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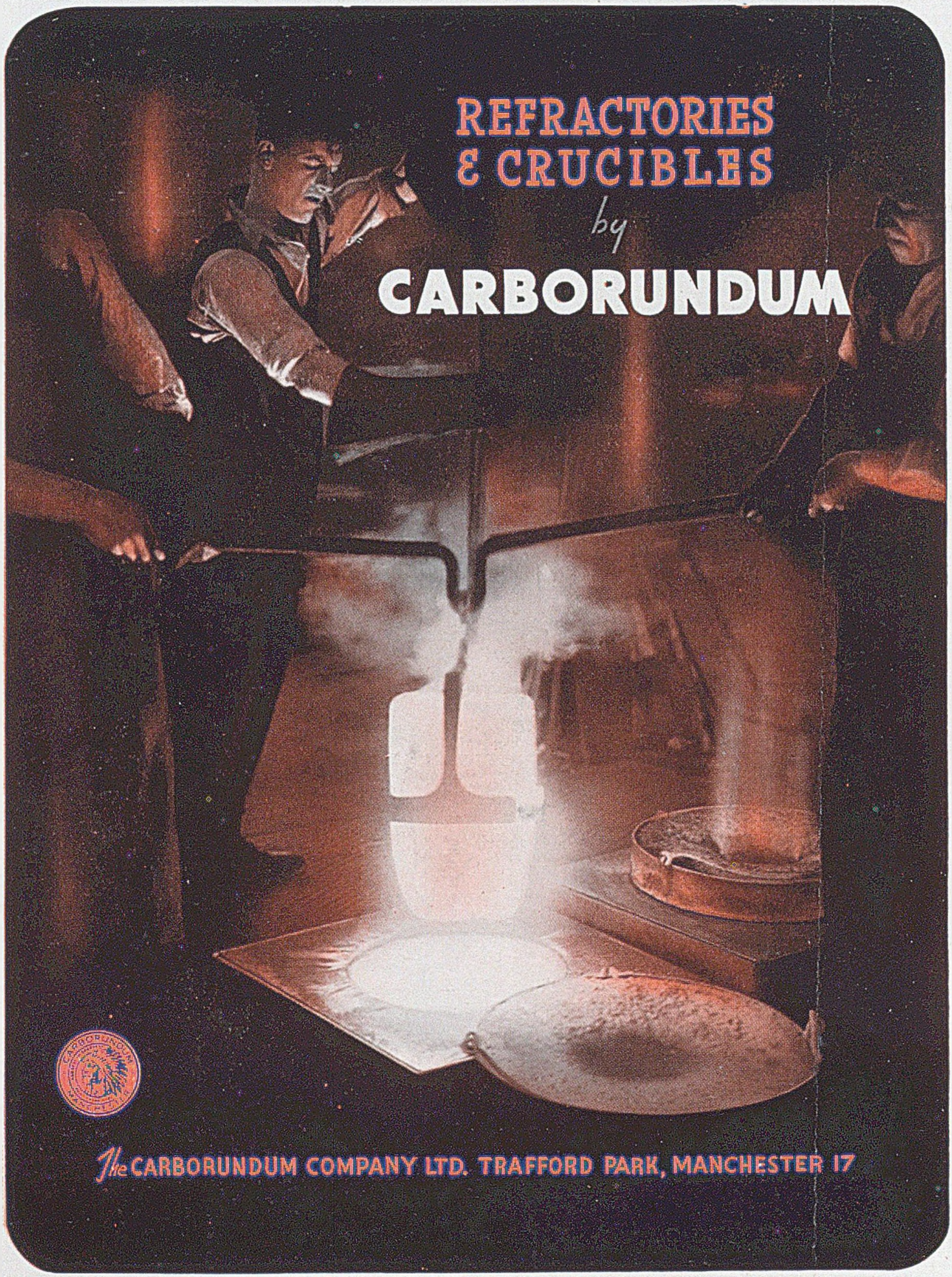
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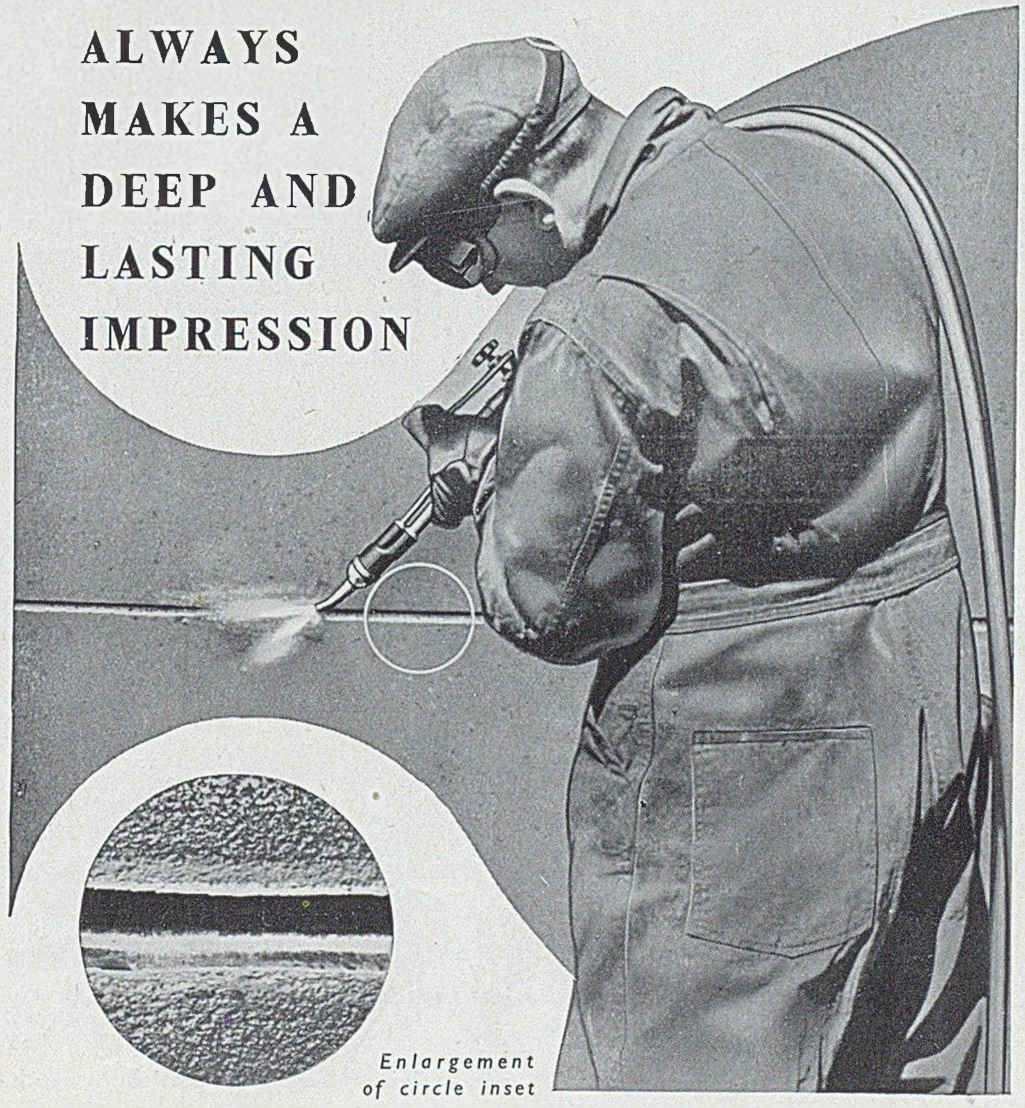

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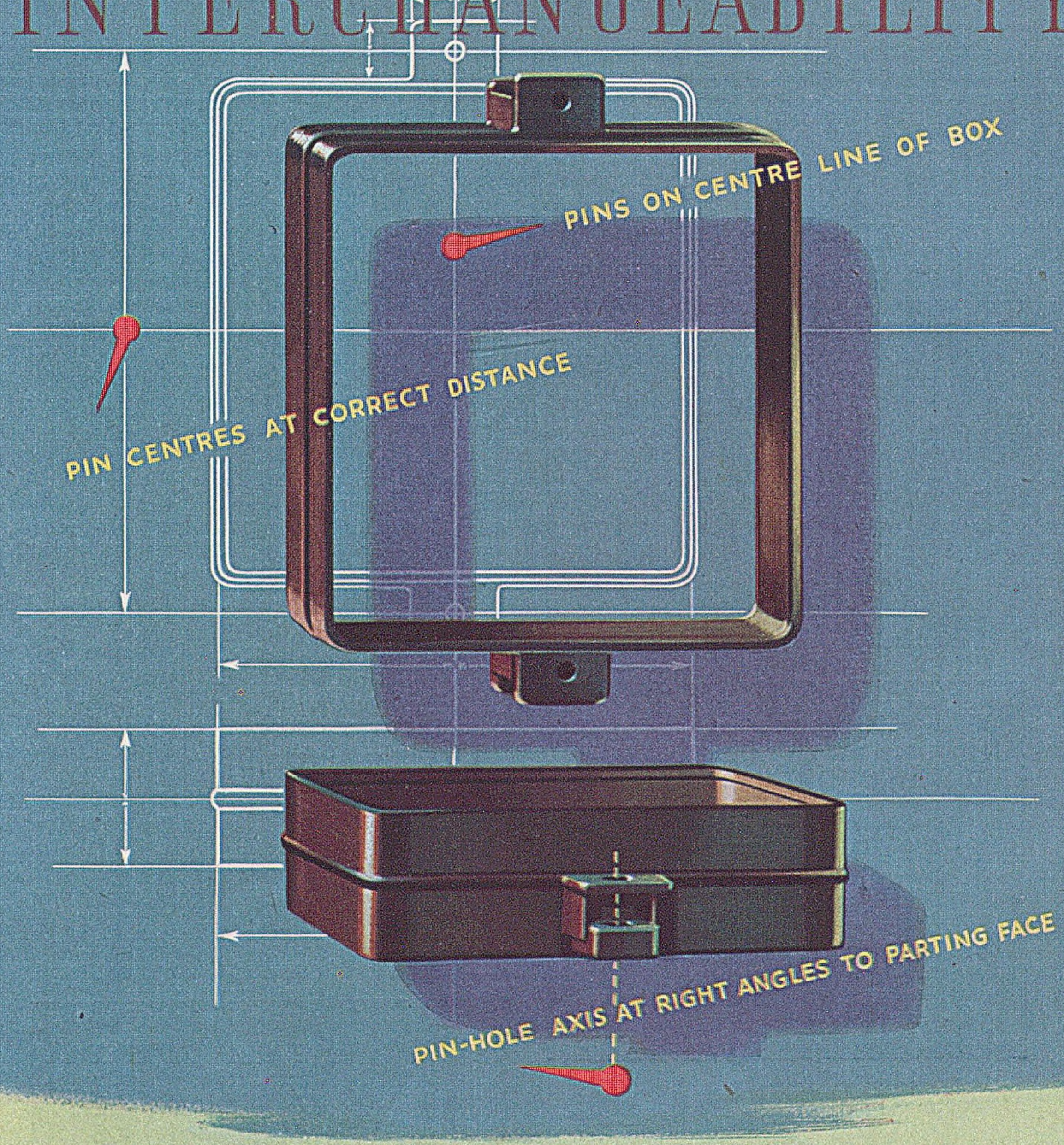

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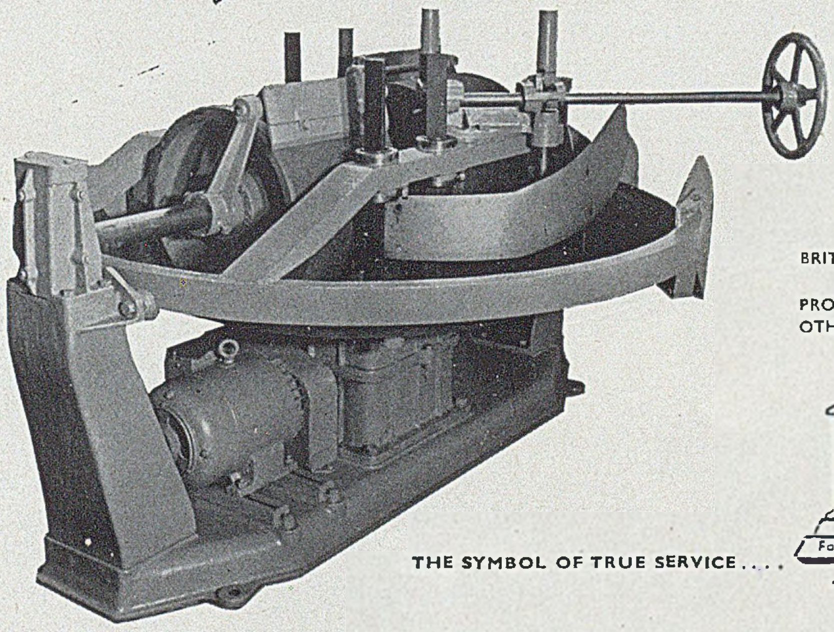

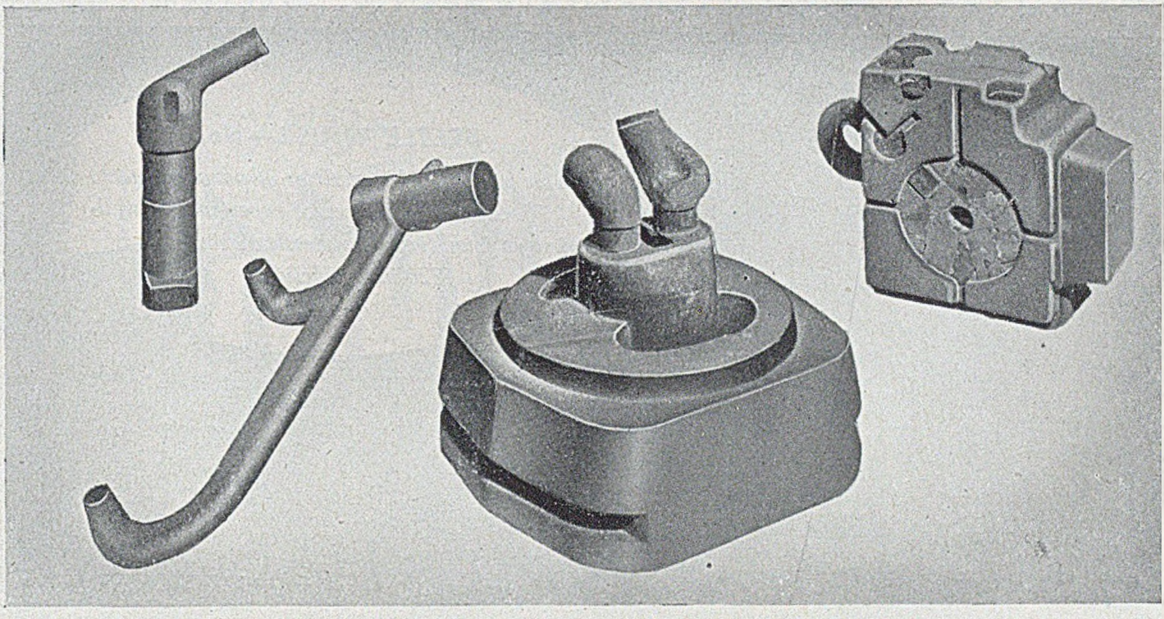

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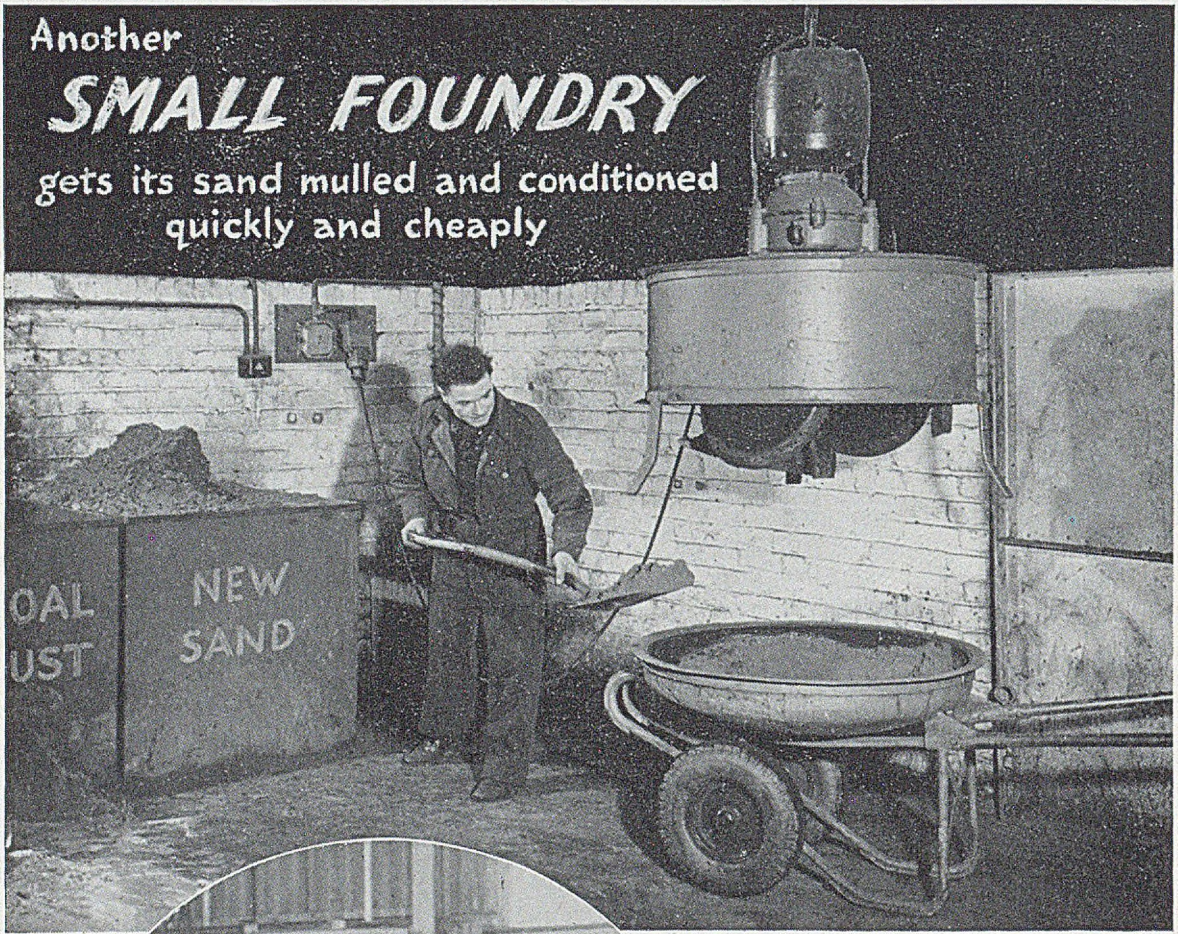

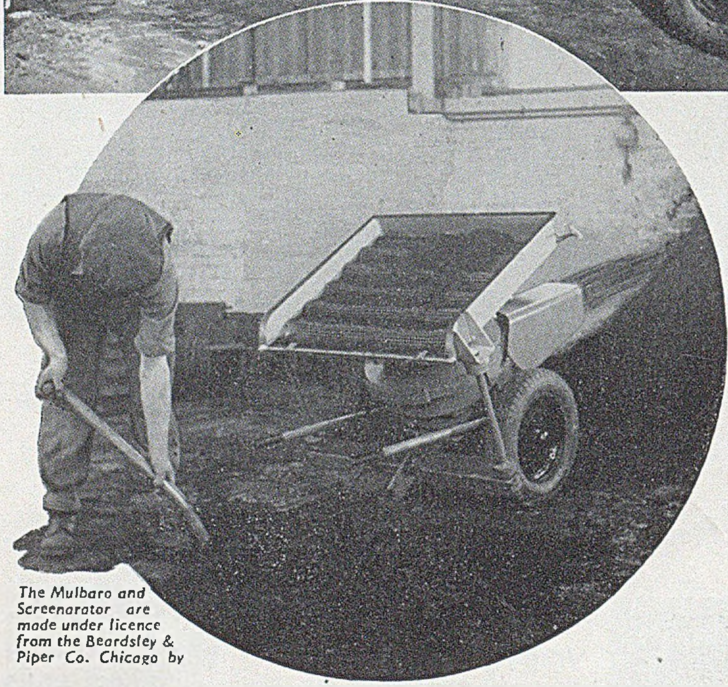

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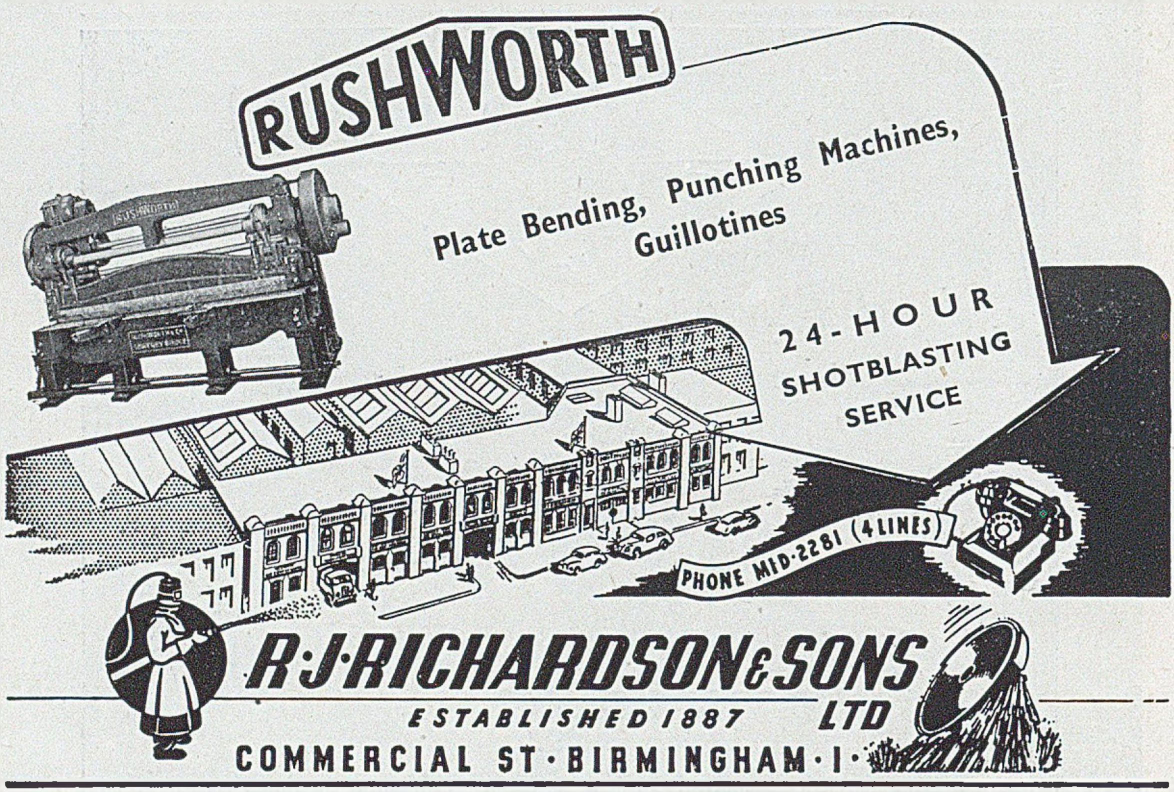
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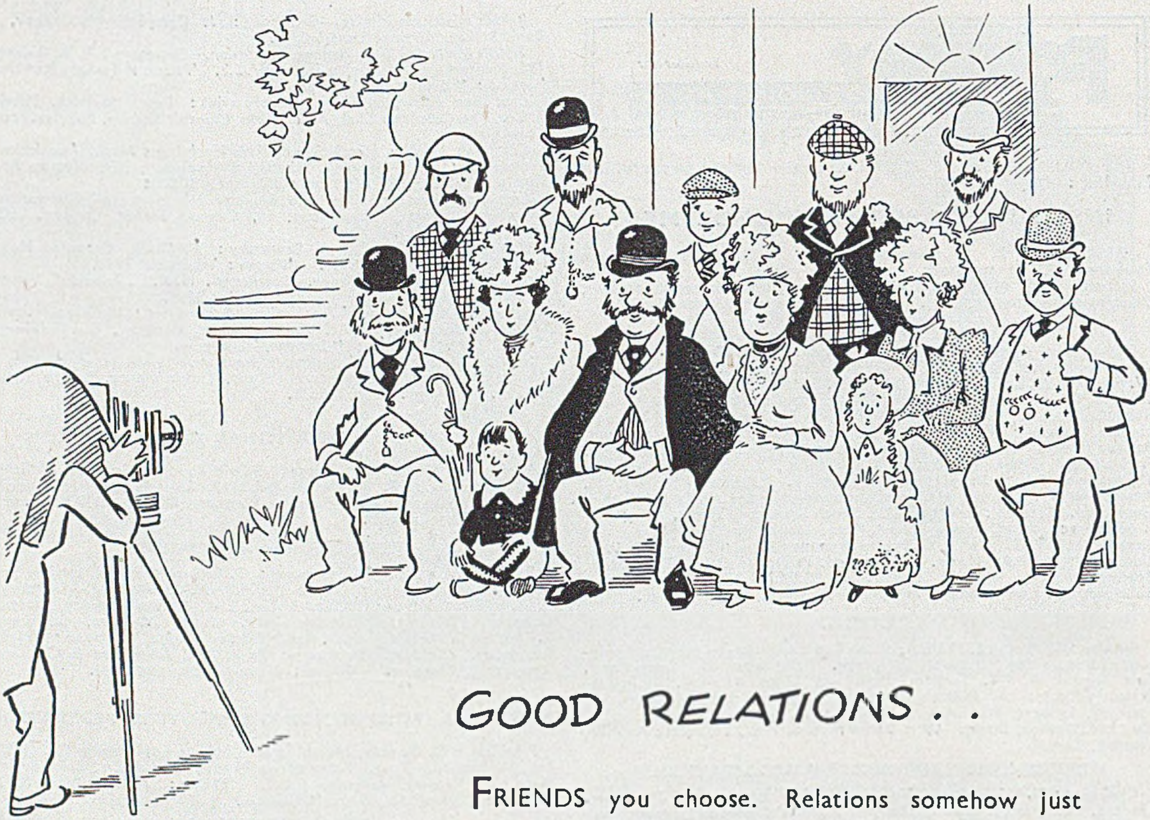

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49, Wellington Street, London, W.C.2. 'Phone: Temple Bar 3951 (Private Branch Exchange) Grams: "Zacatecas, Rand, London"

Festival of Britain

It is significant that the Festival of Britain was declared open by His Majesty the King from the steps of St. Paul's Cathedral, because it stresses that while the South Bank Exhibition in London is the centrepiece, the actual Festival is nation-wide. It may be, and probably is, true to state that the exhibition to be staged in Glasgow will be of more serious interest to our readers than the London show. However, there is more in life than one's professional interests, and it would be difficult to find any cultural or recreational activity that has been omitted from the general organisation.

The South Bank Exhibition is frankly a hotch-potch. Some of the exhibits we saw during our visit we cordially detested, others were frankly boring, yet there were many we thoroughly appreciated. We expected to be really interested in the Dome of Discovery, but, having a defective sense of direction, this circular building caused us to see the same exhibits several times and also, no doubt, was responsible for a feeling that much remained to be seen. There is much scientific symbolism in this hall, which we neither understood nor appreciated. Nor do we believe our readers will be thrilled, for it is common knowledge that the foundryman detests being blinded with science. Not appreciated was a slogan we noted in one pavilion which announced "Land is the blanket of man's birth, his launching ground to the stars." At least being of dual purpose it should be productive! We resent being puzzled by obscure platitudes obtruding themselves in our vista. We much prefer "crosswords," because those solutions which are not too obvious are disclosed in a later issue. The grotesque statuary and most of the symbolic murals are distasteful to those whose views are so admirably expressed by Munnings. Amongst the exhibits we liked were the various animals; the small river craft; the halls lined with not unattractive murals carrying the flight of doves; a hall where machinery is weaving, making ice-cream wafers, producing plastic pressings, and so forth; the old and new locomotives and a motor car so displayed that one can examine every detail of its construction. As the exhibition during our visit was still unfinished, it is only fair to state that dozens of exhibits may be forthcoming of much greater interest.

The question which we feel we ought to answer is whether the South Bank Exhibition is of sufficient interest to warrant the expenditure of the time, money and energy by founders living in the provinces to make the trip. The answer is that as a foundryman's life is not taken up purely by his profession, a visit to London during this summer is genuinely desirable. For one thing, the town has regained much of its pre-war glamour and now, after garnishing with very extensive floral decorations, fresh coats of paint, flags and bunting, it presents an aspect worthy of its great traditions. If one insists, and there is every reason why one should, on seeing matters germane to foundry practice, then one has only to time the visit to coincide with the staging of the Engineering and Marine (Foundry) Exhibition at Olympia at the end of August and the beginning of September.

City and Guilds Foundrywork Awards

The City and Guilds of London Institute, Department of Technology, announce, amongst the list of the winners of the special prizes offered by trade societies and other bodies in 1950, those awarded for patternmaking and foundry practice. The prizes offered through the Institute of British Foundrymen were awarded as follow:—

Final Examination in Patternmaking. — The "Buchanan" silver medal to George Frederick Aston, Dudley and Staffordshire Technical College. A "Buchanan" book prize to Frank John Carr Pearson, Coventry Technical College.

Intermediate Examination in Patternmaking.—The "P. H. Wilson" prizes of the Institute of British Foundrymen were awarded as follow:—1st Prize, £2 5s. for books or instruments, to Royston Dennis Line, Rugby College of Technology and Arts. 2nd Prize, £1 10s. for books or instruments, to Ian McGillivray, Dundee Trades College.

Final Examination in Foundry Practice. — The "Buchanan" silver medal to Robert Lindsay, Huddersfield Technical College. A "Buchanan" book prize to Derek Lane, National Trades Technical Societies Classes, Sheffield.

Intermediate Examination in Foundry Practice.—The "P. H. Wilson" prizes of the Institute of British Foundrymen were awarded as follow:—A prize of £2 5s. for books or instruments to Frank John Carr Pearson, Coventry Technical College. A prize of £1 10s. for books or instruments to Derek Frederick James Thurkettle, Ipswich School of Technology.

Institute of Metals

Oxford Local Section

At a well-attended meeting held in Oxford on April 17, 1951, it was resolved to request the council of the Institute of Metals to approve the formation of an Oxford Local Section, to serve a wide area around that city. The president, chairman of the local section committee and secretary of the Institute were present. The following officers of the section have been elected for the session 1951-52:—As *chairman*, Dr. H. M. Finniston (Atomic Energy Research Establishment, Harwell); as *vice-chairmen*, Dr. W. Hume-Rothery, F.R.S. (Oxford University), and Dr. R. T. Parker (Aluminium Laboratories, Limited, Banbury); as *hon. secretary*, Dr. B. R. T. Frost (Atomic Energy Research Establishment, Harwell); as *hon. treasurer*, Mr. J. C. Arrowsmith (Pressed Steel Company of Great Britain, Limited, Cowley).

Purchasing Officers' Conference

The Purchasing Officers' Association is organising a Scottish and North of England one-day conference at the North British Station Hotel, Edinburgh, on Saturday, May 19. Although the conference is primarily intended for members of the Association's branches in Scotland and on Tyneside, any other purchasing officers will be welcome to attend, and should apply for tickets to the general secretary of the Association, Wardrobe Court, 146a, Queen Victoria Street, London, E.C.4. The charge of 12s. 6d. will cover attendance at the luncheon as well as participation in all conference sessions.

I.B.F. Branch Secretary Retires

Retiring after 15 yrs. secretaryship of Bristol and West of England branch of the Institute of Foundrymen, Mr. A. Hares, (right) *was presented with a clock by* Mr. T. Makemson, *general secretary of the Institute, during the annual dinner of the branch at the Grand Hotel, Bristol. Others in the picture are* (left to right), Mr. D. F. B. Tedds, *branch president;* Mr. J. J. Sheehan, *national president;* Mr. N. P. Newman, *past-president and* Mr. W. J. Hares *who succeeds his father,* Mr. A. Hares, *as branch secretary.*

Notes on Cast Iron—Past and Present

By E. Longden, M.I.Mech.E.

Common contributions to the improvement in cast iron metallurgy have been made by various well-known metallurgists as private individuals, the B.C.I.R.A., *and the research departments of outstanding industrial concerns, although there is a wealth of information locked in the archives of certain industrial firms which would be of general benefit if disclosed. However necessary the need may be for continued research into the properties and qualities possible in cast iron, it would appear that too much concentration of attention on the most recent developments is possible, at the expense of the solution to the many troubles associated with the more common and special metals in everyday use, which constitute 95 per cent. of cast-iron manufactures. The problems referred to are those connected with micro-porosity, cavities resulting from liquid shrinkage and gas and solid contraction. In other words, the question is posed—are discoveries in cast-iron varieties outstripping the abilities and resources of the foundry industry?*

Nodular Irons

Until the impact of nodular iron developments, it was thought necessary to control the total carbon contents to below 3.2 per cent, sometimes well below 3 per cent, if high strengths were to be achieved. Now it is revealed that irons may contain up to 4 per cent. carbon, and yield up to forty tons per square inch tensile, that is, when phosphorus contents are within prescribed low limits. The development of nodular cast iron has, indeed, as with all special-processed irons, intensified the general tendencies in the direction of precise control over all the means to produce iron castings. The so-termed "inherent" properties of certain brands of pig-iron are better understood. Investigators agree with the probability of influences which were, until recently, unaccounted for. The potent effects of quite small amounts of calcium, cerium, and magnesium have very markedly directed attention to the influences of very small amounts of previously unidentified, or recorded, elements such as tin, lead, antimony, bismuth, arsenic, tellurium and titanium. Investigators are of the opinion that certain brands of pig-irons vary in their response to magnesium and cerium treatment as a result of the presence in the iron of comparatively small percentages of residual or accidental elements. Because, in the nodularising process elements are intentionally introduced into the metal, it does not follow that accidental elements, as referred to above, cannot have an influence more profound than has been generally accepted. Do we know enough of the state of their existence as elements, or in combination with each other, or what happens when they are subjected to various melting temperatures, and especially to superheating?

Production Methods

It is not the purpose of this Paper to do more than draw attention to the problems associated with the production of cast iron and to suggest that foundrymen may look in vain for the development of a special cast iron which will effect a solution to their common troubles. Indeed, the introduction of further varieties of cast iron may complicate the practice of founding. Nodular cast iron is another group variety of which there is, as yet, meagre practical experience in applying it to industrial needs. It might be said that, so far as the general industry is concerned, only pilot castings have been made and those with some difficulty.

The two best-known systems for the production of ductile nodular cast iron employ either magnesium or cerium, along with the introduction of a late inoculant, usually silicon. It is known that other elements such as calcium, lithium, and even sulphur, may, under a suitable combination of conditions, produce nodular cast iron. The two processes involve the provision of a suitable base iron.

Magnesium Treatment.—It is reported that an average magnesium-treated metal has the following percentage composition:—C, 3.2; Si, 2.5; Mn, 0.6; P, 0.08; S, 0.016; Ni, 1.0 and Mg. 0.06.

Higher percentages of carbon, within the hyper-eutectic cast iron composition, are considered unsuitable when employing the magnesium process. Magnesium is both a powerful desulphurising agent and carbide stabiliser; but the carbide stabilising effect does not operate until sulphur has been reduced or removed from the metal to below 0.02 per cent. This effect of magnesium is modified by the introduction to the metal of an inoculant, usually silicon, with, if the balance is correct, the formation of the nodular type of graphite. It will be noted that high silicons are permitted, or more correctly, perhaps, are necessary. Phosphorus is low, and manganese is of average content.

Cerium Treatment.—Published literature indicates that the average percentage composition of cerium-treated metal is as follows:—C, 3.7; Si, 2.6; Mn. 0.5; P, 0.03; S, 0.008, and Ce, 0.04. As with the magnesium process, sulphur present must be below 0.02 per cent. Cerium is also a powerful desulphuriser and carbide stabiliser, but the carbide retaining influence, as with magnesium, does not effectively operate until the sulphur is removed to below 0.02 per cent. With this material, too, the carbide-stabilising influence is modified by a late addition of an inoculant, usually silicon, to the molten metal, which, if correctly balanced with the other elements, results in the production of the nodular graphite.

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* Paper delivered early in the session to the Slough section of the London Branch of the Institute of British Foundrymen, Mr. R. B. Templeton presiding.

TABLE I.—*Compositions and Properties of Various High-duty and Alloy Irons.*

Name.	Percentage composition.											Tensile per sq. in.	B.H.N.	Elongation.
	T.C.	Si.	P.	Mn.	S.	Cu.	Ni.	Cr.	Mo.	Ce.	Mg.			
Lanz (hot mould)	2.8 to 3.2	0.8 to 1.2	0.20 to 0.40	0.6 to 0.8	0.13 max.							18 to 21	235 to 250	Slight.
*Emmel (cold mould or ambient temperature)	2.3 to 2.8	2.1 to 2.7	0.10 to 0.30	0.8 to 1.4	0.09 to 1.15							18 to 26	230 to 250	Slight.
Schuz (mould chilled)	3.4 to 3.6	3.3 to 3.5	0.50 to 0.60	0.6 to 0.8	0.10 to 0.12							17 to 22	165 to 175	Nil.
*Corsalli (cupola control)	1.4 to 1.8	0.7 to 1.0	0.05 to 0.20	0.4 to 0.5	0.06 to 0.08							30 to †60	240 to 270	Appreciable.
Dechnesne (shake-jolt)	3.0 to 3.6	1.6 to 2.6	0.15 to 0.46	0.4 to 0.7	0.08 to 0.17							20 to 32	200 to 240	Nil.
Meehanite (inoculated)	2.5 to 3.2	0.8 to 2.8	0.12 to 0.30	0.6 to 1.2	0.07 to 0.14	Nil to 3.0		Nil to 0.5	Nil to 1.0			23 to 30	205 to 280	Measurable.
Ni-Tensyl (inoculated)	2.7 to 3.0	1.5 to 2.0	0.10 to 0.25	0.8 to 1.1	0.10 max.		0.50 to 2.20	Nil to 0.5	Nil to 1.0			20 to 28	220 to 260	Measurable.
Nodular (cerium treatment)	3.5 to 3.9	2.4 to 2.8	0.02 to 0.05	0.3 to 0.8	0.018 max.					0.25 to 0.55		22 to 40	230 to 260	Considerable.
Nodular (magnesium treatment (ductile iron))	3.0 to 3.4	2.0 to 3.0	0.03 to 0.15	0.3 to 1.0	0.018 max.		0.8 to 0.1				0.04 to 0.07	30 to 40	230 to 270	Considerable.

* Very high superheating. † Heat treated.

It will be noted that both carbon and silicon are comparatively high, prosphorus is low, and manganese below average. The compositional difference between cerium- and magnesium-treated metals indicates that the cerium processed metal holds higher carbon and lower manganese content with an absence of nickel, when compared with the magnesium material. In both processes the late addition of silicon should be sufficient to increase the final silicon content by 0.3 to 0.4 per cent.

To date, the following metals and inoculants have been used in the double-process treatment for the manufacture of nodular, or spherulitic, cast iron:—(*a*) 88/20 nickel/magnesium alloy; (*b*) 88/20 copper/magnesium alloy; (*c*) 55/50 copper/magnesium alloy; (*d*) 50/50 aluminium/magnesium alloy; (*e*) 100 per cent. pure magnesium; (*f*) 50/40/10 iron/silicon/magnesium alloy, and (*g*) 50/55 cerium content Mischmetal. The alloys (*a*), (*b*), (*c*), (*d*), (*e*) and (*f*) have been employed in the magnesium process, and (*g*) in the cerium process.

A further development is to combine nodularising and inoculating in the one operation, by the use of an alloy consisting of iron, silicon, and magnesium, which is a little cheaper than the 80/20 nickel/magnesium metal. It would appear that in the present state of knowledge, manganese and phosphorus do not interfere too seriously with the nodularising effect of either magnesium or cerium, although phosphorus introduces the usual weakening effects, when present above about 0.2 per cent. Silicon over about 3 per cent. induces brittleness in the ferrite in which it dissolves; below that figure, silicon refines the ferrite. Lower-carbon irons are difficult to machine, and silicon below 2.0 per cent. may give white iron with carbides of the refined type. Section sensitivity is not great above ¼ in. sections, but sections below ¼ in. need to be heat-treated to produce adequate machinability.

Heat-treatment of Nodular Iron

A Canadian investigator, J. E. Rehder, contributes some information on the heat-treatment of nodular cast iron. It would appear, from his work, that nodular irons at suitable temperatures are susceptible to permanent growth by heat-treatment, associated with complete, or almost complete, graphitisation of the combined carbon. In cross-sections above ½ in. the growth is uniform; in cross-sections below ½ in. the growth is much greater, and in sections of ⅛ in. it may exceed 1 per cent. of linear dimensions. The most effective annealing is accomplished in steps:—An anneal at 950 deg. C. for two hr. to graphitise primary cementite, followed by 1½ hr. holding between 725 and 625 deg. C. to graphitise the pearlite carbides. This treatment varies somewhat according to the section, and where the casting carries contrasting sections, or mixed sections, considerable distortion may be experienced.

Rehder claims that graphite precipitated during decomposition of primary cementite is shown to be in spherulitic form, and that, as in the case for malleable and grey cast irons, the minimum overall annealing time is secured by eliminating pearlite by slow cooling through the critical temperature range. The total annealing time necessary for a typical nodular iron is much shorter than is necessary for malleable iron because of the very low sulphur content and if the manganese content be low also.

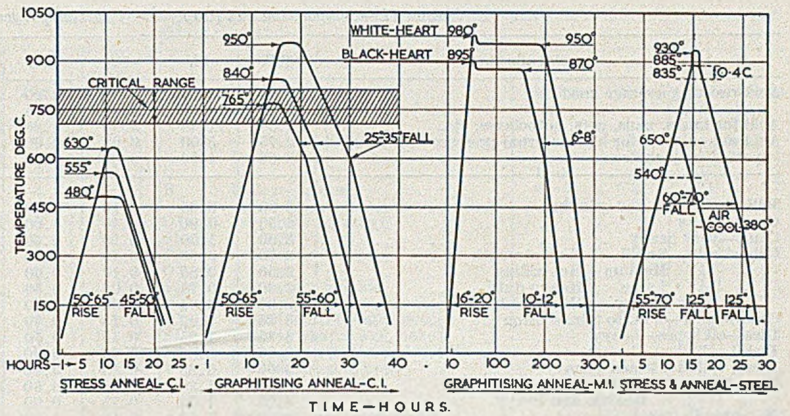


FIG. 1.—*Heat-treatment Temperature Ranges for Grey Cast Iron, Malleable and Steel.*

General Heat-treatment of Cast Iron

It is possible to accomplish by heat-treatment in cast iron all of the structural changes obtained in steel, such as (*a*) ferrite for machinability; (*b*) low temperature treatment for stress relief only, and (*c*) hardened and tempered structures by air or liquid quenching. The heat-treatment of cast iron, however, involves a time allowance for the graphitising or solution of graphite. Alloys influence the response of cast iron to heat-treatment in two directions: (*a*) the effect on the re-solution of the graphite, and (*b*) the retardation of the transformation in the matrix.

Fig. 1 is a graph indicating some of the approximate heat-treatment temperature zones to which cast iron, malleable iron and steel are subjected, they are complementary to each other. When considering the stress annealing of average sections of cast iron, the complete heat cycle can be accomplished in from twenty to twenty-four hours, but in the case of large mixed-section castings, the complete annealing time may extend into two or even three days. In some outstanding cases, such as turbine housings, the complete cycle of heat-treatment may extend to four days. The pointers to 480, 555 and 630 deg. C. in the graph (Fig. 1) give the approximate temperature necessary to stress-relieve a plain iron, a medium-strength iron, and a high-duty iron respectively, or they may be used to indicate the time needed to stress anneal when treating an average iron at various temperatures to accomplish stress-relief. In other words, it may be that stress-relief, within certain temperature scales, can be accomplished in a shorter time at a higher temperature than usually employed.

Machinability

Quite a large number of small castings, used in the textile, the electrical engineering trades, and the like, are required with one predominant physical property, namely, easy machinability. In other

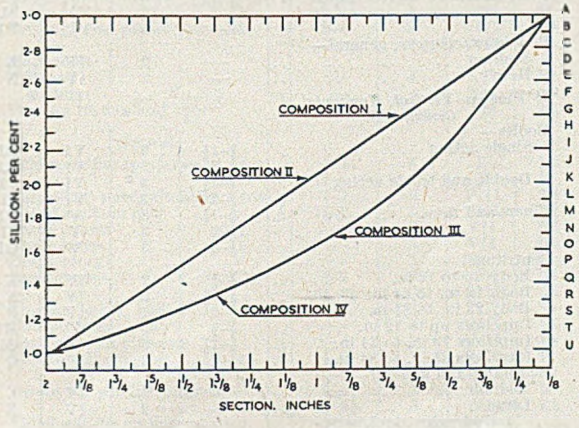


FIG. 2.—*Silicon Contents related to Sectional Thickness for Cast Iron. Code Letters refer to the End Uses listed in Table III; Basic Compositions are as shown below:—*

Basic Composition per cent.	I.	II.	III.	IV.
Carbon	3.40-3.50	3.30-3.40	3.25-3.30	3.25-3.30
Manganese	0.60-0.65	0.60-0.65	0.60-0.65	0.60-0.65
Phosphorus	1.25-1.35	1.10-1.20	0.95-1.05	0.80-0.90
Sulphur	0.07-0.09	0.07-0.09	0.08-0.10	0.08-0.10

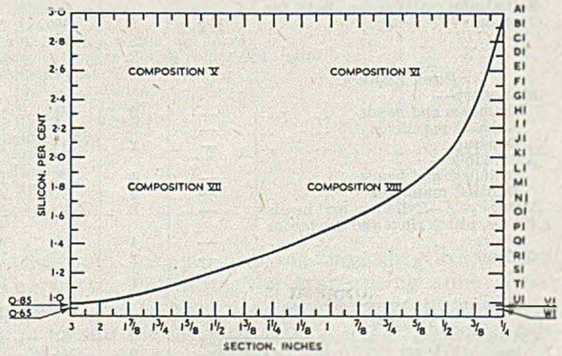


FIG. 3.—*Silicon Contents for Cast Iron related to Sectional Thickness. Code Letters refer to the End Uses listed in Table III; Basic Compositions as shown below:—*

Basic Composition per cent.	V.	VI.	VII.	VIII.
Carbon	3.20-3.25	3.20-3.25	3.15-3.20	3.15-3.20
Manganese	0.65-0.70	0.65-0.70	0.70-0.75	0.70-0.75
Phosphorus	0.65-0.75	0.50-0.60	0.40-0.45	0.25-0.35
Sulphur	0.08-0.10	0.08-0.10	0.09-0.11	0.09-0.11

TABLE II.—*Composition and Properties of Special-pnrpose Irons.*

Special alloys.	T.C.	Si.	P.	Mn.	S.	
Acid-resisting average good ..	1.00	15.00	0.08	2.20	0.08	Tensile 5.5–7.0 tons per sq. in.
" " " "	0.75	18.00	0.08	2.75	0.08	Spec. grav. 6.5–7.0.
Acid for tanks, pans, pots, autoclaves, etc.	1.50	11.00	0.08	1.25	0.07	Melting point 1,370 deg. C.–1,400 deg. C.
Acid not suitable for high internal pressure unless supported by jackets ..	2.75	5.00	0.08	0.60	0.06	
	3·00	4·50	0·08	0.50	0.05	Compression 65,000–70,000 sq. in.

Special alloys.	T.C.	Si.	P.	Mn.	S.	Ni.	Cu.	Cr.	Mo.
Balls for milling and grinding ..	3.00	0.65	0.10	1.50	0.08	0.75	0.75	0.50	0.5
Crusher jaws ..	2.50	0.90	0.10	1.00	0.11	2.00	0.50	0.75	0.2
Cams—very heavy ..	3.00	1.00	0.10	0.60	0.11	0.50	—	0.75	0.3
Chilled rolls—Small (High strength)	2.70	0.90	0.10	0.60	0.08	0.50	—	0.75	0.3
" " Medium (Hot rolling)	2.50	0.85	0.10	0.60	0.08	0.50	—	1.00	0.3
" " Large (Heavy duty)	2.30	0.75	0.08	0.50	0.08	0.50	—	1.00	0.4
" " Heavy (High finish)	2.00	0.65	0.06	0.40	0.08	1.05	—	—	—
Caustic pots—2 in. to 3 in. section ..	3.25	1.00	0.15	0.70	0.06	1.00	0.50	0.55	0.3
Dies—all types—heavy ..	3.15	1.25	0.15	0.70	0.09	1.00	—	0.25	0.2
Diesel cylinders—heavy ..	3.00	0.85	0.15	0.90	0.10	1.00	—	0.50	0.3
Diesel cylinder heads—heavy ..	3.00	0.85	0.15	0.90	0.10	0.80	0.25	0.60	0.5
Heat-resisting—Light ..	3.00	1.20	0.15	0.90	0.10	1.00	0.20	0.80	0.6
" " Medium and heavy ..	3.00	1.00	0.15	0.90	0.10	1.00	—	0.7	0.8
Non-growth iron ..	2.60	1.60	0.10	1.00	0.05	18.00	—	2.0–5.0	—
*Nicrosilal—heat resistance ..	1.70	4.50	0.08	0.80	0.08	3.00	—	0.75	—
*Ni-Hard—hardness and toughness in white iron ..	3.00	0.70	0.08	0.80	0.08	14.00	7.00	2.00	—
*Ni-Resist—resistance, Heat and corrosion ..	3.00	1.50	0.08	1.00	0.08	1.50	—	—	—
*Ni-Tensyl—high strength (inoculated) ..	2.90	1.30	0.08	0.90	0.08	11.00	—	—	—
*Nomag—non-magnetic ..	3.00	1.50	0.08	7.00	0.08		—	—	—

* Patented processes.

TABLE III.—*Recommended Compositions of Cast Irons for Specific Purposes Related to Figs. 2, 3 and 4 for Sectional Thickness and Silicon Content.*

—	Section, in.	Fig.	Composition.	Code.
Machinery Castings.				
Heavy machinery ..	—	2	IV	O
Rubber machinery ..	—	2	IV	L
Agricultural machinery ..	—	2	IV	K
Woodworking machinery ..	—	2	III	K
Flour-milling machinery ..	—	2	III	K
Paper-milling machinery ..	—	2	III	L
Sugar machinery ..	—	2	III	L
Laundry machinery ..	—	2	IV	M
Printing machinery ..	—	2	IV	M
Textile machinery ..	—	2	IV	K
Dyeing machinery ..	—	2	IV	K
Cement mill machinery ..	—	2	IV	M
Tables, cylinders, rolls and guides for above ..	½–¾	2	IV	K
	⅞–1¼	3	V	P1
	1⅜–1⅞	3	V	T1
	2–2½	3	VI	U1
	2⅝–3	3	VI	V1
Soft strong castings (*i.e.*, flats) for above ..	½–⅜	3	V	C1
Petrol Engines.				
Stationary—				
Cylinders and heads ..	—	3	VI	M1
Exhaust manifolds ..	—	3	VI	F1
General ..	—	2	III	F
Automobile—				
Cylinders and heads ..	—	4	IX	B2
Exhaust manifolds ..	—	4	IX	A2
Motor cycle—Cylinders and heads	—	3	V	D1
Valves, piston rings and similar for above ..	—	4	X	A2
General ..	—	2	IV	D
Gas and Oil Engines, Blowing Engines.				
Cylinders—Combined liner and breech	¾1¼	3	VI	P1
	1⅜2	3	VI	S1
Cylinders without combined liner	¾1¼	3	V	P1
	1⅜2	3	V	T1
Combustion chamber heads ..	11¼	3	VIII	Q1
	1⅜2	3	VIII	S1
Liners ..	¾1	3	VI	O1
	1⅛1½	3	VI	Q1
	1⅝2	3	VI	T1
	2⅛3	3	VI	V1
Pistons and piston rings ..	¾1¼	3	VII	P1
	1⅜1¾	3	VII	S1
	1⅞2½	3	VII	U1
Bedplates—				
Small and medium ..	—	2	IV	K
Large ..	—	2	IV	M
General ..	—	2	IV	K

—	Section, in.	Fig.	Composition.	Code.
Marine and Land Steam Engines and Air Compressors—All Types.				
Cylinder with liner combined ..	¾1¼	3	VI	P1
	1⅜2	3	VI	S1
	2⅛–3	3	VI	U1
Cylinder without liner combined ..	¾–1¼	3	V	O1
	1⅜–2	3	V	R1
	2⅛–3	3	V	U1
Liners—all types ..	¾–1¼	3	VI	P1
	1⅜–2	3	VI	S1
	2⅛–3	3	VI	U1
Pistons and piston rings ..	¾–1¼	3	VII	P1
	1⅜–2	3	VII	R1
	2⅛–3	3	VII	U1
Cylinder heads, valves, slides ..	¾–1¼	3	VII	P1
	1⅜–2	3	VII	S1
	2⅛–3	3	VII	U1
Bedplates, columns, general—				
Medium ..	—	2	IV	L
Heavy ..	—	2	IV	N
Pumps—Vertical, Horizontal, Centrifugal.				
Bodies—				
Single acting ..	¾–1¼	3	VI	O1
	1⅜–2	3	VI	R1
Double and treble acting ..	¾–1¼	3	VI	P1
	1⅜–2	3	VI	S1
Liners and rams ..	¾–1¼	3	V	P1
	1⅜–2	3	V	S1
	2⅛–3	3	V	O1
Centrifugal—				
Body up to 12 in. ..	½–¾	2	IV	K
Body 13 in. to 24 in. ..	⅞–1⅛	2	IV	N
Body 25 in. to 84 in. ..	1¼–2	2	IV	P
Impellors up to 12 in. ..	½–¾	3	V	M1
Impellors 13 in. to 24 in. ..	⅞–1⅛	3	V	O1
Impellors 25 in. to 84 in. ..	1¼–2	3	V	Q
Bedplates and general—				
Medium ..	—	2	IV	L
Large ..	—	2	IV	N
Hydraulic Machinery.				
Cylinders and rams ..	¾–1¼	3	VI	P1
	1⅜–2	3	VII	S1
	2⅛–3½	3	VIII	V1
Heads, platons and general ..	¾–1¼	3	V	P1
	1⅜–3	3	V	S1
Power Hammers.				
Anvil blocks—				
Up to 1 ton ..	—	3	VI	P1
1 ton to 5 tons ..	—	3	VI	Q1
5 tons to 100 tons ..	—	3	VI	R1
Anvils and discs—				
Medium ..	—	3	VIII	R1
Large ..	—	3	VIII	T1
General—				
Small and medium ..	—	3	V	N1
Heavy ..	—	3	V	P1

TABLE III (*Continued.*) *Recommended Compositions of Cast Irons for Specific Purposes Related to Figs. 2, 3 and 4 for Sectional Thickness and Silicon Content.*

—	Section, in.	Fig.	Composition.	Code.
Machine Tools.				
Bedplates	½–⅝	2	IV	M
	¾–1¼	2	IV	O
	1⅜–2	2	IV	R
Slides, saddles and rests—				
Light	1	3	VI	Q1
Medium	—	3	VI	S1
Heavy	—	3	VI	T1
Boring bars, rams, faceplates, bearings	¾–1¼	3	V	O1
	1⅜–2	3	V	S1
	2⅛–3	3	V	U
Spindles, collars, couplings ..	1–1⅜	3	VI	Q1
	1½–2	3	VI	S1
	2⅛–3½	3	VI	V1
General	—	2	IV	M
Electrical Machinery.				
Turbine casings—rotors	1–1¼	3	VI	Q1
	1⅜–2	3	VI	S1
	2⅛–3	3	VI	U1
Turbine diaphragms	—	3	V	P1
Generator bodies, dynamo frames	—	3	V	P1
Condenser bodies	1 –1⅜	3	V	P1
	1½–2	3	V	S1
Soft light strong castings for above	—	4	X	Aa
General	—	2	IV	M
Blowers and Exhausters.				
Impellors and revolvers	½–1	3	IV	K1
	1⅛–2	3	IV	Q1
Cylinders, endplates, outlets ..	¾–1¼	2	IV	M
	1⅜–2	2	IV	R
Bedplates and general	—	2	IV	M
Steel Works Plant.				
Rolling mill bedplate—				
Heavy	—	2	IV	M
Medium	—	2	IV	N
Rolling mill housing—				
Heavy	—	3	VIII	Q1
Medium	—	3	VIII	P1
Rolling mill stay frames	—	3	VIII	Q1
Forging press cylinders	4–5	3	VIII	W1
	2¾–3¾	3	VIII	V1
	2–2½	3	VIII	U1
	1¼–1¾	3	VIII	S1
Forging press covers	2¾–3¾	3	VIII	U1
	1¾–2½	3	VIII	S1
Forging press piston body.. ..	3–4	3	VIII	U1
	2–2¾	3	VIII	T1
Slag ladles—				
Heavy	—	4	XII	B2
Medium	—	4	XII	A2
Furnace frames and doors.. ..	—	4	XII	A2
General.				
Acid-resisting components ..	⅝–1	4	X	H2
	1⅛–2	4	X	J2
Annealing pans, aluminium and lead melting pots	¾–1	3	VIII	N1
	1⅛–2	3	VIII	R1
Brake drums	—	3	VII	N1
Brake shoes	—	3	VII	Q1
Brake blocks	—	3	VII	S1
Caustic pots	1¼–2	3	VIII	R1
	2⅛–3½	3	VIII	U1
Crusher, heads, bodies	—	3	VIII	S1
Crusher jaws	—	3	VIII	V1
Chutes for all minerals	—	3	VIII	T1
Dies for all purposes	1¼–2	3	VIII	T1
	2⅛–6	3	VIII	V1
Drums for winding engines ..	1–1¼	3	VI	R1
	1⅜–2½	3	VI	T1
Flywheels for all purposes—				
Small	—	3	VI	P1
Medium	—	3	VI	Q1
Large	—	3	VI	R1
Furnace components	—	3	VII	Q1
Gas plant	—	3	V	P1
Gears	1–1½	3	V	P1
	1⅝–2	3	VI	S1
	2⅛–6	3	VI	V1
Glass moulds and plungers ..	—	3	VIII	M1
Grinding balls	—	3	VIII	V1
Heating resisting components ..	1–1½	3	VI	Q1
	1⅝–2	3	VI	S1
Hardware	—	2	I	D
Lamp posts, grids, manholes ..	—	2	II	N
Pipes and fittings	⅜–1¼	2	II	J
	1⅜–2	2	II	P
	2⅛–3	2	II	V
Pulleys	⅜–1	3	V	P1
	1⅛–2	3	V	R1
Pulleys—Rope	2⅛–3	3	VI	V1
	3–6	3	VI	V1
Propellors—Marine—				
Small	—	3	VIII	P1
Medium	—	3	VIII	R1
Large	—	3	VIII	S1
Permanent moulds	—	3	VIII	P1
Piano frames—ornamental ..	—	2	III	F
Radiators, rainwater goods ..	—	2	I	B
Railway chairs, axle boxes ..	—	3	VII	N1
Stove grate, baths and similar ..	—	2	III	E
Slag ladles, slag pots—				
Small	—	3	VIII	O1
Large	—	3	VIII	P1
Sullage pump components ..	—	4	XII	K2
Tyre moulds	—	3	VIII	S1
Valves—all classes—				
Light	½1	3	VIII	N1
Medium	1⅛1½	3	VIII	R1
Medium heavy	1⅝2	3	VIII	T1
Heavy	2⅛3	3	VIII	V1
Wheel spiders	—	3	VI	P1
Wheels for mine cars	—	3	VII	P1

—	Fig.	Composition.	Code.
Special General.			
Chilled rolls for cement milling	3	VIII	V1
Chilled rolls—			
Flour milling and laundry	3	VIII	V1
Paper, printing, rubber	3	VIII	V1
Light, cold steel rolling	4	XI	K2
Medium, cold steel rolling	4	XI	L2
Heavy, cold steel rolling	4	XI	M2
Light, hot steel rolling	4	XII	K2
Medium, hot steel rolling	4	XII	L2
Heavy, hot steel rolling	4	XII	M2
Chilled wheels—			
Light	3	VIII	T1
Medium	3	VIII	U1
Heavy	3	VIII	V1
Chilled cams—			
Light	3	VIII	R1
Medium	3	VIII	S1
Heavy	3	VIII	T1
Chilled plough points and shares	3	VII	S1
Chilled stronger plough points and shares ..	4	X	K2
Chilled roll moulds—			
Light } Carbon	4	XIII	A2
Medium } Lower	4	XIII	C2
Heavy } Limit	4	XIII	E2
Ingot moulds—..			
Small	4	XIII	Aa
Medium	4	XIII	B2
Heavy	4	XIII	E2

cases, both strength and machinability are needed. The curves indicating the graphitising anneal may be employed to ensure various degrees of graphitisation to suit the class of casting. The critical transformation range, approximately 700 to 800 deg. C., is very important in the graphitisation process. A temperature of 765 deg. C. may be employed to give only a partial graphitisation, the elevation of the temperature to 840 deg. C. will produce a greater degree of graphitisation and 950 deg. C. the maximum. The time cycle, especially through the critical-temperature zone, is very important, and should not be hastened if maximum graphitisation be desired. It will be noted that the graphitising anneal may cover a complete cycle extending over 40 hrs.

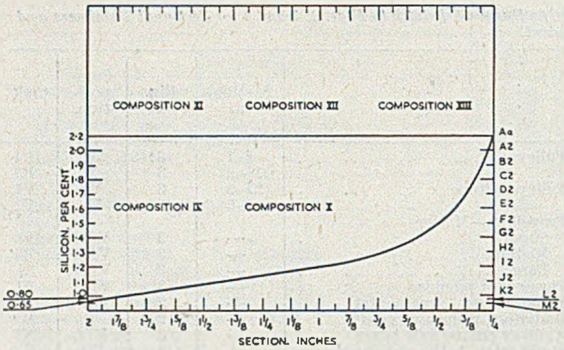


FIG. 4.—*Silicon Contents for Cast-iron Alloys related to Sectional Thickness. Code Letters refer to the End Uses listed in Table III; Basic Compositions are shown below:—*

Basic Composition (percent.)	IX.	X.	XI.	XII.	XIII.
Carbon ..	3.10-3.20	3.10-3.20	3.00-3.10	3.00-3.10	3.50-3.70
Manganese	0.70-0.75	0.70-0.75	1.15-1.25	0.70-0.75	0.70-0.75
Phosphorus	0.45-0.55	0.25-0.40	0.10-0.15	0.10-0.15	0.05-0.10
Sulphur	0.09-0.11	0.09-0.11	0.09-0.10	0.09-0.10	0.07-0.09
Nickel ..	0.90-1.0	0.90-1.0	—	1.0-1.10	—
Copper ..	1.15-1.20	1.15-1.20	—	—	—
Chromium	—	—	—	0.75-0.80	—

Malleable Iron

The curves drawn for malleable iron show the comparative time and temperature conditions needed for the blackheart and whiteheart processes. It will be noted that for whiteheart, a peak temperature of 980 deg. C. is often reached and maintained for about ten hours, with a fall to 950 deg. C. for the remainder of the high-temperature heat-zone section. A similar procedure is indicated for the blackheart process, which ranges at lower temperatures for effective annealing. This fall from the short period at the peak temperature to the lower temperature takes advantage of the knowledge that the precipitation of carbon to the free state, once initiated, will continue at temperatures below those which either will not initiate separation of graphite, or will repel it. A complete heat cycle for the average-section blackheart malleable iron casting may extend to the 130 hrs. and for whiteheart up to 300 hrs. The different time and temperature heat cycles referred to for whiteheart and blackheart are due to the different qualities required. The whiteheart process involves the elimination of most of the carbon from the metal by oxidation and migration of the carbon as a gas, and some degree of nodular graphitisation. The blackheart process involves the precipitation and retention of the bulk of the carbon as nodular graphite, with some small amount of oxidation on the skin of the casting.

The curves for steel anneal are included for comparison. It will be noted that a range between 540 and 650 deg. C. is adequate to allow for stress annealing, but that for normal annealing, requirements needed to refine the crystal structure for a 0.4 per cent. carbon steel lies in the region between 835 to 885 deg. C. after a preliminary rise to a peak of 930 deg. C. for two hours or so. The rise and fall in the heat-treatment cycle will be noted.

The rate of the rise and fall in the temperatures required for the various metals referred to differ considerably, as well as the actual temperatures required to anneal the metal.

Comparison of Special-process Cast Irons

In this section of the Paper, reference is made to special cast irons which received attention many years ago, and which are still employed by certain founders in various parts of the world. Table I lists a number of special irons which the Author had experience of in the years, ranging from 1919 to 1930.

Lanz Hot-mould Iron

The practice of heating moulds to slow up the rate of cooling of high-duty metal of border-line composition with tendencies to produce white iron in thin sections has long been known. Such a metal is of improved quality, if the analysis is suitable, and is generally associated with a high percentage of pearlite structure. However, the systematic production of heated-mould iron was not fully developed until Diefenthaler, Germany, regulated the manufacture on a scientific basis, and was granted a patent in 1916, during the first world war. The cast iron so produced is known by the name of Lanz iron.

The iron intended for pearlitising should be of such a composition that when poured into a cold mould, or one of ambient temperature, the casting section will have a structure of either white or white-to-mottled facture; but, on being poured into a heated mould at a predetermined temperature, according to the thinnest section of the casting, a grey and machinable structure results, with high physical and mechanical properties. The sum of the carbon and silicon may vary in addition to the temperature of the mould, according to section thickness. The range of compositions are shown in Table I.

Mould temperatures vary from about 50 to 500 deg. C. at the time of pouring. The tensile strength and Brinell values will be seen to be very satisfactory. Transverse and yield strength were well above the strongest cylinder irons made in those days by the ordinary methods, but the most outstanding property lies in the resistance to impact. During the years 1916 to 1930 there were few impact testing machines used. With a certain measured section of given softness and quality of hammer blow, heated-mould iron withstood from 220 to 300 blows before fracture, compared with 10 to 12 for a cylinder iron. Such a metal found a use for gas and oil-

TABLE IV.—*Suggested Rotation of Charges for Cupola Melting.*

Quality.	T.C.	Si.	P.	Mn.	S.
No. 0 ..	3.25	1.50	0.50	1.00	0.12
No. 1 ..	3.10	1.00	0.30	0.80	0.12
No. 2 ..	3.15	1.25	0.50	0.70	0.11
No. 3 ..	3.20	1.50	0.70	0.70	0.11
No. 4 ..	3.25	1.75	0.80	0.70	0.10
No. 5 ..	3.25	2.00	0.90	0.70	0.10
No. 6 ..	3.30	2.50	1.00	0.60	0.08

engine combustion chambers and castings requiring high strength with the maximum resistance to impact stress and cracking at elevated temperatures.

Emmel Iron

Herr Emmel of Germany is credited with a special process for producing a low-carbon, high-silicon pearlitic iron (see Table I). This iron is known as Emmel iron.

The metal possesses the higher quantities of silicon and carbon when poured into thin-section castings and the lower silicon and carbon contents fall into line with increasing section. The metal is melted in the cupola from a very high steel mixture, with the addition of ferro-alloys to adjust the silicon and manganese to the required level. Very high melting temperatures and low carbon pick-up were attained, for which high-quality, dense coke doped with a lime film is stated to be responsible.

Moulds were prepared by ordinary means, but made with a sand to withstand the very high temperatures at which the metal was poured—up to 1,470 deg. C. The metal examined by the Author showed no unusual shrinkage tendencies. It had a structure, in both thin and thick sections, showing massive pearlitic areas. (See Table I for properties.) The physical properties of malleable iron can be obtained by subjecting Emmel metal, of a composition which would freeze as a white iron, to a short anneal of twenty hours, at a temperature of 870 to 890 deg. C.

Schuz Iron

Schuz in Germany developed a high-silicon and high-carbon cast iron. This metal was entirely devoid of pearlite and consisted of a ferritic-graphitic structure. The structure was dependent upon the influence of chill moulds and was therefore restricted to simple forms of castings. The chilling of the high-silicon high-carbon iron brings about a very fine graphite variety of the free carbon. The chilling of the casting creates a hard skin on the casting, containing cementite, which is

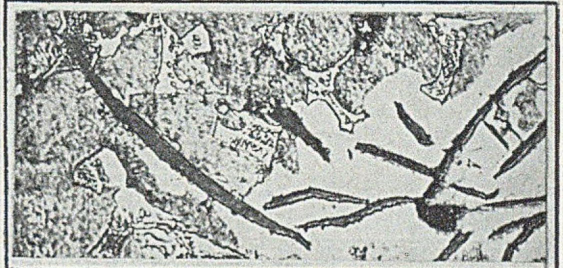


FIG. 5.—*Common Iron. Fairly Coarse Graphite associated with Ferrite, Pearlite, and Phosphide Eutectic.* × 200. *Etched in Picric Acid.*

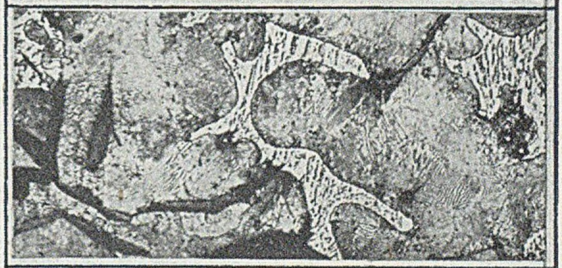


FIG. 6.—*Pearlitic Phosphoric Grey Iron.* × 200. *Etched in Picric Acid.*

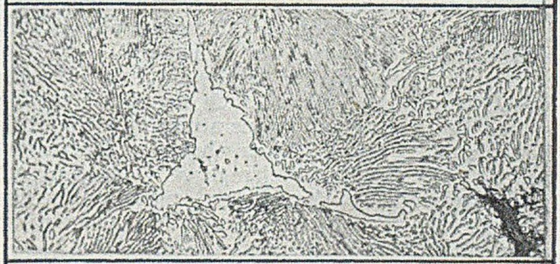


FIG. 7.—*Nature of the Pearlite Matrix in a Grey Cast Iron; Graphite and Phosphide Eutectic.* × 200. *Etched in Picric Acid.*

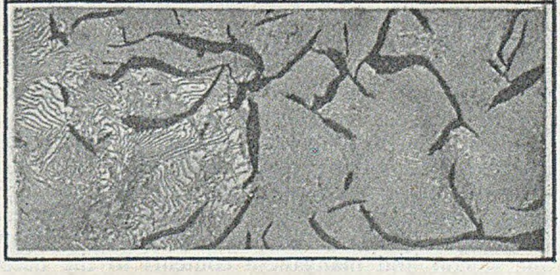


FIG. 8.—*Good-quality Hematite Iron. Medium-size Graphite in a Matrix of Pearlite.* × 200. *Etched in Picric Acid.*

FIG. 9.—*Diesel Cylinder Metal.* × 200. *Etched in Picric Acid; Medium-size Graphite in Pearlite with Phosphide Eutectic.*

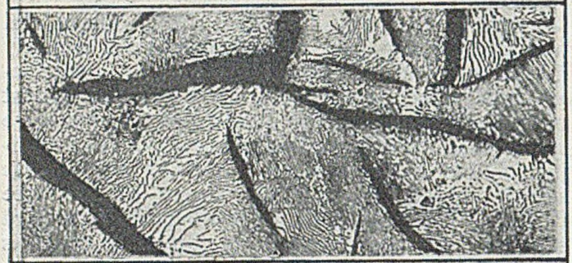


FIG. 10.—*Ingot-mould Material; Coarse Graphite in a Matrix of Coarsely Laminated Pearlite with a Small Amount of Ferrite. Etched in Picric Acid.* × 200.

FIG. 11.—*Low-carbon Grey Iron. Fairly fine, Extra-dendritically arranged Graphite in a Matrix of Pearlite.* × 200. *Etched in Picric Acid, T.C 2.5 and Si 2.5 per cent.*

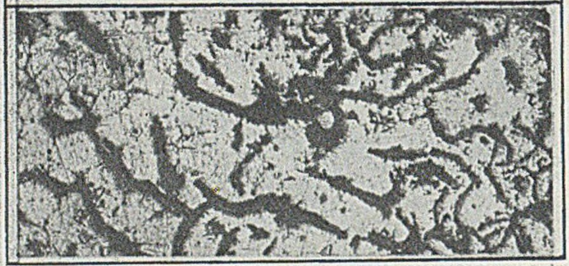


FIG. 12.—*Burnt Firebar Metal.* × 200.

easily softened by about one hour's anneal at a temperature of 850 deg. C. (Note the physical and mechanical properties given in Table I.)

The stability of the ferrite-graphite structure would suggest the use of such metal for castings subjected to elevated temperatures, and repeated heating and cooling. Since the iron contains no pearlite, no permanent change in volume of any great consequence should take place on passing through the critical transformation temperature zone.

Low-carbon Cast Iron

Corsalli is credited with the development of a very low-carbon-cupola, melted cast iron, see Table I. The process consists of coating the melting coke with a lime-cement compound to retard combustion until the melting zone is reached. On reaching the melting zone, the amount and distribution of the air is of such a character to produce rapid combustion and melting of upwards of 90 per cent. of steel scrap charge and ferro-alloys to bring up the silicon and manganese contents to the necessary level. Arrangements are made for the melted metal to fall rapidly away from the coke charge to a receiver or ladle. It was also claimed that temperatures of 1,500 deg. C. were obtained.

The Author examined test-bars yielding up to thirty tons tensile and was assured that up to sixty tons tensile had been obtained after a short anneal. The difficulties surrounding melting such metal in the cupola would suggest resort to melting in other types of furnaces. However, the true melting procedure adopted by Corsalli was never fully disclosed.

Dechnesne Iron

Dechnesne of Germany contrived to secure an improved metal of quite average composition by subjecting molten metal to shaking and jolting in a special forehearth to the cupola. The mechanical agitation of the metal influenced the elimination of dissolved and entrapped gases and also the formation and distribution of the graphite and the matrix. Test-bars examined confirmed the physical and mechanical properties stated in Table I. This process is still practised.

Meehanite Processed Iron

Meehanite metal is made by a patented process by which an excellent range of high-duty and pearlitic cast irons is produced. The molten metal of suitable composition is subjected to inoculation at the furnace spout. A number of grades of metal are produced according to the degree of strengths and properties desired. The same bath of metal can be manipulated to yield several grades of iron. Strengths of twenty to thirty tons tensile are obtained from cupola metal, and up to forty tons on metal melted in other types of furnaces which may be heat-treated, and respond to quenching in water or oil to produce improved strengths and Brinell hardness up to 300 points. Whilst the commercial grades are produced from the simple inoculation of cast iron containing the ordinary elements, alloy additions may include copper, nickel, chromium, and molybdenum. The action of the graphitiser introduced to the molten metal breaks down the very hard cementite into a refined pearlite and a fine nodular graphite formation. The variety of compositions covers a very wide range, as will be noted on examining Table I.

Ni-Tensyl Iron

A British patent in the name of the Mond Nickel Company describes the production of a highly pearlitic cast iron, namely, "Ni-Tensyl," by inoculating a bath of molten cast iron of a suitable composition with nickel and silicon. Again, as with most high-duty irons, the charge mixture contains large percentages of steel and ferro-alloys. The final stage consists of the addition of between 0.5 and 2.2 per cent. nickel as "F" shot to the metal as it issues from the furnace. It may be necessary to make also an addition of silicon at the same time as the "F" shot. Excellent properties are obtained from the metal as outlined in Table I. With suitable compositions, upwards of 30 tons per sq. in. tensile may be obtained after heat-treatment, with a Brinell hardness up to 450 points.

FIG. 13.—*Nicrosilal; Supercooled Graphite and Chromium Carbide in a Matrix of Austenite.* × 200. *Etched in Boiling* 10 *per cent. HCl in Alcohol.*

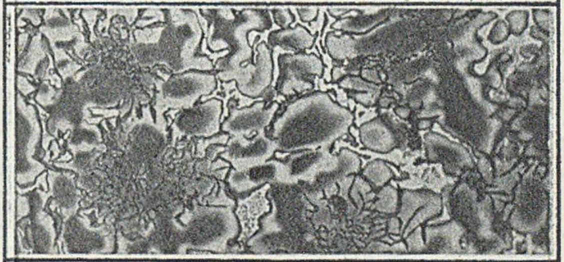


FIG. 14.—*Ni-Resist; Cluster Graphite and Carbide in Austenite.* × 200. *Etched in Picric Acid.*

FIG. 15.—*Ni-Hard.* × 200. *Etched in Picric Acid.*

FIG. 16.—*Ni-Tensyl Iron. Extra-dendritically arranged Graphite in a Matrix of Fine Pearlite.* × 200. *Etched in Picric Acid.*

FIG. 17.—*Iron without the B.C.I.R.A. Titanium-and-CO_2 Treatment.* × 200. *Etched in Picric Acid.*

FIG. 18.—*Iron after Treatment by the B.C.I.R.A. Titanium-and-CO_2 Process.* × 200. *Etched in Picric Acid.*

FIG. 19.—30 *per cent. Chromium Iron.* × 200. *Etched in Ammonium-persulphate Solution.*

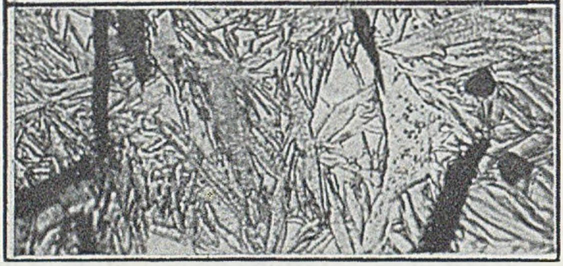


FIG. 20.—*Martensitic Grey Iron.* × 1,000. *Etched in Picric Acid.*

Range of Metal Quality Available

It is probable that percentage of industrial requirements for the various casting group qualities will approximate as follows:—

(*a*) General quality, 35 per cent.
(*b*) Medium quality, 30 per cent.
(*c*) Cylinder quality, 12 per cent.
(*d*) Hematite quality, 10 per cent.
(*e*) High-duty quality, 6½ per cent.
(*f*) High-duty quality, alloyed, 5 per cent.
(*g*) Special qualities, 1 per cent.
(*h*) Special qualities alloyed, ½ per cent.

It is too early to place the nodular irons in the range of groups of cast-iron qualities usually employed in industry. Within these groups, the writer has collected the analyses suitable to the class of casting compositions which are tabulated in the respective captions to Figs. 2, 3 and 4 and Tables II and III. Each casting is identified under a code letter and number, which, in conjunction with Figs. 2, 3 and 4, can be used to arrive easily at a desirable composition for any particular end use. Nodular irons are not included for obvious reasons.

It is not by any means sufficient to consider the chemical analysis. When comparing properties of cast iron, it is necessary to compare the structural components of the matrix, as well as the form and distribution of the graphite.

Photomicrographs

The micros, shown in Figs. 5 to 20, give a fair representative cross-section of the structure of the cast irons (including malleable iron), in use to-day and referred to in the course of the Paper. (A further selection of photomicrographs, Figs. 21 to 45, will be printed with the second portion of the Paper.) The original photomicrographs for Figs. 5 to 30 were provided by the British Cast Iron Research Association.

[*The second section of this Paper, dealing mainly with cupola practice, will be printed shortly.*—EDITOR.]

Work of the British Non-Ferrous Metals Research Association

The 31st Annual Report of the British Non-Ferrous Metals Research Association discloses an increasing activity in work of direct interest to brass, bronze and light-alloy founders. Ultimately the more interesting phases of this work are made available for the foundry public through Papers given to its premier technical institute. Anything that can be done to shorten this period would be appreciated. It would certainly increase interest in the more recent work being undertaken and it is hoped lead to greater support from the foundry industry. Below are excerpts from the very interesting Annual Reoort of the Association:—

Melting and Casting of Brass

Brasses are melted on a large scale in low-frequency Ajax-Wyatt furnaces and very long lining lives are usually obtained. When copper or high-copper alloys are melted in these furnaces the lining life is comparatively short and co-operative work is in progress in members' works with a view to developing improved linings for melting these latter materials. One member of the Association had already made considerable progress to this end and the first step in the co-operative work comprises a series of trials using linings rammed and fired according to the recommendations of this member. The trials are designed to see whether these recommendations cover all the factors involved and, if not, to identify other variables affecting the life of the lining. Concurrently some experimental work is in progress in the laboratory to examine the permeability and the resistance to thermal shock and slagging of refractories other than the alumino-silicate type at present used to line these furnaces. This work is designed to facilitate the selection of refractories for further works trials.

Grain Refinement and Deoxidation

The Association's recent study of the grain refinement of cast aluminium-base alloys has revealed the mechanism of the grain refining process and in the period under review a research has been started to see whether the findings of the light alloy studies can be applied to copper-base alloys. The work on light alloys indicated that fine-grain castings are obtained if particles of compounds structurally similar to the alpha phase aluminium-rich solid solution are dispersed through the melt immediately before it reaches the liquidus temperature. When this condition obtains and when the growth of the alpha phase crystals is hindered by composition gradients in the liquid surrounding them, crystallisation occurs at a large number of centres and a fine-grain casting results. A study of the structure and other properties of possible compounds for nucleating the crystallisation of copper suggests that a number of materials might be useful. Attempts are being made to introduce these substances into molten copper-base alloys and it has been possible to show that fine-grain castings are produced by suitable additions. However, it is more difficult to produce a stable dispersion of suitable particles in the copper-base alloys than in the light alloys, and it is not yet possible to say whether a practical process of grain refining copper-base alloys can be developed along these lines.

Earlier work has defined the equilibrium between oxygen and phosphorus in molten copper and has provided an adequate explanation of the deoxidation of copper by phosphorus additions. In the period under review an attempt has been made to determine the solubility of oxygen in solid copper containing phosphorus, but the interpretation of the experimental data is uncertain. However, it is clear that the solubility of oxygen in this copper is extremely small and the Research Committee has decided that further work on this subject is not justified.

One of the objects of this research was to throw light on the brittleness encountered in the past from time to time when fabricating phosphorus "deoxidised" coppers of low-phosphorus content. This difficulty has not recurred in practice during the past few years and samples of brittle material have not been available for examination. However, in the period under review it has been shown that such coppers may be embrittled severely by annealing treatments which have little or no embrittling effect on tough-pitch copper or on phosphorus-deoxidised coppers with the high-phosphorus contents typical of normal practice. A little further work is in progress to confirm present ideas on the mechanism of the embrittlement and the research will probably be brought to an end if these further results provide a satisfactory explanation of the embrittlement.

Properties of Copper Slags

A thermodynamic analysis of the reaction between copper or copper mattes and ferrous-silicate slags has been made in order to define suitable experimental conditions for studying the solubility of copper and copper sulphide in the molten slags.

Apparatus has been constructed for these experiments and it is hoped that the experimental data will facilitate a theoretical appraisal of the solubilities in the more complex slags formed in smelting in reverbatory furnaces. With such an appraisal the conditions for the experimental measurement of copper solubilities in slags of practical interest should be predictable within certain limits and to that extent the experimental study of the solubility of copper in complex slags of widely varying composition should be facilitated.

Casting Light Alloys

The research on the grain refinement of cast light alloys has been terminated with the completion of further work on grain refinement by additions of titanium and boron. These additions produce titanium boride particles which function as nuclei for the crystallisation of the aluminium-rich primary crystals. While this method of grain refinement may be attended by segregation difficulties, the work has shown that alloys grain-refined in this way are relatively insensitive to the adverse effects of overheating.

A limited amount of further work has been done on the reaction between aluminium/magnesium alloys and water vapour before and during solidification. Earlier work had shown that the gas absorption resulting from this reaction can be inhibited in castings of certain section thicknesses by adding beryllium to the molten alloy and adding boric acid to the sand mould. The present work has shown that very much smaller beryllium additions than have previously been used suffice equally well for this purpose. This finding is of practical

British Non-Ferrous Metals Research Association

importance because the alloying element is expensive and members are trying these smaller additions of beryllium in practice. A considerable programme of further work is contemplated to study the influence of variations in the composition of the metal and of the surrounding atmosphere on the rate at which gas is absorbed by these alloys, in the hope that such information will lead to further improvement in the methods of inhibiting mould reactions in casting alloys of this type.

Impurities in Aluminium

A critical review of information on the effects of impurities and minor constituents on the corrosion of aluminium and its alloys has been completed. The review will be extended to summarise existing information on the effects of minor constituents on other properties of aluminium and its alloys, including mechanical properties and response to heat-treatment.

Vitreous Enamelling of Aluminium

Little further work has been done on the testing of vitreous enamels for aluminium and its alloys, but some of the enamels previously tested, including one leadless enamel, are promising.

Thermal Gradients in Casting

Little work has been done on thermal gradients in castings in the past year because the Research Board diverted the available effort to a survey of present practice in the copper-base founding industry. The purpose of the survey was to see how far existing knowledge was being applied and what further steps were required to ensure that this knowledge is used to the best effect. The results of the survey have been considered by the Board, who have authorised some *ad hoc* work in the Association's laboratory designed to facilitate the more widespread practical application of existing knowledge in the copper founding industry.

Spectrographic Analysis

A panel of the Research Committee supervising the Association's spectrographic work is continuing to study the analysis of dilute lead alloys by this method and another is exploring the possibilities of rapid analysis of copper-base alloys for major alloying elements.

Direct recording equipment employing two photocells has been built which is admirably suited for exploratory work on analytical methods. With the photographic recording technique, the selection of the most useful spectrum lines is tedious, but with direct reading equipment the selection can be made quickly. In this respect the apparatus is a valuable complement to the conventional photographic recording apparatus. The apparatus is also suitable for studies of the characteristics of the electrical discharges from source units, and work is in hand to identify and eliminate sources of error in the source unit itself. Preliminary tests show that the location of the electrodes is more critical than was previously supposed and that errors due to this cause must be eliminated before studying errors arising from the nature of the discharge.

The Association hopes to obtain shortly an American Production Control Quantometer through the agency of the D.S.I.R., with a view to determining the possibilities and limitations of direct-reading equipment of this type for routine control analysis. The equipment ordered is designed to deal with the routine analysis of copper-base alloys and additional equipment has been obtained which can be adapted to the analysis of other non-ferrous metals. It is hoped that the Association's experience with equipment of this type will provide members with the information necessary to decide whether such equipment is an economic proposition for their individual routine control purposes.

New Catalogues

Metal Holding Furnaces. From Sklenar Furnaces. Limited, Colchester Estate, Colchester Avenue, Cardiff, we have received a four-page leaflet illustrating the "Reverbale Junior" melting and holding furnace for die-casting foundries. The reviewer quite recently visited a large die casting foundry, which must have had over fifty open-topped bale-out holding furnaces, and the temperature of the shop was fairly high. Now this new furnace only exposes sufficient metal surface for the easy insertion of the ladle. If the furnace casing is well insulated, as in most modern melting plant, then there should be a real amelioration in working conditions. This matter has had the attention of designers in other directions, for a tool locker has been incorporated, whilst correct working height has also been considered. The plant is oil- or gas-fired and is stated to use less than a gallon of oil per hour or 1.8 therms of gas. This leaflet is available to our readers on writing to Cardiff.

Precision Castings. A 12-page booklet received from Firth-Vickers Stainless Steels, Limited, Staybright Works, Sheffield, 9, is probably the first ever issued dealing commercially with the production of "lost-wax" castings. The dimensional tolerance is given as "0.005 in. per in. of length, width, diameter or thickness." The text describes in simple terms the process used. Five pictures illustrate this, but unfortunately they are devoid of captions. Moreover, the scattering of the text gives the wrong impression that the isolated bits refer to the pictures. The illustrations of the actual castings are excellent, but even they might have included a wider range so as to include, for example, surgical instruments. The general presentation of the catalogue is excellent.

Hydraulic Jacks. Tangyes, Limited, Cornwall Works, Smethwick, Birmingham, for their Publication No. 692, have chosen an unusual shade of green which is very attractive. The catalogue discloses by letterpress and illustration the wide variety that it is necessary to make properly to service the various consuming industries. Obviously a standardised series has been developed, which forms the bulk of the output—but in other cases the pump is remote from the lifting head. At the same time a catalogue No. 695 covering horizontal Diesel engines was also received.

First Aid Requisites. Cuxson, Gerrard & Company, Limited, of Oldbury, Birmingham, have sent us a very useful catalogue covering everything necessary for the first-aid room or ambulance box. The first-aid outfits have been particularly well thought out and the make-up is varied for each industry, but there seems to be no special one for foundries. This catalogue, together with the accompanying price list, should be included in every library of business publications. It is available to our readers on writing to Oldbury.

Welding Equipment. From the British Oxygen Company, Limited, of Bridgewater House, Cleveland Row, St. James's, London, S.W.1, we have received a 12-page catalogue which illustrates and describes their "Argonarc" welding equipment. This equipment is of special interest to non-ferrous welders and stainless-steel manufacturers, as no flux is used.

Institute of British Foundrymen

Birmingham and West Midlands Students Discuss the Grey Ironfounders' Productivity Report

A Paper presented by Dr. H. T. Angus and Mr. W. B. Parkes to the Birmingham and West Midlands students' section of the Institute of British Foundrymen recently outlined the findings of the Grey Ironfounders' Productivity Team's Report and compared some of these with present methods of production in British foundries. The meeting was then opened for discussion.

MR. A. W. MATTHEWS asked if the high output per used floor space in the U.S.A. was due to double-shift working, as compared with the more normal single-shift working in Great Britain.

MR. W. B. PARKES said that none of the foundries visited was working double shifts. The high output for a given floor space was due partly to more mechanisation and partly to greater output per man, even where foundries were not mechanised.

MR. W. T. WAKEMAN asked in what way did the use of wood flour replace the use of coal dust, and was there any difference in cost.

MR. PARKES replied that wood flour was not used in order to save coal dust, although there was a saving of about 3 per cent. coal dust for each 1 per cent. wood flour used. Frequently both coal dust and wood flour were used together. An attempt to use wood flour in place of coal dust might lead to serious difficulties in the foundry using, say, 10 per cent. coal dust.

MR. J. MARSHALL, referring to Mr. Parkes' original remarks as to foundries being more selective in their work, asked what happened in the case of demand for a prototype casting.

DR. ANGUS replied that a foundry would accept a prototype if a large enough order was in prospect, because the experience would then be useful to them.

Maintenance

MR. J. MARSHALL asked if Dr. Angus thought American foundry maintenance was better than ours and, if so, was a larger labour force employed for this purpose. What was the relative position in respect to surface finish and dimensional accuracy, and was also machine-shop rejection lower.

DR. ANGUS said it was his opinion that the quantity and quality of maintenance men were better than in this country. Their mechanical and maintenance department averaged 3 to 6 per cent. of their total personnel, which was considerably higher than in this country. In their castings, surface finish and accuracy was variable. There were occasionally flashes of $\frac{1}{8}$-, $\frac{1}{4}$- and $\frac{3}{8}$-in. in heavy castings in some foundries. However, it was later found that castings produced were in every way as good as ours. Whilst the castings were not always so good from the foundry as regards finish, much more attention was paid to the fettling, cleaning and finishing, 15 to 20 per cent. of their labour being engaged on this work. They seemed to feel that it was easier to fettle the casting rather than attempt to achieve 100 per cent. good surface in the foundry. In one fettling shop a notice stated, "They pour the metal—we make the castings." American scrap figures were definitely low. Rejects from the engineering and machine shops were probably substantially lower than the average in this country. If the returns were high, the company went out of business.

MR. A. J. SHORE commented that during a recent visit to America he had visited a large automobile foundry and that the following figures were of interest in relation to Mr. Marshall's questions. In this foundry the total labour force was 6,000, associated with 300 patternmakers and 200 men on maintenance. Their production was about 9,000 cylinder blocks and 60,000 pistons per day with a figure of only 1.2 per cent. wasters.

Cupola Charging

MR. H. BOYLE asked, with reference to Fig. 14 (swivel skip hoist) of the Report, where three men handled a considerable tonnage of charge materials by means of a gantry crane, how was the coke actually handled.

DR. ANGUS said one man was used in the gantry crane, one man was on the weighbridge and one man was watching the stockyard. It was not certain whether this third man shovelled the coke into the skip. It was observed in some instances that the coke suppliers put the coke into a skip at the coke ovens and that this same skip was used on the make-up platform for coke supply and was then returned to the coke ovens to be refilled.

MR. H. BOYLE asked how was the servicing of a Sandslinger system with cores carried out, what staff was employed for marshalling the cores and for bringing them to the assembly point?

MR. PARKES said that the actual number employed was not really important. What mattered was that the overall level of productivity was higher than in Britain and that unskilled labour was used to feed the skilled moulder with tools, equipment and cores.

MR. H. BOYLE said that in this country it is common practice to see two men laboriously hauling a 2-cwt. ladle of metal along a monorail. Was American practice similar in this respect?

MR. PARKES said that American monorail systems were easily handled, because of their light construction, and they never jammed.

MR. BOYLE asked if Mr. Parkes saw any methods of core-sand reclamation employed in America.

MR. PARKES replied that they saw no case of Americans trying to reclaim used core-sand for re-use in cores. In many mechanised plants the only make-up sand employed consisted of used core sand.

MR. J. MARSHALL asked if the team were able to make any comparisons between British and American foundrymen, *e.g.*, was the American worker more punctual, did he work at a regular pace, and

Students Discuss Productivity

had he any incentives which were not obvious in this country?

DR. ANGUS said that there were foundries in this country where the men worked as hard and as enthusiastically as in America and their productivity was relatively high. This was not entirely due to labour or mechanisation; in some cases it was a question of management.

Discussing the output of work per man with an American manager who had worked for 12 years in Britain, the conclusion reached was that there was no significant difference between the workers in the two countries, if the management, working conditions and equipment were similar.

The Team could not pin-point exactly why there was an overall difference in production between the American foundries and British foundries, but it was thought to be partly due to management and government, partly due to a much higher level of taxation in Britain, and partly to the system that has developed in America whereby the foundries have developed a world market for specialised products. The American worker did not always have the same pride in his job as the British worker, but he had a pride in the factory as a whole. The American offered less resistance to the introduction of mechanised methods which reduced the number of workers required on a particular job, but unemployment figures in the States were higher than in Britain. Many foundries worked on day rates and not piece work, but even so output was extremely high.

Working Conditions

MR. J. MARSHALL asked what was the difference between the status of the white and coloured American in the foundry.

DR. ANGUS said that white and coloured men work together on level terms, but there were only very few coloured men in supervisory jobs.

MR. F. DUNN (chairman) asked if the Team had formed the impression that in the States foundry working conditions were very much better than here?

DR. ANGUS replied that in the best American foundries conditions were good, but the worst were not better than the worst in Britain. He remarked that foundry conditions had nothing to do with output. An interesting point was that high output figures often occurred in foundries with very ordinary working conditions.

MR. W. T. WAKEMAN asked what was the equivalent in the States to our primary and final inspection? Did they have primary inspection before fettling? Were there any comments regarding their dimensional and surface errors?

DR. ANGUS said he did not remember seeing both inspections employed. Americans had very close final inspection, particularly of repetition work, and his impression was that primary inspection was generally left to the fettlers. American methods were such that they did not have many dimensional errors, but in one or two foundries producing very large castings the ultimate dimensions must have been inches out—some were shocking. Certain castings for special equipment bore thick flashes, but after many man-hours of fettling, a first-class job was produced. This, however, was not characteristic of the foundries visited. Americans did not make a casting any better than was necessary, their attitude being that surface finish was not important if the casting was not ultimately to be seen. Their motto was "Good enough is good enough and better is a waste of time."

MR. A. J. CROOK proposed a vote of thanks to the speakers. He said that it had certainly been a very interesting evening, and although only 24 foundries had been visited a great amount of material had been amassed. He commented that there was much to learn from American methods of manufacture.

MR. MATTHEWS seconded the vote of thanks to Dr. Angus and Mr. Parkes for giving a very instructive evening. The meeting also passed a vote of thanks to the Technical College and Mr. Garratt for the facilities provided to hold a meeting at Smethwick.

Publications Received

Heating, Cooking and Hot-water Supplies for the Small House. A report published by the Women's Advisory Council on Solid Fuel. 18, South Molton Street, London, W.1.

Those of our readers who make domestic heating and cooking apparatus would do well to acquire this report for herein are all the basic statistics they need for an appreciation of the actual potential market for their wares, and trends in design. One section touches, in recommendation No. 5, domestic water supply which reminds the reviewer of a suggestion he once made whilst in France, that a suitable body should campaign for the motion that all new cottages should be provided with a bathroom. The answer was that the proposition was untenable as there was insufficient water in the country to envisage such an action. Recommendation No. 16 asks makers to supply in a durable form (*e.g.*, a glazed card) some simple instructions for the operation of their apparatus for presentation to each user, whilst the last one, No. 23, asks for fixed fireguards. This happens to be a factor about which the council have very strong views. The report is marred a little by the use of too much Whitehall jargon—"targets," "income groups" and "levels."

Thermal Couductivity Method of Gas Analysis. Published by the Cambridge Instrument Company, Limited, 13, Grosvenor Place, London, S.W.1.

This is one of a series of monographs issued by the company dealing with prominent men of science who have been associated with them since their inception in 1880. This one associates the work of Dr. G. A. Shakespear with the development indicated in the title. Very kindly the company is making this strictly technical booklet available to our readers who desire to take advantage of this offer by writing to Grosvenor Place.

Cupola Drop Bottoms

by James Timbrell

Dropping the cupola bottom doors, at the end of a "blow," is not without considerable risk to the operator who knocks out the supporting prop. Cupola routine and conditions in some cases leave something to be desired, to ensure a degree of safety comparable with other branches of foundry production. Many cupolas are situated outside but adjacent to the main building, often with little or no cover below the charging platform. In inclement weather, the area below and surrounding the drop-bottom doors may become water-logged; it also absorbs the hose or water-bucket supply which is used to drench the incandescent mass which falls at the finish of the blow. Recently, a case occurred where an unexpected drop of cupola *débris* into a saturated, saucer-shaped area below the drop doors, severely burned several workers by distributing hot slag and coke at explosive force over many yards.

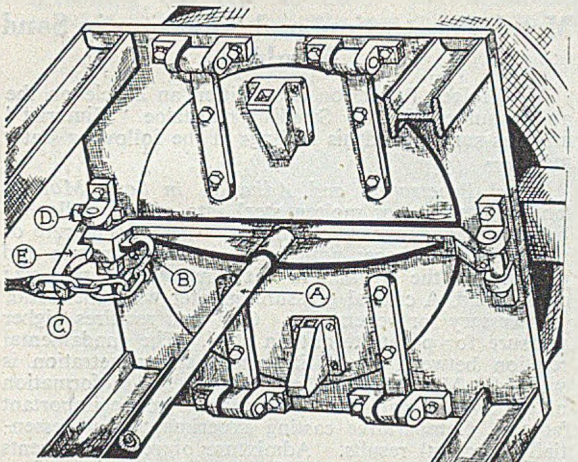


FIG. 1.—*Worm's-eye View of a Suggested Cupola Drop-bottom Arrangement.*

Recommendations

Where circumstances contribute to conditions such as these, a more reliable and safer method than "knock the prop down and jump for cover," should be made. Fig. 1, shows a "worm's-eye" view of an arrangement, which is positive in action and permits the "dropper" to stand clear when releasing the doors. The sketch is largely self-explanatory and the arrangement can be modified easily to suit most types of drop-bottom cupolas. For small cupolas, the steel-tube centre prop *A* can be dispensed with, but for 30 in. dia. cupolas and over, it may be considered advisable to use the prop, to ensure rigidity and as an extra precaution. The prop is, of course, knocked out at the end of a blow, after attaching the chain and hook *C* and *B*.

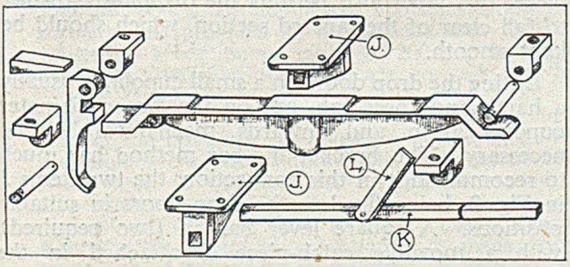


FIG. 2.—*Detail Parts for the Drop-bottom Arrangement, shown in Fig. 1.*

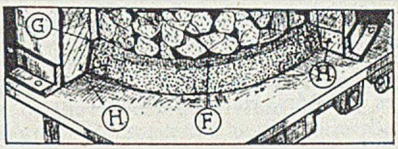


FIG. 3.—*Part Section View of the Base of the Cupola, when in Use, showing the Formation of the Crust on the Bottom Cake.*

The safety wedge *D* is also removed, this wedge being put in when the drop doors are lifted, as a precaution to prevent accidentally knocking the catch open during the run. A pull on the rope attached to the chain opens the catch *E* the extra links and hook *B* in the cross-bar, permits this to be pulled clear of the hot slag and coke, etc.

Fig. 2 shows the arrangement in detail. The ideal "drop" is that which consistently falls immediately the drop doors are released. An experienced cupola man, who rams in the bottom bed, can usually anticipate the fall to almost a second and is aware of what can happen. The speed of the drop is, of course, controlled by the bond strength and dampness of the bed sand used, the degree of hardness to which it is rammed, and the length of the "blow." The longer the blow the deeper and more vitrified the crust of the bottom cake becomes, as shown at *F* in Fig. 3. This bottom cake also becomes part of the cupola-well lining, shown as *G*, this attached area has to break away when the bottom cake falls away.

Ramming the Bed

Too strong a bed sand rammed hard will delay the drop, and may require the use of a long chisel bar to release it. This adds to the risk during the poking

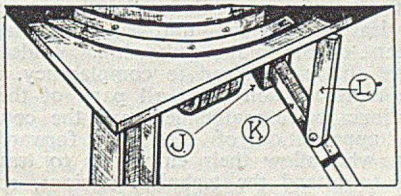


FIG. 4.—*Use of the Square Lever Bar (K) makes Closing of the Doors a One-man Job.*

(*Continued on following page at foot of column 2.*)

Notes from the Branches

Bristol and West of England

About 70 members and ladies were present at the Annual Dinner of the Bristol and West of England branch of the Institute of British Foundrymen held at the Grand Hotel on April 28. Mr. D. Robertson proposed the toast of the Institute which was responded to Mr. John J. Sheehan, B.SC., the president. The branch president, Mr. D. B. F. Tedds, responded to the toast of the Bristol and West of England branch proposed by Mr. T. Makemson, and Mrs. C. Sheehan replied to the toast, visitors and ladies, given by Mr. H. Balme.

The presentation of a clock was made to Mr. A. Hares on behalf of the members of the branch to mark his retirement as branch secretary after 15 yrs. service. The presentation was made by Mr. T. Makemson, M.B.E., the secretary, who spoke of the devoted and able manner in which Mr. Hares had built up and conducted the affairs of the branch. He also remarked that it gave him much pleasure that Mr. Hares' son, Mr. W. J. Hares, was to be his successor as honorary secretary. Mrs. C. Sheehan presented a diamanté brooch to Mrs. Hares on behalf of the branch and both Mr. Hares and Mrs. Hares responded.

London Branch—East Anglian Section

The annual general meeting of the East Anglian section of the London branch of the Institute of British Foundrymen was held in the Lecture Hall, Central Library, Ipswich, on April 12, Mr. W. L. Hardy presiding. The annual report was presented by the secretary, Mr. L. W. Sanders, as follows:—

During the past session, the section has witnessed a full technical programme of seven meetings, which were as follows:

(1) Presidential address and films—" Flawless and British " and " All Star Castings."

(2) " The necessity for co-operation between foundry and drawing office."

(3) " The construction and operation of a model cupola."

(4) The I.B.F. Sub-committee's report T.S.23, " The repair and reclamation of grey-iron castings by welding and allied methods."

(5) " Patternmaking—the old and the new."

(6) Anglo-American Non-ferrous Productivity Team's film—" The Brass Trail."

(7) F. H. Lloyd film—" And Now."

It is desired to record here a tribute of appreciation to the authors and various managements whose cooperation made this satisfactory programme possible. The section was fortunate enough to provide the president of the parent branch, Mr. F. E. Tibbenham, who had administered the branch with considerable success.

Membership. The membership strength of the section has once more slightly improved, five new members joining, and two deceased, thus showing a total net gain of three. Generally, the attendance at the technical sessions has improved, the average being 33 per cent. of the total membership. Whilst this improvement should not lead to complacency, we hope that the representation from all parts of the section will continue to be maintained, and the council feel that an appreciation of the more forward-looking founders, who allow their employees to travel large distances to attend the technical sessions, should be recorded.

Election of Officers. The following officers were elected for the 1951-52 session: As *president*, Mr. V. W. Childs; as *senior vice-president*, Mr. R. J. Hart; as *junior vice-president*, Mr. K. Bolton; *as hon. secretary*, Mr. L. W. Sanders; as *members of council* (for three years), Mr. Ward, Mr. Watson, Mr. Calder, and Mr. Bridger. Mr. Whipp was elected for two years in place of Mr. Bolton.

On the proposal of Mr. Childs, seconded by Mr. Dobbie, the secretary's report was adopted. After the business meeting, the film on ductile cast iron " And Now " was presented by courtesy of F. H. Lloyd & Company, Limited, Wednesbury. The film, which outlined various aspects in the production and testing of ductile cast iron, was greatly appreciated by the members of the section. Following the film, a very interesting discussion regarding the economies and future development of this type of iron took place. At the conclusion of the meeting, a vote of thanks to F. H. Lloyd & Company, Limited, was proposed by Mr. D. Carrick.

Metal Penetration and Adhesion in Sand Moulds

Mr. Holger Pettersson has written an article on the above subject in the Swedish magazine " Gjuteriet " and has summarised his findings in the following statement:—

Metal Penetration and Adhesion in Sand Moulds. The penetration of molten steel into mould walls has been studied by means of immersion tests. The rate of penetration increases with increasing temperature and pressure of the metal and with increasing grain size of the sand. A critical pressure, greater with finer sand, is necessary for penetration. Cast iron requires higher pressure for penetration than steel. The fundamental relation between capillarity and metal penetration is stressed. Movement of sand grains and deformation of the mould wall is also considered to be important factors. Comparative casting experiments gave essentially identical results. Admixture of reducing agents gave rather controversial effects on penetration when tested according to the two methods. Even if no metal penetration occurs, sand may adhere to a casting if the surface of the casting becomes slightly oxidised during cooling.

Cupola Drop Bottoms

(*Continued from page* 501)

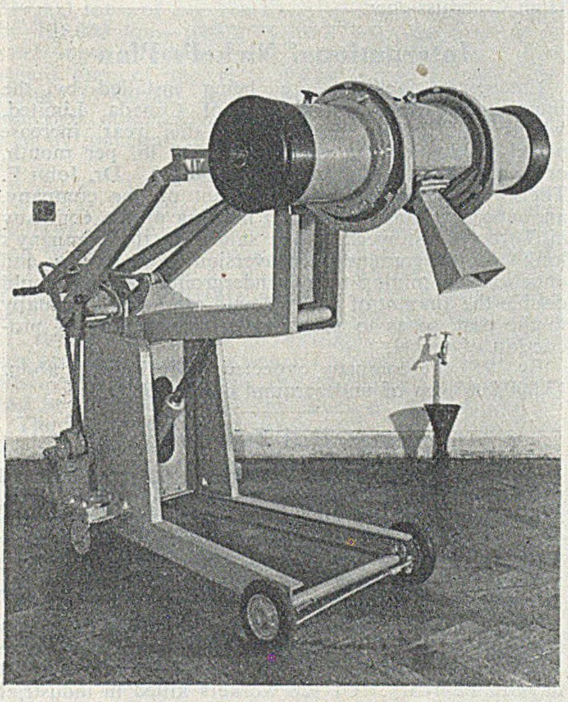
operation. Alternatively, a soft-rammed bottom bed, or a hard-rammed " rotten sand," is liable to disintegrate during the blow with disastrous results in many ways. An instantaneous drop is almost certain if the cupola-well lining is dressed to a taper, as shown at *H* and the cake will usually fall in one piece; this taper also permits the dripping wall-slag to fall clear of the tapered section, which should be kept smooth.

Lifting the drop doors on a small cupola, is usually a hands-and-knees job, but on the larger diameter cupolas 30 in. and upwards, mechanical help is necessary. The bracket-and-bar method has much to recommend it in this connection, the two items *J* in Fig. 2, being fixed to the drop doors in suitable positions. A square lever bar, *K* (two required), with a movable catch-piece *L* attached in the manner shown, will make lifting doors a one-man job, in the manner shown in Fig. 4.

New Industrial X-Ray Unit

The use of X-rays as a means of non-destructive testing has now achieved an established place in foundries. For some lines it has become an essential and routine part of the inspection process. This particularly applies to products which are highly stressed and where hidden flaws would be fraught with serious consequences. During the past two decades much progress has been made in the design of equipment more in keeping with industrial problems. A recent example is the "Compactix" unit, newly developed by Philips Electrical Limited, which the makers claim greatly simplifies procedure and leads to speedier inspection.

The X-ray unit proper is cylindrical in form, and is sub-divided internally by two insulating partitions. The high-voltage energising source comprises two specially-designed transformers, each complete in itself and each developing 100 kvp. to earth. The transformers, together with the X-ray tube, are oil immersed, the tube being housed in the central compartment. They are directly connected to the tube with which they are thus in series, an additional filament-heating transformer being provided on the cathode side. The tube, which has a continuous rating of 200 kvp 10 ma, acts as its own rectifier, and there are no valves or high-tension cables.



Compactix X-ray Unit.

The X-ray beam emerges from a window in the wall of the container, the position of the focus being the geometric centre of the whole. The anode of the X-ray tube is water-cooled; an internal water duct also cools the oil. The control unit is of very small dimensions designed to facilitate easy transport. Reproducible operating conditions are made possible by means of a mains compensator. A stepless auto-transformer, working in conjunction with a kilovoltmeter, enables the penetration to be controlled with a high degree of precision. The tube current, which can be varied, is indicated by a milli-ammeter. A protective circuit prevents the apparatus from being switched on or alternatively it is switched off automatically if for any reason the water supply should be interrupted. Cooling is normally effected from the water main, but the makers also offer a trolley-mounted, closed-circuit system for use where mains water supply cannot be relied upon.

The illustration (Fig 1) shows the "Compactix" unit mounted on a truck with hydraulically-operated raising and lowering gear, which permits a very wide range of vertical adjustment. For large castings the cylindrical form of the tube head makes it possible for it to be inserted through a quite small hole. This British-made unit has a radiographic penetration of 3 in. of steel in an economical exposure time, and operates from a single-phase supply 220/250 v. 50/60 cycles.

Plea for Empire Iron-ore Search

Home ore fields were wasting assets, and much of the easier-to-get ore had been used up, said Mr. J. Langton Highton, managing director of the Workington Iron & Steel Company, Limited, at the recent annual dinner of the Lincolnshire Iron and Steel Institute at Scunthorpe. He suggested that Britain should explore the Empire for new iron-ore fields, this being, he said, the only means of safeguarding the future of the iron and steel industry now that scrap supplies were about finished.

Mr. Highton said that additional and richer sources were needed if the industry was to maintain and increase its production in a competitive world. We could build the best blast furnaces in the world, but that was no good if there was no ore to put in to them. In Cumberland, he said, they were getting into that state now.

I.C.I.'s Record Profit

A record profit, before tax, but after charging depreciation, of £31,018,457 is announced by Imperial Chemical Industries, Limited, for 1950. The group profit is also the highest recorded by any British industrial undertaking. The directors have decided to recommend a final dividend on the £60,558,139 ordinary capital of 9 per cent., less tax, making, with the interim of 3 per cent., a total of 12 per cent. for the year. For 1949 there was a final dividend of 7 per cent. to make a total of 10 per cent., less tax.

The directors state that the manufacturing assets of the company and its wholly owned manufacturing subsidiaries at home have been revalued on the basis of replacement at current construction costs at January 1, 1950, reduced by reference to the age of the assets and their remaining useful lives.

Commonwealth Fund Fellowships

Among the appointments to Fellowships, tenable by British graduates in American universities for one year beginning next September, made by the Committee of Award of the Commonwealth Fund Fellowships, are the following:—Mr. H. Davies (Oxford), theoretical physics; Mr. W. S. Owen (Liverpool), metallurgy; Mr. K. V. Roberts (Cambridge), theoretical physics; Mr. O. Smithies (Oxford), physical chemistry; Mr. L. E. Weiss (Birmingham), geology.

Dominion Civil Service Fellowships have been awarded to Mr. E. W. de Lisle (New Zealand), radio engineering, and Mr. K. G. E. Moody (Australia), civil engineering.

American Foundrymen's Society

Awards

The American Foundrymen's Society at its annual meeting made the following awards:—

Honorary Life Membership: Mr. E. W. Beach, a past director of the Society; Mr. Edward J. McAfee (co-author Patternmakers' Manual); and Mr. Walton L. Woody, the outgoing president. *John A. Penton Medal*: Mr. Victor A. Crosby (Climax Molybdenum). *Peter L. Simpson Medal*: Mr. Thomas W. Curry (Lynchburg Foundry Company), and *John H. Whiting Medal:* Mr. Alfred A. Boyes (United States Pipe and Foundry Company).

Future Plans

The American Society has announced a programme to found a technical centre for the producers of cast metals vital to the nation's rearmament needs. Over $95,000 of a $100,000 appeal has been raised by voluntary subscription from the Society's 9,500 members, and the centre is to be established during the next two years in one of the principal midwestern foundry areas.

The need for a technical foundry centre has been demonstrated during two world wars, according to Mr. Woody, the president, during which the importance of cast metals to rearmament has been shown by the enormous requirements of the armed forces. Cast armour and steel castings are required for mobile equipment and artillery; grey cast iron for engines, transmissions, etc., for mobile ordnance; malleable cast iron for truck and small arms components; cast aluminium and magnesium for aircraft engines and many vital parts. In addition, naval craft require huge steel castings for sternposts, anchors, chain and many other component parts, as well as large quantities of brass and bronze castings for valves, pumps and other non-corrosive applications in all ships and submarines.

American Productivity

The straight-line layout of the cleaning room at the new Fairbanks-Morse Freeport works in the United States enables one man to clean 2,500 castings in an 8-hr. day. Equipped with a blasting table and a rocker-barrel, the room receives castings from an overhead conveyor system direct from the shake-out. Castings range from 2 oz. to 120 lb. (average 10 lb.), the larger being picked off the conveyor by the operator and placed in the skip of the automatic loader of the barrel. Flat castings or fragile parts which might be damaged by tumbling go on to the table. The revolving platform of the table is set for 3½ min. per rev. and each casting passes through the centrifugally-propelled stream of abrasive twice, once on each side. The castings are cleaned in the barrel in from five to seven minutes.

Record U.S. Steel Capacity

Steel mills in the United States were last week scheduled to operate at a record 104 per cent. of rated capacity and produce 2,079,000 tons, according to the American Iron and Steel Institute. This compares with the previous record, set up a few weeks ago, of 103.5 per cent. and 2,069,000 tons.

PROF. EDWARD R. SCHWARZ, head of the textile division of the Massachusetts Institute of Technology, is to receive next October the Harold DeWitt Smith memorial medal of the American Society for Testing Materials.

Toronto Trade Talks

Meetings of the Anglo-Canadian Trade Committee at Toronto on May 17 and 18 will be attended by two delegates each from the Federation of British Industries, the National Union of Manufacturers, and the Association of British Chambers of Commerce, while the National Farmers' Union is also taking part in the talks, which are a continuation of the work of the committee which has helped to double the amount of trade between Britain and Canada since the end of the war. The committee hopes to overcome the dollar difficulties now restricting trade between the two countries.

The National Union of Manufacturers will be represented at the meetings by its vice-president, Mr. C. S. Garland, and its director, Sir Leonard Browett. After the talks they will meet representatives of the Canadian Manufacturers' Association, and will visit Ottawa for talks with Mr. C. D. Howe, Canadian Minister of Trade and Commerce, and Sir Archibald Clutterbuck, British High Commissioner.

International Nickel's Plan

Emergency facilities are being installed by the International Nickel Company of Canada, Limited, which will, before the end of this year, increase nickel production by about 1,000,000 lb. per month, or about 5 per cent. above present output. Dr. John F. Thompson, chairman and president of the company, announced this at the annual meeting of the company in Toronto last week. He said that the company's long-term programme of conversion from surface and underground mining to all underground mining would double the amount of underground ore hoisted annually in the past, so as to preserve the current rate of production of nickel.

By 1953 the company expected to be hoisting about 13,000,000 tons of underground ore annually.

Wage Bill Increases

During March about 1,890,000 workers received pay increases amounting to about £717,000 a week, making a total for the first three months of the year of £1,858,800 a week affecting approximately 4,835,000 workers. In the corresponding months last year there was an increase of about £317,600 a week in the pay of 1,998,000 workers.

Nearly 35,000 workers were affected by stoppages through industrial disputes during March, and some 143,000 working days were lost, compared with 339,000 days in February. Of 128 workers killed in industrial accidents in March, 24 lost their lives in underground accidents at coal mines, 19 in building operations, and 15 on the railways. The comparative total for February was 147.

Unemployment Falls

Between February 12 and March 12, unemployment fell by 27,100 to 274,900—the lowest level since last June. Statistics issued by the Ministry of Labour show that in the basic industries as a whole, the number employed decreased by 2,000 during the month, although the number engaged in coal mining increased by 4,800.

There was an increase of 6,000 in the number employed in the metals, engineering and vehicles group, and one of 3,000 in workers employed in chemical manufacture—further evidence of the effect of the rearmament programme on the man-power situation.

The total working population increased by 12,000 (about 6,000 men and 6,000 women) to 23,261,000.

Raw Materials for Steelmaking

Stocks Dangerously Low

Serious aspects of the raw materials situation were revealed when the Minister of Supply made a statement on the prospects of steel production and supplies in the current year in the House of Commons on April 30. Mr. Strauss said it was now certain that this year's steel output would be below last year's record of 16.300,000 tons. Britain's stocks of steelmaking raw materials, he said, were dangerously low.

Mr. Strauss said that the House would recall his warning on February 7 that the Iron and Steel Corporation, on taking over from the former private owners on February 15, was likely to be faced with a raw material supply situation which would make it difficult or impossible to maintain the recent level of steel output. He had now received a report on the situation, drawn up by the Corporation at his request.

During the last quarter of 1950, the iron and steel industry reduced its stocks of imported iron ore by 327,000 tons, of pig-iron by 20,000 tons, and of scrap by 195,000 tons, which in total was equivalent to a steel ingot production of over 400,000 tons. This meant that, of the 1950 output of 16,300,000 tons. about 15,900,000 tons were produced from raw materials obtained during the year and over 400.000 tons by reduction of stocks.

Scrap from Germany

Further reductions in stocks of imported iron ore, pig-iron, and scrap, equivalent to a steel ingot production of over 500,000 tons, were made by the industry in the first quarter of this year. During the last six months it had, therefore, used up about 1,000,000 tons of its stock of steelmaking raw materials. This source of supply would not be available for the rest of this year, as stocks had now been reduced to a dangerously low level. Indeed, some furnaces had already had to be closed or damped down on this account.

The intake of raw materials which, as distinct from the use of stocks, accounted for an output of about 15,900,000 ingot tons in 1950, included an import of scrap, mainly from Germany, of over 1,900,000 tons. The House would know that, although they were doing their best to obtain maximum supplies from Germany, there was no prospect of attaining anything like that figure this year. Against this they hoped for some slight improvement in the import of iron ore (which was reduced in the last six months by shipping difficulties), some small increase in the import of pig-iron, some increase in the use of home ore (which. however, because of its lower iron content. reduced output per blast furnace), and, most important, some increase in home scrap supplies.

The success of the present national scrap drive was, therefore, of supreme importance and unsparing efforts must be made during the coming months to recover every possible ton.

Mr. Strauss concluded: "These factors, however, even at best, can only offset part of the shortfall. In view of this and the exhaustion of reserve stocks on which we can draw, it is evident that steel production this year will be lower than last year. The greatest ingenuity on the part of manufacturers will be needed to overcome the shortage of steel."

THE CHAMBER OF COMMERCE JOURNAL calculates that electricity cuts between November 1, 1950, to the first week in January were responsible in man/hours lost—13,788,967; loss to firms £8,485,281 and loss of wages £1,366,659.

Sulphur and Sulphuric Acid for Industry

Detailed allocation schemes for the distribution to industry of sulphur and sulphuric acid to provide the most effective use of these commodities in the national interest were put into effect by the Board of Trade on May 1. The schemes are based on a consumption of sulphur at the rate of approximately 100,000 tons per quarter. In general, this will mean that users will receive supplies varying between 80 and 90 per cent. of their total 1950 consumption. In the case of the superphosphate industry, however, the quantity of sulphuric acid allowed will remain at the present level, which is approximately two-thirds of capacity.

Key industries such as iron and steel, explosives, metal extraction, tinplate, and certain oil-refining processes will be maintained at full output (including output from new capacity).

When these allocation schemes are in full operation, no consumer should receive either less sulphur or sulphuric acid than he has had since the start of the year, and many will benefit by some increase in the rate of supplies.

In the House of Commons during a recent session the Under-Secretary of State for the Home Department (Mr. Geoffrey de Freitas) said that recent work at the chemical research laboratory of the Department of Scientific and Industrial Research had produced two results which might help to relieve the shortage of sulphur.

One opened up the possibility of substituting nitric acid for rather more than half the sulphuric acid in the manufacture of phosphate fertilisers. The other was the possibility of producing sulphur by bacterial means. Sulphur had been produced by bacteria in the laboratory, but further research was required before its industrial possibilities could be assessed.

This research was being undertaken with vigour, but at present it must be regarded as a long-range undertaking.

French Steel Prices Raised

The French Government has suspended import duties on most types of iron and steel, on non-ferrous metals, and on various chemical products.

Steel prices were increased on April 26 by between 18 and 24 per cent. At the same time cast-iron prices were freed from control. The French steel industry had asked for an increase of 30 per cent., which it considered a minimum in view of the sharp rise in production costs, and it seems likely therefore that a further price increase will be announced later.

Sheffield Steel Record

During February, production of steel castings and steel for ingots in the Sheffield area reached a record weekly rate of 46,900 tons—700 tons a week greater than the previous record set up last October.

Shortages of scrap metal and of pig-iron make it unlikely that output will be maintained at this level in subsequent months. Steel, Peech & Tozer, for example, recently had four of its 21 melting furnaces out of action because of shortage of raw materials.

Obituary

MR. DONALD MACKAY, late of the British Aluminium Company, Limited, Fort William (Inverness-shire), died on April 28.

MR. P. C. TARRANT, a director and works manager of Effingham Steel Works, Limited, Sheffield, died recently at the age of 75.

MR. GEORGE A. WILSON, secretary of the West Riding Regional Council of the Federation of British Industries, died on April 26 at the age of 57.

The death occurred on May 2 of MR. WALTER VICTOR PAGETT a director of the old-established iron foundry firm of Thos. W. Robinson, Limited, Audnam, Wordsley, Stourbridge. He joined the firm in 1907, when the family business was made a limited company.

MR. FREDERICK GROVER, whose death has taken place at the age of 81, was the founder of the Forgrove Machinery Company, Limited, Leeds, and was previously a lecturer in machinery design in the engineering department of Leeds University. He was one of the first engineering employers in Leeds to introduce the 47-hr. week.

MR. H. P. BRADBURY, who began his career with the former North Stafford Railway Company, Limited, in 1892 and retired in 1937 as senior assistant to the district engineer, Stoke-on-Trent, died recently. He was resident engineer of Cauldon Low quarries from 1914 to 1919 and returned in 1929 as manager, a post which he held until 1934, when the quarries were taken over by Hadfields, Limited.

MR. REGINALD AUBERY CARDER, chairman and managing director of the Esso Petroleum Company, Limited, died on April 28 at the age of 59. He joined the company, then known as the Anglo-American Oil Company, Limited, as a secretarial assistant in 1920, being appointed deputy secretary five years later and secretary in 1930. He was elected to the board in 1933, becoming managing director in 1940 and chairman in 1949.

MR. ARTHUR CROOKE, a director of the Appleby-Frodingham Steel Company Branch of the United Steel Companies, Limited, died on April 30 at the age of 82. Since 1925 he had been chairman of the National Council of Ironmasters and from 1936 onwards he was chairman of the Lincolnshire Ironmasters' Association. He had been associated with the Appleby-Frodingham works since 1893. Mr. Crooke went to Frodingham nearly 60 years ago as blast-furnace and mines manager at a time when basic pig-iron was found difficult to produce successfully, and it was he who was largely responsible for overcoming the difficulties at the Frodingham works. In 1899 he took over the management of the steel-melting furnaces and in 1902 started the first tilting furnace working the Talbot process in this country. In 1908 he was appointed joint general manager of the Frodingham works. When the Frodingham Iron & Steel Company took over the Appleby Iron Company in 1912, he was appointed a director and general manager of the Appleby works. He was responsible for the design of the new blast furnaces and steel-melting shop of the then new Appleby plate works and was also responsible for the general layout of the whole Appleby plant.

ONE AND ONE-THIRD MILLION TONS of sand each year are used by the iron, steel and foundry industries according to a speaker at the annual dinner of the Silicon and Moulding Sands Association.

Iron and Steel Export Control

Under an Order made by the Board of Trade, operating on and from May 14, licences will be required in respect of the export to all destinations of additional forms of iron and steel, and wire and strip of copper or copper alloy. Details of the changes are as follow:—

IN GROUP 6(1) the following items are added :—

Billets, blooms and slabs, including crop ends. Ingots, including crop ends and discards. Tube rounds, squares and hollows, including crop ends.

The heading "Iron and steel (including alloys containing by weight more than 55 per cent. of iron) in the following forms" and the items thereunder, are deleted and the following substituted :—

Iron and steel (including alloys containing by weight more than 55 per cent. of iron, not elsewhere specified in this Schedule) in the following forms :—

Angles, channels, tees, joists, girders, beams, pillars, piling sections and other sectional material (whether fabricated or not) including crop ends, but not including machinery parts. Bars, rods and bar and rod ends of all kinds including hollow-mining drill steel. Billets, blooms, and slabs, including crop ends. Colliery arches, pitprops, and parts thereof. Header bars of all descriptions. Hoop and strip whether coated or not. Ingot moulds. Ingots, including crop ends and discards. Pig-iron. Pipes and tubes, other than of cast iron. Pipe and tube fittings, other than of non-malleable cast iron or electric conduit fittings. Plate and sheet work, unassembled. Plates and sheets of all kinds, whether coated or not including plate and sheet cuttings, other than tinplate, terneplate, blackplate, and tinned sheets.

Railway and tramway material (assembled or unassembled, other than points and crossings) the following :—Chairs, dog spikes, fishbolts, fishplates, rails and rail crops, sleepers and sole plates

Rails and rail crops, bridge and crane. Structures, fabricated of iron and steel (other than prefabricated buildings and machinery parts), and parts prepared ready for assembly into structures. Tube rounds, squares and hollows, including crop ends. Tyres, wheels, wheel centres and axles of the type used for railway or tramway vehicles (assembled or unassembled) not elsewhere specified in this Schedule. Welding electrodes and welding rods. Wire, plain or barbed, whether coated or not, other than insulated wire. Wire rods.

Under the heading relating to used material of iron and steel, the following items are deleted :—Axles. Pipes and tubes, welded or seamless. Rails, railway, tramway, bridge or crane. Railway and tramway material, the following : Chairs, sleepers, dog spikes, fishbolts, and fishplates. Sheet piling. Wheels, wheel centres, and tyres of railway or tramway vehicles.

IN GROUP 6(3) the following is added :—

Wire, single, and strip of copper or copper alloys, covered or insulated with any material, not elsewhere specified in this Schedule.

Non-ferrous Scrap Prices

The Minister of Supply has made the Non-ferrous Metals Prices (No. 4) Order (SI 1951, No. 773), which consolidates earlier Orders, revises certain maximum prices of scrap, and provides for special prices for exceptional transactions. The Order came into force last Friday.

The revised prices (per ton) are:—

Secondary zinc alloy ingots to BSS No. 1141, £177; No. 1 copper wire, £183; clean heavy copper, £178; No. 2 copper wire, £173; braziery copper, £156; lead cable sheathing scrap, £147; lead scrap other than cable sheathing, £143; zinc alloy diecasting not free from inserts, £129; SAA cases mechanically treated or fired, £173.

Other changes permit *bona fide* scrap metal merchants to charge a commission of 1½ per cent. on remelted lead, and to increase the maximum charge for briquetting to £2 per ton. In addition, the maximum price for scrap not mentioned in the Order may be fixed by agreement between the buyer and seller. The agreed price, however, must not exceed the highest scheduled price for material in the same class.

Provision is also made for special prices for scrap chemical lead and for scrap produced in technical colleges, and for the Minister to authorise special prices for scrap which has to be sorted to unusual requirements.

Pig-iron and Steel Production

Statistical Summary

The following particulars of pig-iron and steel produced in Geat Britain have been extracted from the Statistical Bulletin for March, issued by the British Iron and Steel Federation. Table I gives the production of pig-iron and ferro-alloys in February, 1951, and number of furnaces in blast; Table II, production of steel ingots and castings in February, and Table III, deliveries of finished steel. Table IV summarises activities during the previous six months.

TABLE I.—*Weekly Average Production of Pig-iron and Ferro-alloys during February, 1951. (Thousands of Tons.)*

District.	Furnaces in blast	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants, Essex	25	—	19.2	21.0	1.1	—	41.4
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire .. Yorkshire (incl. Sheffield, excl. N.E. Coast) ..	6	—	8.3	—	—	0.7	9.0
Lincolnshire ..	13	—	24.7	—	—	—	24.7
North-East Coast	23	7.9	35.1	0.3	—	1.5	44.8
Scotland	9	0.9	11.7	2.7	—	—	15.3
Staffs., Shrops., Worcs. and Warwick ..	9	—	9.0	1.6	—	—	10.6
S. Wales and Mon.	7	3.1	22.6	—	—	—	25.7
North-West Coast	8	13.8	—	0.2	—	0.8	14.8
Total ..	100	25.7	130.6	25.8	1.1	3.0	186.3†
January, 1951* ..	101	25.7	126.6	26.7	1.4	2.7	183.1
February, 1950 ..	101	29.2	122.8	28.3	1.4	2.7	184.4

† Including 100 tons direct castings.

TABLE III.—*Weekly Average Deliveries of Non-alloy and Alloy Finished Steel. (Thousands of Tons.)*

Product.	1949.	1950.	1950. Feb.	1951. Jan.*	1951. Feb.
Non-alloy steel:					
Ingots, blooms, billets and slabs†	4.5	3.6	4.5	3.7	4.2
Heavy rails, sleepers, etc.	9.8	11.3	12.7	8.9	9.8
Plates ⅛ in. thick and over ..	39.2	40.0	42.4	38.7	44.4
Other heavy prod.	36.1	38.7	40.0	39.7	42.1
Light rolled prod.	46.4	47.6	48.5	49.0	53.6
Hot rolled strip ..	17.1	19.4	19.2	18.9	23.6
Wire rods	15.1	16.0	16.4	17.4	17.7
Cold rolled strip ..	4.9	5.5	5.1	5.9	5.8
Bright steel bars ..	5.8	6.5	6.0	7.5	7.5
Sheets, coated and uncoated ..	27.6	30.5	30.1	31.4	31.2
Tin, terne and blackplate ..	13.7	14.3	13.7	14.1	13.4
Tubes, pipes and fittings	18.5	20.0	20.2	19.6	23.8
Mild wire	11.8	12.3	11.8	11.9	13.1
Hard wire	3.2	3.5	3.6	3.8	4.1
Tyres, wheels and axles	4.1	3.5	3.6	3.5	2.9
Steel forgings (excl. drop)	2.4	2.2	2.5	2.0	2.4
Steel castings ..	3.6	3.5	3.8	3.6	3.6
Total	263.8	278.4	284.1	279.6	303.2
Alloy steel	10.4	10.6	10.3	10.7	12.2
Total deliveries from U.K. prod.‡ ..	274.2	289.0	294.4	290.3	315.4
Add imported finished steel	9.5	3.8	4.0	3.2	3.2
	283.7	292.8	298.4	293.5	318.6
Deduct intra-industry conversion‖ ..	51.0	53.4	55.3	57.8	64.0
Total deliveries ..	232.7	239.4	243.1	235.7	254.6

† Other than for conversion into any form of finished steel listed below.
‡ Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.
‖ Material for conversion into other products also listed in this table.

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in February, 1951. (Thousands of Tons.)*

District.	Open-hearth. Acid.	Open-hearth. Basic.	Bessemer.	Electric.	All other.	Total. Ingots.	Total. Castings.	Total ingots and castings.
Derby, Leics., Notts., Northants and Essex	—	2.6	10.8 (basic)	1.3	0.2	14.3	0.6	14.9
Lancs. (excl. N.W. Coast), Denbigh, Flints., and Cheshire .. Yorkshire (excl. N.E. Coast) and Sheffield ..	1.4	22.7	—	1.6	0.5	25.3	0.9	26.2
Lincolnshire ..	—	30.8	—	—	0.1	30.7	0.2	30.9
North-East Coast ..	1.6	62.3	—	1.0	0.5	63.8	1.6	65.4
Scotland ..	4.5	38.5	—	1.7	0.7	43.5	1.9	45.4
Staffs., Shrops., Worcs. and Warwick ..	—	17.4	—	0.8	0.7	17.4	1.5	18.9
S. Wales and Monmouthshire ..	10.8	51.0	6.2 (basic)	0.9	0.1	68.5	0.5	69.0
Sheffield (incl. small quantity in Manchester) ..	9.4	28.2	—	8.7	0.6	45.0	1.9	46.9
North-West Coast ..	0.7	2.5	4.7 (acid)	0.4	0.1	8.2	0.2	8.4
Total ..	28.4	256.0	21.7	16.4	3.5	316.7	9.3	326.0
January, 1951* ..	25.6	241.0	20.8	15.2	3.3	297.4	8.5	305.9
February, 1950 ..	28.7	257.1	21.4	14.3	3.5	316.2	8.8	325.0

TABLE IV.—*General Summary of Pig-iron and Steel Production. (Weekly Average in Thousands of Tons.)*

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy). Imports.‡	Steel (incl. alloy). Output of ingots and castings.	Steel (incl. alloy). Deliveries of finished steel.	Steel (incl. alloy). Stocks.†
1949	258	169	199	183	188	17	299	233	1,071
1950	249	174	197	185	197	9	313	239	997
1950—September ..	229	179	198	187	207	8	326	256	1,160
October	266	183	201	194	202	5	328	251	1,097
November* ..	260	179	200	193	206	6	336	261	1,060
December	259	171	198	188	175	5	296	234	997
1951—January* ..	258	163	200	183	183	7	306	236	920
February	262	164	202	186	193	7	326	255	865

† Stocks at the end of the years and months shown. ‡ Weekly average of calendar month. * Five weeks (all tables).

News in Brief

The British Steel Founders' Association inform us that their telephone number is now Sheffield 63046.

The Council of Ironfoundry Associations has circularised all its members as to the recall of Z reservists.

This year's Congress of the Scientific Film Association is to be held at the Hague, in the Municipal Museum, from September 15 to 22.

The Ministry of Supply announces that the principles of a new agreement have been settled with the Aluminium Company of Canada to ensure increased supplies of aluminium to the United Kingdom.

The Northern Regional Board for Industry has suggested that vessels used to carry coal from America to the United Kingdom might be switched during the summer to the transport of hematite and pig-iron.

Chamberlain Industries Limited have made an agreement with General and Overseas Trading Corporation Limited, 50, Gresham Street, London, E.C.2, appointing them as their agents for bending machines and other "Staffa" products.

The Association of Bronze and Brass Founders (25 Bennetts Hill, Birmingham 2) are asking their members to report cases where shortages of raw material were handicapping production. They need this information in connection with their negotiations with the Ministry.

The latest foundry in Falkirk to instal baths and washing facilities for their workers is Merchiston Foundry, Limited. The firm has been granted permission for baths at their Smith Street works. Plans are also in hand to extend the moulding shop and provide a patternmaking shop and offices at a cost of £10,000.

At a general meeting of the Institution of Mechanical Engineers on May 4, in the presence of the Danish Ambassador, Count Eduard Reventlow, it was announced that Dr. H. H. Blache, of Denmark, had been elected an honorary member of the Institution. This distinction is highly prized among mechanical engineers in all parts of the world.

A gift of £35,000 over a period of seven years towards the cost of extensions to the Royal Technical College, Glasgow, was intimated on May 3 on behalf of the Anglo-Iranian Oil Company and one of the companies in the Shell Oil Group. The announcement was made by Mr. T. W. Lyle, general manager of Scottish Oils and Shell Mex, Limited, when he spoke at the opening ceremony of an exhibition of the petroleum industry in the college, which will be open until May 19.

The 1951 Autumn Meeting of the Institute of Metals will be held in Italy, by invitation of the *Associazione Italiana di Metallurgia*. The meeting will open in Venice, and there will be optional extensions to Milan (and Bolzano), and Florence. The Institute's meetings in Venice will be held side by side with those of the *Associazione*, and there will be a joint session. Full particulars may be obtained from the secretary, Lieut.-Col. S. C. Guillan, T.D., at 4, Grosvenor Gardens, London, S.W.1.

Mr. Walter Nurnberg staged a one-man exhibition of industrial photographs, which was held recently at the Alpine Galleries, South Audley Street, London, W.1. There were a number of excellent studies taken in the works of the United Steel Companies. The composition, and light effects introduced in to the pictures result from true artistic perception of the needs of modern publicity. The writer looks forward to the next exhibition when studies from steel foundries will be shown.

Personal

Mr. J. E. Steel, managing director of Steel & Company, Limited, engineers, of Sunderland, is attending a materials exhibition in Chicago.

Mr. W. J. E. Black, of the English Electric Company, Limited, has been elected chairman of the Institution of Engineering Inspection.

Mr. E. H. Hickery, South Wales divisional officer of the Iron and Steel Trades Confederation, is the new vice-chairman of the Welsh Council of Labour.

Mr. William Scott, chairman of Armstrong Whitworth & Company (Pneumatic Tools), Limited, Gateshead, and managing director of Jarrow Metal Industries, Limited, is visiting the United States on business.

Mr. Michael Stewart, M.P., who has been appointed to succeed Mr. John Freeman as Parliamentary Secretary to the Ministry of Supply, has been Under-Secretary to the War Office since 1947. He is Labour member for East Fulham.

Viscount Davidson, president of the Engineering Industries Association since 1944, is making a business trip to Australia. He expects to return home at the end of June. Viscount Davidson is a director of Dorman, Long & Company, Limited.

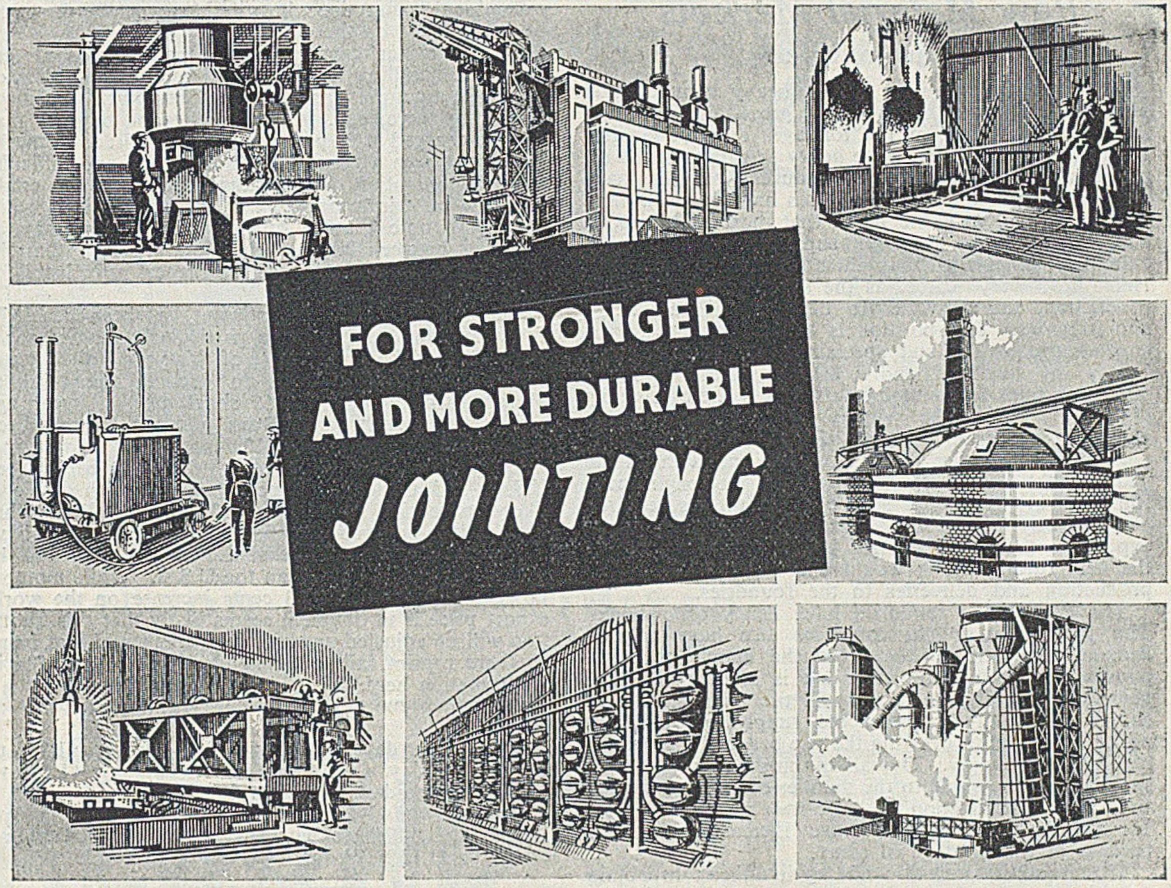
Mr. John O. Crabtree, vice-chairman of R. Hoe & Company, Limited, London, and R. W. Crabtree & Sons, Limited, Leeds, and a director of the Crabtree Foundry Company, Limited, has been re-elected chairman of the Association of British Manufacturers of Printing Machinery.

Lord Aberconway, chairman of John Brown & Company, Limited, Thos. Firth & John Brown, Limited, and of other companies, and Sir Henry Tizard, F.R.S., chairman of the Defence Research Policy Committee, have accepted invitations to receive honorary degrees of Doctor of Science of Reading University.

Mr. H. E. Boyd, secretary of W. H. Allen, Sons & Company, Limited, mechanical and electrical engineers, of Bedford, has resigned. He joined the company in 1894, becoming assistant secretary in 1910 and secretary 14 years later. The new secretary is Mr. P. C. Saltmarsh, who joined the company two months ago.

After holding the position of managing director of Crossley Brothers, Limited, Manchester, for 35 years, and 60 years after joining the firm as a boy, one of the most respected figures in the oil-engine industry, Mr. J. J. Carter, retired on April 30. He is, however, at the request of his co-directors, continuing as a director of the company, and is also continuing in his capacity of chairman of Crossley-Premier Engines, Limited, which position he has held since he brought the Premier Gas Engine Company into the Crossley Group. He is succeeded as managing director by Mr. H. Desmond Carter, M.I.MECH.E., M.I.MAR.E., director and chief engineer of the company.

Mr. Henry M. Laws, who is attached as a consulting foundryman to the Economic Co-operation Administration, last week visited a number of foundries in the Midlands. Mr. Laws has been in Europe—mainly Holland and France—for the last six months, where he has been engaged on promoting productivity. So much were his services appreciated in France, that the centuries-old *Syndicat des Fondeurs*—the direct descendant of the old guild of founders—made him the first honorary member in their long history. Any of our readers wishing to have a visit from this exceptionally well-experienced foundry expert should send an invitation to him at the E.C.A. Hotel Witteburg, The Hague, Netherlands.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Raw Material Markets

Iron and Steel

All grades of pig-iron are in heavy demand, and producing furnaces are under great pressure for supplies. Apart from the tonnages required against current licences, makers have heavy arrears to make up, particularly for hematite. Reduced outputs have delayed completion of orders which have been on hand for some time, with the result that most foundries, in addition to being short of supplies, are finding it extremely difficult to book their forward requirements. Hematite is very scarce, as the shortage of ore limits production, and deliveries to the foundries are small and irregular. The position is causing anxiety to the engineering, textile, and speciality foundries, as with barely any stock at hand it will be difficult to maintain operations at present levels unless there is a big improvement in the supply position. Available tonnages of refined iron and of the low- and medium-phosphorus irons are being taken up, but, with all the grades that are available to them, the engineering foundries are unable to secure the quantities required for capacity production. The hematite makers are expecting some improvement in the supply of ore in the near future, which would enable them to step up production and deliveries to the foundries.

The engineering foundries have heavy order-books. The jobbing and light foundries also have a good demand for their products, but the supply of high-phosphorus pig-iron for their use is inadequate. The new furnace blown in recently in the Derbyshire area should eventually improve the supply position, but not to the extent of bridging the gap between the present demand and supply. Overall outputs will continue to show a deficiency, due to the number of furnaces turned over to the production of basic-steel making pig-iron, for which the steelworks have increasing demands because of the shortage of scrap.

Most foundries are also finding it difficult to obtain suitable parcels of cupola scrap, which is a further handicap to production. Stocks have been heavily drawn upon and there is an insistent demand for parcels of both steel and cast-iron scrap.

Foundry coke supplies have continued to come forward satisfactorily and most foundries have now ample quantities to meet current needs, although in many instances stocks are low and regular despatches are essential.

Ganister, limestone, and firebricks are being received to requirements, but those foundries in need of ferro-alloys are having difficulty in obtaining supplies of some grades.

The re-rolling establishments are unable to secure sufficient steel to ensure capacity working, though the demand for such products as small bars, sections, and strip is extremely heavy. Demand for finished steel is perhaps concentrated most heavily on flat and rolled products, and rollers of sheets and plates are offered more business than they can possibly meet.

Non-ferrous Metals

Last week brought a further Ministry of Supply Order dealing with scrap and secondary metal, the issue of which had been expected for some time. It will be remembered that when Order No. 3 came out certain errors crept in which had to remain until such time as a new Order was promulgated. These adjustments have now been made and minor increases have occurred in certain sections of the copper class. Provision is made in this new Order for special prices to be quoted in exceptional transactions, but the Ministry will doubtless be kept posted on these deals.

As was rather expected, scrap metal merchants engaged in handling remelted lead are to be permitted to charge a commission of 1½ per cent. on this business. Cutting-up wire, etc., into briquettes or bundles may now be charged at £2 per ton instead of 25s. as formerly. There has been a good deal of confusion and difficulty over the operation of the clause relating to the establishment of "in proportion" prices, and it is satisfactory to note that in future, these matters may be arranged between buyer and seller, provided that the price agreed does not exceed the highest price listed for material in the same class.

The trend of market sentiment has been decidedly firm, lead and copper being particularly fancied for a rise. During the first quarter of this year United States stocks of lead continued to decline, the total at March 31 being only 27,259 short tons. A year ago stocks were nearly 90,000 tons, and the fall has been continuous throughout the 12 months.

Copper is firm on the agreement reported between U.S.A. and Chilean producers under which Chile is likely to receive an additional 3 cents per lb. for her metal. It is believed that matters other than price have also been decided and that Chilean copper will be shipped to points other than the U.S.A. While momentarily the effect of this 3 cents increase on the world export price is in doubt, it seems likely that this quotation will be adjusted upwards by 3 cents, and that being so there cannot fail to be an increase of some £24 in the quotation here.

London Metal Exchange tin quotations were as follow:—

Cash—Thursday, £1,140 to £1,145; Friday, £1,155 to £1,160; Monday, £1,140 to £1,145; Tuesday, £1,140 to £1,145; Wednesday, £1,140 to £1,150.

Three Months—Thursday, £1,125 to £1,130; Friday, £1,135 to £1,140; Monday, £1,115 to £1,120; Tuesday, £1,120 to £1,125; Wednesday, £1,120 to £1,125.

Tunisian Iron Ore

Tunisian iron-ore production in 1950 totalled 757,897 tons, compared with 711,894 tons in 1949. Exports were 697,904 (769,046) tons, an overall reduction of 9.20 per cent. on the year. The United Kingdom accounted for 66.62 per cent. of the 1950 exports, other percentages being:—United States, 14.22; Germany, 7.38; Holland, 4.05; Italy, 5.30; France, 2.43.

Production of iron ore in December last was 69,143 tons, against 64,370 tons in the previous month, the corresponding export figures being 40,072 (51,938) tons, the decline in December's exports being attributed to a shortage of shipping. Stocks at December 31 totalled 155,283 tons (131,785 tons at the ports and 23,498 tons at the mines), against a total of 98,096 tons at the end of 1949.

Steel Consumers' Council

The Minister of Supply has announced that the following bodies have been invited to submit nominations of possible representatives for the Iron and Steel Consumers' Council:—Federation of British Industries, National Union of Manufacturers, Engineering Industries Association, Association of British Chambers of Commerce, National Association of Iron and Steel Stockholders, National Federation of Iron and Steel Merchants, and Trades Union Congress.

Arrangements are also being made for representation of the other socialised industries as consumers.

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

(Delivered, unless otherwise stated)

May 9, 1951

PIG-IRON

Foundry Iron.—No. 3 Iron, Class 2:—Middlesbrough, £10 17s. 9d.; Birmingham, £10 13s.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £12 9s., 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 16s. 6d.; South Zone, £12 19s.

Scotch Iron.—No. 3 foundry, £12 7s. 9d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £13 7s. 6d.; South Zone, £13 10s.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £13 17s. 6d.; South Zone, £14.

Cold Blast.—South Staffs, £16 10s. 6d.

Hematite.—Si up to 2½ per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. Coast and N.-W. Coast of England, £12 7s. 6d.; Scotland, £12 14s.; Sheffield, £13 2s. 6d.; Birmingham, £13 9s.; Wales (Welsh iron), £12 7s. 6d.

Spiegeleisen.—20 per cent. Mn, £18 3s.

Basic Pig-iron.—£10 19s. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered.)

Ferro-silicon (6-ton lots).—40/55 per cent., £37 15s., basis 45% Si, scale 14s. per unit; 70/84 per cent., £52, basis 75% Si, scale 14s. 6d. per unit.

Silicon Briquettes. (5-ton lots and over).—2lb. Si, £44 2s.; 1lb. Si, £45 2s.

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

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

Ferro-titanium.—20/25 per cent., carbon-free, £167; ditto, copper free, £183.

Ferro-tungsten.—80/85 per cent., 31s. 6d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 33s. 6d. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent C, £66, basis 60% Cr, scale 22s. per unit; 6/8 per cent. C, £61, basis 60% Cr, scale 21s. per unit; max. 2 per cent. C, 1s. 6¾d. per lb. Cr; max. 1 per cent. C, 1s. 7¼d. per lb. Cr; max. 0.15 per cent. C 1s. 8d. per lb. Cr.; max. 0.10 per cent. C, 1s. 8½d. per lb. Cr.

Chromium Briquettes. (5-ton lots and over).—1lb. Cr, £69 4s.

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

Metallic Chromium.—98/99 per cent., 5s. 9d. per lb.

Ferro-manganese (blast-furnace). — 78 per cent., £32 3s. 7d.

Manganese Briquettes. (5-ton lots and over).—2lb. Mn, £40 15s.

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

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—Basic: Soft, u.t., £17 4s.; tested, up to 0.25 per cent. C (100-ton lots), £17 9s.; hard (0.42 to 0.60 per cent. C), £19 4s.; silico-manganese, £24 6s. 6d.; free-cutting, £20 9s. Siemens Martin Acid: Up to 0.25 per cent. C, £22 11s. 6d.; case-hardening, £23 9s.; silico-manganese, £26 14s.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £20 4s.; basic, hard, over 0.41 up to 0.60 per cent. C, £21 9s.; acid, up to 0.25 per cent. C, £23 9s.

Sheet and Tinplate Bars.—£17 6s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £21 3s.; boiler plates (N.-E. Coast), £22 10s. 6d.; chequer plates (N.-E. Coast), £23 8s.; heavy joists, sections, and bars (angle basis), N.-E. Coast, £20 1s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £22 15s.; flats, 5 in. wide and under, £22 15s.; hoop and strip, £23 10s.; black sheets, 17/20 g., £29 13s.; galvanised corrugated sheets, 17/20 g., £43 6s.

Alloy Steel Bars.—1-in. dia. and up: Nickel, £37 19s. 3d.; nickel-chrome, £56 6s.; nickel-chrome-molybdenum, £63 1s.

Tinplates.—I.C. cokes, 20 × 14, per box, 42s. 7½d., f.o.t. makers' works.

NON-FERROUS METALS

Copper.—Electrolytic, £210; high-grade fire-refined, £209 10s.; fire-refined of not less than 99.7 per cent., £209; ditto, 99.2 per cent., £208 10s.; black hot-rolled wire rods, £219 12s. 6d.

Tin.—Cash, £1,140 to £1,150; three months, £1,120 to £1,125; settlement, £1,145.

Zinc.—G.O.B. (foreign) (duty paid), £160; ditto (domestic), £160; "Prime Western," £160; electrolytic, £164; not less than 99.99 per cent., £166.

Lead.—Good soft pig-lead (foreign) (duty paid), £160; ditto (Empire and domestic), £160; "English," £161 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, all English destinations, £180; rolled zinc (boiler plates), all English destinations, £178; zinc oxide (Red Seal), d/d buyers' premises, £178.

Other Metals.—Aluminium, ingots, £124; antimony, English, 99 per cent., £390; quicksilver, ex warehouse, £73 10s. to £74; nickel, £406.

Brass.—Solid-drawn tubes, 21¾d. per lb.; rods, drawn, 29½d.; sheets to 10 w.g., 26⅝d.; wire, 27½d.; rolled metal, 25½d.

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), —; BS. 1400—LG3—1 (86/7/5/2), —; BS. 1400—G1—1 (88/10/2), —; Admiralty GM (88/10/2), virgin quality, —, per ton, delivered.

Phosphor/bronze Ingots.—P.Bl, —; L.P.Bl, — per ton.

Phosphor Bronze.—Strip, 37d. per lb.; sheets to 10 w.g., 39½d.; wire, 40½d.; rods, 36¾d.; tubes, 42d.; chill cast bars: solids —, cored, —. (C. Clifford & Son, Limited.)

Nickel Silver, etc.—Ingots for raising, 2s. 4½d. per lb. (7%) to 3s. 3½d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 2s. 10½d. (7%) to 3s. 9½d. (30%); to 12 in. wide × .056, 2s. 10½d. to 3s. 9¾d.; to 25 in. wide × .056, 3s. 0½d. to 3s. 11¾d. Spoon and fork metal, unsheared, 2s. 7½d. to 3s. 6½d. Wire, 10g., in coils, 3s. 4d. (10%) to 4s. 3½d. (30%). Special quality turning rod, 10%, 3s. 3d.; 15%, 3s. 7¾d.; 18%, 4s. All prices are net.

Forthcoming Events

MAY 14

Incorporated Plant Engineers

Dundee Branch:—Talk and film on "Oil," by Scottish Oils and Shell Mex, Limited, 7.30 p.m., at Mathers Hotel, Dundee.

MAY 16

Purchasing Officers Association

South Wales Branch:—"Problems in Transport," by Mr. C. E. Shaw, 7.30 p.m., at the Kings Head Hotel, Newport, Mon.

MAY 17

Incorporated Plant Engineers

Liverpool and North Wales Branch:—"Causes of the Deterioration of Lubricants in Industry," by Dr. H. E. Priston, 7 p.m., at Radiant House, Bold Street, Liverpool.

MAY 18

Institution of Chemical Engineers

29th Annual Corporate Meeting and Annual Dinner, 11 a.m., at the May Fair Hotel, Berkeley Street, London, W.1.

MR. MARIO OLIVO, the well-known Italian foundryman, is at present on a business trip in the Argentine.

MR. V. C. FAULKNER, Editor of the FOUNDRY TRADE JOURNAL last Tuesday addressed the Dereham Rotary Club on the subject of the "Foundry Industry".

BAILEY & CLAPHAM, LIMITED, heating and welding engineers, of Keighley (Yorks), which was founded over 60 years ago, has ceased production following the retirement of the managing director, Mr. F. Weatherhead.

PRINCESS MARGARET, who visited the British Industries Fair at Castle Bromwich on May 2, later laid the foundation stone of the new Colleges of Technology, Commerce, and Art in Aston Street, Birmingham.

BATHS HAVE BEEN PROVIDED for workers in a foundry of the North Eastern Marine Engineering Company (1938), Limited, Wallsend, and it is hoped eventually to extend similar facilities to workers in the company's other foundry.

THE FIRST of 30 mixed traffic locomotives of a new standard type, just completed at the Derby works of British Railways, was on view to the public at Marylebone Station, London, on April 26. It is planned ultimately to replace the 400 designs of locomotive now operating on British Railways with about 12 standard types.

THE FACTORY of the London Aluminium Company, Limited, at Fazeley Street, Birmingham, is to be sold by auction in Birmingham on May 24 because it has become "surplus to requirements." The workers are to be transferred to one of the company's three other Birmingham factories.

THE BRITISH IRON AND STEEL RESEARCH ASSOCIATION has acquired the whole of the light industrial premises at 140, Battersea Park Road, London, at which their physics, chemistry and plant engineering laboratories now occupy about one quarter. This will make available some 43,000 sq. ft. of additional laboratory and office accommodation, until recently occupied by the research department of Powell Duffryn Research Laboratories, Limited. The Association's plant engineering division and chemistry department, including the corrosion and refractories sections, will move into the new accommodation as soon as sufficient alterations have been completed. Starting within the next two months, the move will probably be completed in the autumn of this year. This in turn will make possible an expansion of the physics laboratories.

CLASSIFIED ADVERTISEMENTS

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

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

SITUATIONS WANTED

FOUNDRY FOREMAN, with 17 years' experience in die casting, requires position with progressive firm. Preferably in the South of England, but not essential.—Box 906, FOUNDRY TRADE JOURNAL.

YOUNG METALLURGIST, with sound experience laboratory and foundry, ferrous and non-ferrous, requires situation. Excellent qualifications.—Box 934, FOUNDRY TRADE JOURNAL.

ADVERTISER desires position as Light Castings WORKS' MANAGER. Technical and practical experience of mechanised and floor moulding. Patternshop, fitting and assembly shops. Excellent administrative training.—Box 942, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

PATTERNMAKERS REQUIRED.—MOYLE, KINGSTON-ON-THAMES.

JUNIOR METALLURGIST required for control work in Grey Iron Foundry of an expanding concern engaged in manufacturing agricultural machinery. State age, experience, and wage required.—Apply INTERNATIONAL HARVESTER CO., Doncaster.

A MOULDER, with good experience of Automobile manifold castings, to run a small country Foundry in Norfolk. Able to do own cores and produce a good job. A good rate of pay and bonus. We do not require a highly technical manager, but someone who can and will work on the floor to produce manifolds to our mutual advantage. State experience.—Box 912, FOUNDRY TRADE JOURNAL.

A STEEL FOUNDRY in Yorkshire is desirous of increasing its supervisory and technical staff. Personnel of a high standard of efficiency, coupled with initiative and a desire to progress are required for the supervision of a mechanised unit and also for a jobbing section. A good salary with housing accommodation will be provided for successful applicants. Write in the first instance, giving full details of experience to date, stating age and salary required.—Box 918, FOUNDRY TRADE JOURNAL.

A STEEL FOUNDRY, having a progressive and modern outlook, wishes to contact foundry personnel or metallurgical students having had either a technical or practical apprenticeship, who would be prepared to undergo a period of training which would result in the appointment to a position of foreman or higher level of authority should the applicant possess sufficient initiative and organising ability to warrant this. A good salary will be paid during the training period and housing accommodation found.—Box 920, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

EXPERIENCED FOUNDRYMAN, with managerial qualifications, will be accepted by an East Midland Company manufacturing Core Binders, Fluxes, etc. —Box 894, FOUNDRY TRADE JOURNAL.

PATTERNMAKERS (Wood and Metal). Excellent opportunities for younger men on all classes of work, under ideal conditions in the largest modern pattern shop.—G. PERRY & SONS, LTD., Hall Lane, Leicester.

REQUIRED.—Experienced GRAVITY DIE DRAUGHTSMAN. — Apply, JOHN DALE, LTD., London Colney, St. Albans.

THE STANTON IRONWORKS CO., LTD., near Nottingham, require an experienced FOUNDRY ENGINEER.—Apply in writing, giving experience and present salary, to the DEPUTY MANAGING DIRECTOR. Mark envelope " Personal."

FOUNDRY MANAGER. — Aluminium Sand and Die Casting. Good disciplinarian. Able to build up staff. Must be experienced foundryman. 20 per cent. increase on present salary for right man.—Box 956, FOUNDRY TRADE JOURNAL.

FOREMAN required, to supervise production at Grey Iron Foundry. 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.

METALLURGICAL CHEMIST required to take charge of Works routine laboratory. Must have metallurgical and analytical experience in aluminium and non-ferrous alloys, cast iron and steel, as well as sundry materials connected with foundry work. To be responsible to Chief Metallurgist and capable of supervising small staff. Will also be required to assist in making-up metal mixtures for crucible and cupola charges. The post calls for a wide range of activities and requires a versatile and interested man with good qualifications. Salary according to age and experience, pension scheme.—Apply, with full particulars of training and positions held, to GENERAL MANAGER, John I. Thornycroft & Co., Ltd., Engineers and Shipbuilders, Woolston, Southampton.

SITUATIONS VACANT—*Contd.*

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

WANTED, immediately, first-class young STRUCTURAL DRAUGHTSMAN. Good wages paid and house available.—Apply, stating age, wage and experience, to Box 936, FOUNDRY TRADE JOURNAL.

AN ASSISTANT CHEMIST required for a large Iron Foundry, North Midlands. Knowledge of cast iron analysis and preferably accustomed to sand control, although not essential. Please state experience and salary expected to Box 938, FOUNDRY TRADE JOURNAL.

CHEMIST (WORKS) required for laboratory of light engineering works, large manufacturing company, London (West) area. B.Sc. or equivalent qualification, with general experience, including metal finishes, an advantage. Age 25-30. Commencing salary £550 to £625. Pensions scheme.—Letters of application to Box 954, FOUNDRY TRADE JOURNAL.

FOUNDRY SUPERINTENDENT required for Non-ferrous Mechanised Foundry employing about 100 hands, in the Glasgow S.W. area. Applicants must have had previous mechanised and non-ferrous foundry experience, and be capable of engaging all their own labour.—Reply, stating age, experience, and salary required, to Box 950, FOUNDRY TRADE JOURNAL.

GOVERNMENT OF IRAQ.

FOUNDRY SHOP MANAGER required by the Iraqi State Railways for one tour of 3 years in the first instance. Salary: Iraqi Dinars 90 a month (I.B. 1 equals £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 experienced in modern foundry practice covering ferrous and non-ferrous metals. They must be capable of operating cupolan and tilting furnaces, have some knowledge of 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 M.25167B on both letter and envelope. The Crown Agents cannot undertake to acknowledge all applications, and will communicate only with applicants selected for further consideration.

MACHINERY FOR SALE

ONE Pneulec Herman Plain Jarring Machine, Bumper Type, having table plate 40 in. by 58 in. Maximum jarring capacity 7,000 lbs. at 80 lb. air pressure.—Apply W. C. HOLMES & CO., LTD., Turnbridge, Huddersfield. Tel.: Huddersfield 5280.

MACHINERY FOR SALE—*Contd.*

ELECTRICALLY-OPERATED 10-Cwt. Passenger Lift for Cupola. Height of lift approx. 15 ft. Carefully maintained and inspected.—Apply MONMER FOUNDRY, LTD., Willenhall.

SWARF Masticating Machine, by George White. Complete with 15 h.p., 400 volt, 3-phase Motor, and Star Delta starter. As new.—Apply H. B. BARNARD & SONS, LTD., Tipton.

FOR SALE.—Battery of 5-Core Drying Cabinets, by Modern Furnaces & Stoves, Ltd. Complete with firebox, electric motor, fan, etc. Would sell cabinets separately.—Offers for quick sale to THE BROCKMOOR FOUNDRY CO., LTD., Brockmoor, Brierley Hill, Staffs.

QUANTITY "MORRIS" Worm-geared Pulley Blocks, ½ to 7 tons. ALL at less than half makers' prices.
1-ton capacity, Paterson-Hughes, underslung o/h. Electric Lifting and Travelling Crane, 18 ft. span, 3/50/400 V.
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5-cwt. CLEAR SPACE TYPE PNEUMATIC POWER HAMMER. Alldays anvil block; 20 h.p. protected type S.C. Motor, 350/3/50.
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NEW 42 in. by 48 in.—ditto.

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

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PATTERNMAKING. — Accurate first-class Patterns for machine or hand moulding. Keen prices, quick delivery.—D. C. POOLE, 27, Priory Avenue, Taunton, Somerset. Tel. 5046.

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THE Pattern Equipment Co. (Leicester), Ltd., has immediate capacity for all types of wood and metal patterns, equipment for mechanised foundries a speciality.—147, Mount Road, Leicester; Telephone : 23773.

MISCELLANEOUS

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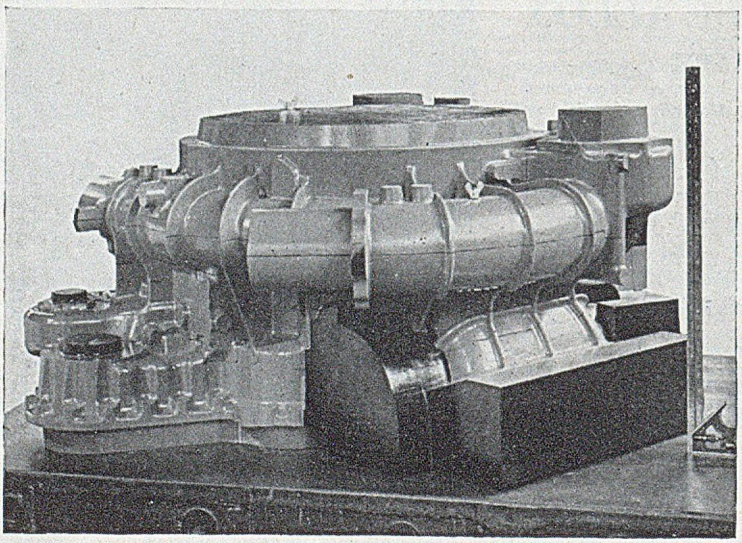

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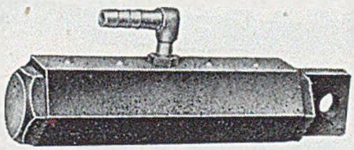

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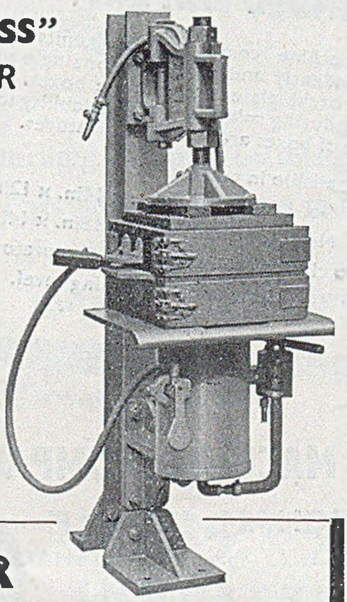

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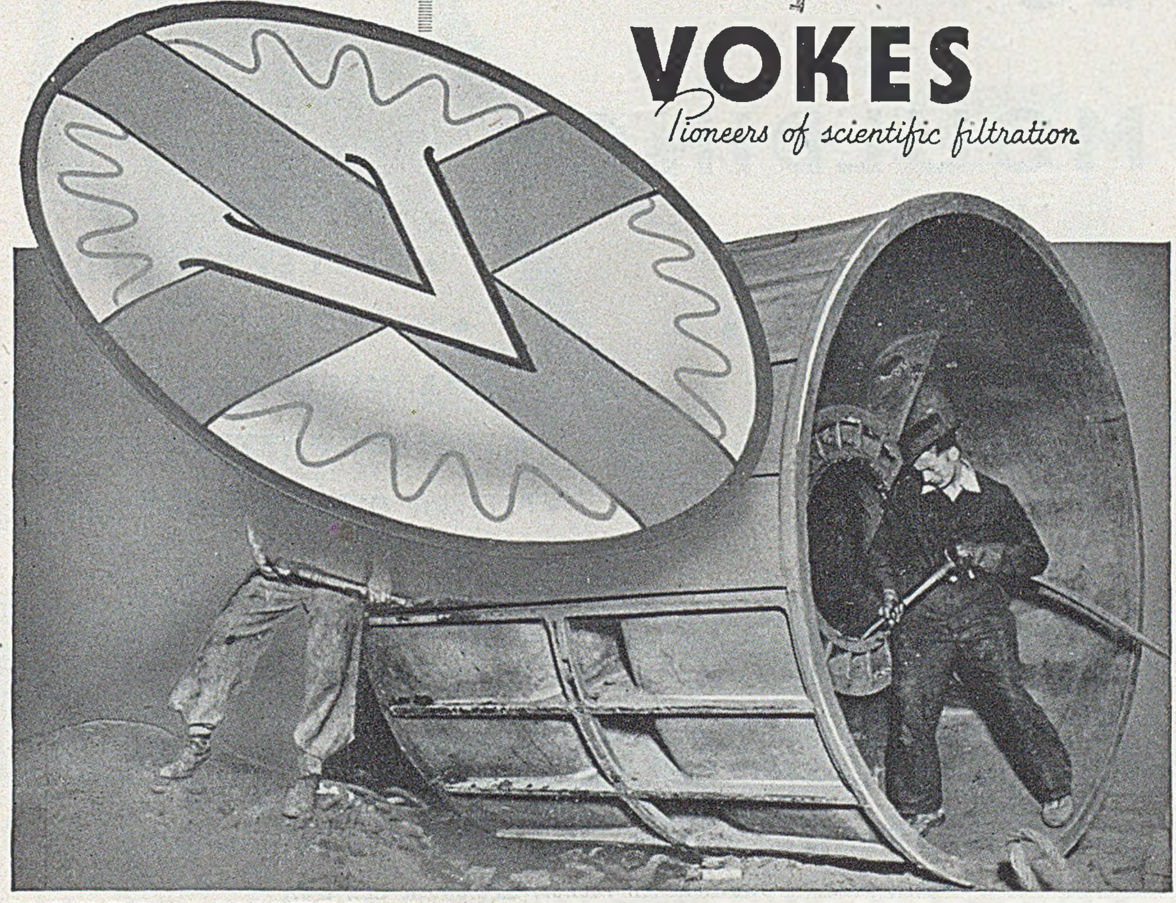

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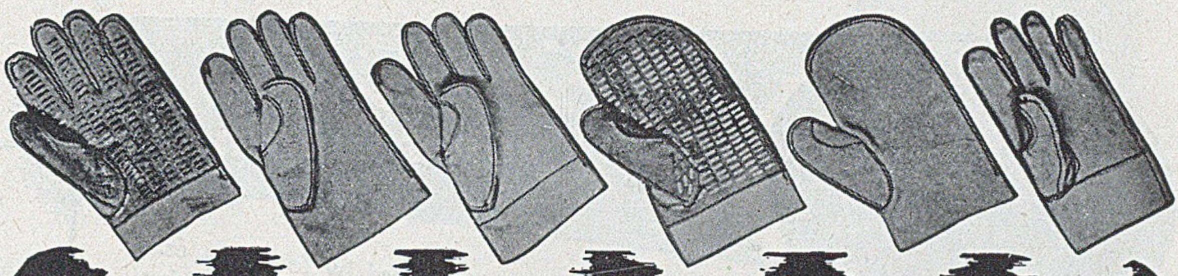

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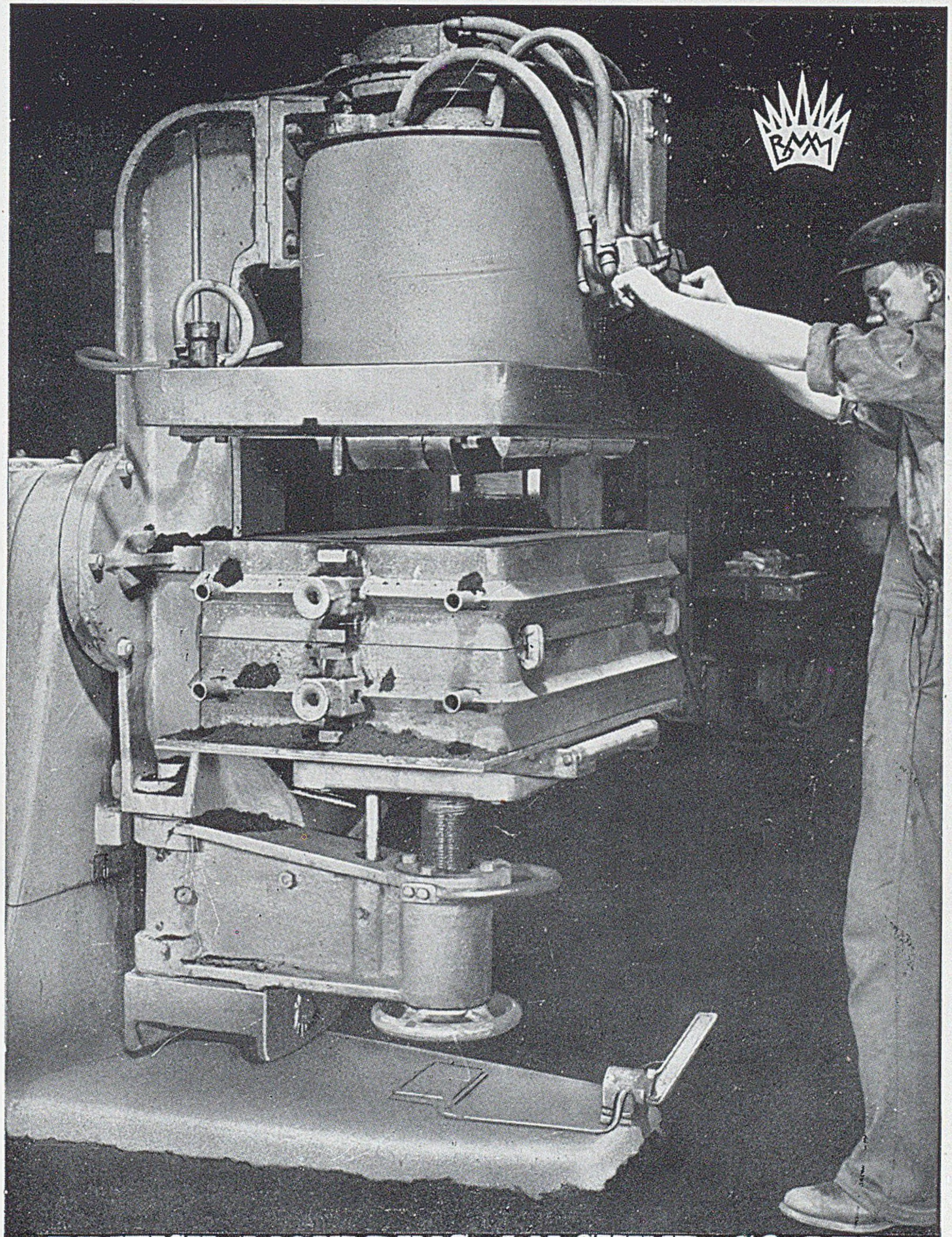

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