft.; top of spark arrester cowl, 51 ft. Particularly heavily built, complete with fan, charging platform, 1-ton capacity electric goods lift, and supporting steel work.—NEWMAN INDUSTRIES, LTD., Yate, Bristol.

MISCELLANEOUS

FORDATH Sand Mixer, Type B., 10-cwt. capacity.
Coleman "Prosama" Sand Disintegrator and Aerator.
Holmes Type "VSK" Sand Mixer and Aerator.
Pneulec Royer Sand Thrower, Size No. 1.
"Finex" Shaker Type Sieve.
"Steel-Shaw" Paint Shaking Machine.
Mathieson Gas-fired Mould Dryer, 6 ft. 0 in. by 4 ft. 6 in.
Mathieson Gas-fired Mould Dryer, with 3/50/400-volt Blower.
All above for 3/50/400 Volts.
Foundry Equipment Coke-fired Sand Dryers.
Pneumatic Moulding Box Knockout.
Smedley 7 ft. Sand Mill, overdriven.
4 ft. dia. Sand Mill, overdriven, self-discharging Pan, motorised.

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

ALBION TWW WORKS

BLOWING and EXHAUSTING FANS

ROTARY BLOWERS:

MOTOR DRIVEN ROTARY BLOWER, by Hick Hargreaves. 546 c.f.m., 5-lbs. pressure. Driven by 28 h.p. Motor, 400 volts, 3-phase, 50 cycles. All mounted on combined bedplate.

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