FOUNDRY TRADE JOURNAL

Established 1902

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

Vol. 91 Thursday, August 9, 1951 No. 1823

PRINCIPAL CONTENTS

PUBLISHED WEEKLY: Single Copy, 9d. By Post 11d. Annual Subscription, Home 40s., Abroad 45s. (Prepaid).
49, Wellington Street, London, W.C.2. 'Phone: Temple Bar 3951 (Private Branch Exchange) Grams: "Zacatecas, Rand, London"

Restrictive Practice

In order to help the national effort during the war, everybody in industry agreed to renounce restrictive practices. Yet now, although there is not exactly a peaceful atmosphere surrounding the international political situation, the Government are proposing to impose upon industry a limitation of dividend payments for the next three years. They do so as a gesture towards combating inflation, instead of tackling the major problem of national extravagance. For example, the increased amount paid since the freeze, said to be 0.06 per cent. of the national income, is but a "flea-bite" compared with the loss on the ground-nuts scheme. The situation which caused this proposal has been well expressed by the Federation of British Industries in a Press release which states:—"The adverse balance of overseas payments, which has been aggravated by a rise in cost of imported materials and foodstuffs, must be redressed. This will involve an increase in exports or a reduction in imports and both present serious difficulties. Domestic prices have been affected by the rise in cost of imports but the main inflationary pressure derives from the high level of spending which has itself been inflated by the needs of defence and the scale of Government expenditure generally. In short the total output of goods and services in this country is insufficient to maintain the present level of consumption (including capital outlay). There can be no remedy for this in the long term except higher productivity or reduced consumption. Yet this—the crux of the problem—received scant attention from the spokesmen of the Government who produced no policy to try to achieve these ends."

Foundry owners need incentives just as much as the operatives, but the new proposal removes the motive for progress. There is an inference that profit is something anti-social, and that hats should be taken off to those whose commercial careers end in Carey Street. The technical hazards to be associated with the foundry industry are sufficiently onerous without the knowledge that, no matter how successfully the concern is conducted, the reward will be a "lemon." For a number of sections of the industry, order-books are overflowing, raw materials are scarce and expensive, and labour is being increasingly difficult to find and retain. Only the well-organised concerns, headed by enthusiastic and ambitious leaders can establish a proper economic policy. The two principal factors are the stability of the enterprise and adequate profits, the latter being essential for the institution of the former. Moreover, what appears to be glossed over by the authors of the scheme is the fact that the money from dividends is exactly the same as income from any other source, and buys less and less with each succeeding year.

Very fortunately for this country, there is amongst foundry owners, as with most other industrialists, an inherent urge to progress. Despite the temporary (we hope) restriction on dividends, they will still pursue the customary path of striving to make each year a better showing than the last. This, of course, is essential for the prosecution of the export business coupled with the added burden of rearmament. The overcoming of day-to-day troubles will keep the foundry executive's mind off the stabilised reward for his efforts.

German Foundrymen's Association

Annual General Meeting

As previously announced, the 42nd annual general meeting of the Verein Deutscher Giessereifachleute will be held from September 27 to 29 in Düsseldorf. The following programme has been arranged.

Thursday, September 27.—(In the large dining hall of the Eisenhüttenhause 27 Breitestrasse. Professor H. Jungbluth presiding.).—3 p.m. Film Show—"Modern American Sand-handling"; 3.30 Mr. H. Herschenz on "Tests on Synthetic Sands" followed by contributions from Mr. J. Rembold and K. Houben; 4 p.m. Dr. M. Beilhack on "Recent Progress with the Cement-sand Casting Process" and at 4.30 Dr. H. Gries on "Cement-sand Practice." At 6 p.m. there will be supper at the Benrather Hof.

Friday September 28.—(In the Robert Schumann Hall, Exhibition Park, Dr. C. W. Pfannenschmidt presiding):—9 a.m. Mr. E. Mickel on "The Strength Properties of Malleable Cast Iron"; 9.30 Dr. O. Werner on "The Application of Spectro-analyses in Foundry Practice"; 10 a.m. Dr. K. Fink on "The Analysis of Bending Stresses in Cast Materials"; 10.45 American Film Show "Principles of Foundry Gating Technique" with a commentary by Mr. Ph. Schneider. At noon there will be luncheon (ladies invited) followed at 2.30 p.m. by the annual general meeting.

Continuing at 3.30 p.m. there will be papers by Professor M. Weller "The Executive and the Spoken Word"; 4.30 Mr. L. Brandt on "The Rôle of the Executive in Germany's Future." At 8 p.m. a dinner-dance and cabaret at the "Rheinterrasse" is arranged.

Saturday, September 29 (Meeting to be held at the Robert Schumann Hall, Dr. K. Roesch presiding). 10 a.m. Dr. W. Magers on "Modern Core-drying"; 10.30 Mr. H. Heimann on "Melting Practice"; 11 a.m. Dr. E. Lanzendörfer on "Heat-treatment"; 11.45 a.m. Professor E. Piwowarsky in "Moulding and Foundry Practice in Pre-Christian Times" followed at 1 p.m. by luncheon at the "Rheinterrasse."

A ladies programme has been arranged for Friday, September 28, starting with luncheon with the members, followed by a fashion parade at "Melodie" and ending with the dinner-dance at the "Rheinterrasse."

Readers desiring to participate should write for details to Dr. Hugo, 167 Hansa Allee (Gusstahlwerk Oberkassel) Düsseldorf Oberkassel, Germany.

Mount Pleasant Post Office

Last Friday afternoon, the Post Office at Mount Pleasant, where astronomical quantities of parcels and letters are dealt with, was visited by our representative. The showpiece was, of course, the underground railway connecting Liverpool Street and Paddington. The most interesting features from the industrial point of view were the mechanical-handling contrivances, though most of them deal with light and bulky loads. One type which appeared to be new was an inclined slotted skid beneath which ran a belt carrying special upright fingers projecting through the slot.

In the parcels section, which is a war-damaged building, the floor appears to be of a magnesite composition. For certain movements, ordinary well-made wheelbarrows are used. At one time, they were provided with rubber-tyred wheels, but these have now been discarded in favour of plain cast-iron wheels, to meet the preferences of the men using them. The problems facing the Post Office are exactly the same as with private industry—mainly, recruitment of man-power and difficulty in obtaining building licences—yet the work goes on and moreover goes on most efficiently.

Conference Paper Author

Marcel Chaussain

MR. MARCEL CHAUSSAIN.

Marcel Chaussain, Author of the French Exchange Paper presented to the I.B.F. Newcastle-upon-Tyne conference, which is printed on the facing page, was born at Villeneuve-sur-Allier in 1907. He holds the title of *Ingénieur* awarded by the *Conservatoire National des Arts et Métiers* in 1933. Mr. Chaussain was appointed some years ago as engineer and research manager at the laboratories of Usines St. Jacques de Montluçon of the Companie des Forges de Chatillon Commentry et Neuves Maisons, and is at present still serving in that capacity.

Follsain Wycliffe Extension

The first stages of a major expansion scheme, which will eventually provide increased employment, have now been put into operation at Lutterworth by Follsain Wycliffe Foundries, Limited, the oldest engineering works in the town. The company have acquired from George Spencer, Limited, the large modern building, formerly used by the Raleigh Company as a canteen, and all the intervening land.

Part of this building is already in use as a drawing office and the remainder is to be used partly as a store for the firm's thousands of patterns and partly as a machine-shop. A spokesman for the company states that when the removal has been completed the present machine-shop in the main works will be used as a finishing shop and the foundry will be extended into the present finishing shop.

Important items of new equipment include two additional two-two Sesci pulverised-fuel-fired melting furnaces, which will enable the weight of metal now being melted to be nearly doubled, and a new annealing furnace.

Among the amenities to be provided for employees, many of whom may have thirty years' service with the company, is a canteen, a sports and social club, and ultimately a sports ground.

Parallel with these developments at Lutterworth, where the original Wycliffe foundry was established in 1906, is an expansion programme being carried out by the company's wholly-owned subsidiary Varatio-Strateline Gears, Limited, in their factory at Slough.

New Abstract Service

The British Steel Founders' Association through its research and development division are giving an excellent service to their members by the periodic issue of abstracts of germane technical literature. These are set out under nineteen headings and are clearly and concisely written. Sufficient is given to indicate to the reader whether or not it is worthwhile to study the original. Whilst, obviously, this publication is not for general distribution, no doubt research bodies and the like will be favoured with copies on writing to the division at Broomgrove Lodge, Broomgrove Road, Sheffield 10.

Platinum-Platinum/Rhodium Thermocouples and their Industrial Applications*

By Marcel Chaussain

Official Exchange Paper from the Association Technique de Fonderie

In the temperature range between 1,000 and 1,700 deg. C., the most suitable measuring instrument is still the platinum-platinum/rhodium, thermo-electric pyrometer. The first researches of Le Chatelier in 1887[1] determined the composition of the platinum-platinum/rhodium 10 per cent. thermocouple,[2] which has been retained to the present day. Since Le Chatelier, the technique and instrumentation of the method have been much improved, but, in France at least, the available bibliography on the subject is still scanty. Sourdillon and Rolet[3] have studied the behaviour of thermocouples in service: apparent variation of the electromotive force, appearance of parasitic couples, corrosion and corrosion-protection of the wires. The most important researches and developments have originated in the United States, and have substantially modified both current methods, and the technique. The present Paper has the object of defining and determining the conditions ensuring maximum accuracy in temperature measurements with platinum-platinum/rhodium thermocouples.

Formerly, only direct calibration was used: a thermocouple was connected with an instrument measuring the e.m.f. Calibration consisted in determining the e.m.f. corresponding to a number of "fixed points" from which a temperature curve was plotted against the e.m.f. values.

Repeated calibration enabled the variations of the e.m.f. of the couple to be compensated, but continued use of the thermocouple wires introduced, as demonstrated by Sourdillon and Rolet, parasitic couples, the value and importance of which was for long overlooked. In current practice, it was found difficult to continue calibration beyond the fixed point for gold at 1,063 deg. C., and the calibration curve could not be exterpolated beyond 1,200 deg. without risk of grave errors.

The method of calibration by standard curves has to-day replaced the method of direct calibration. For the Pt-PtRh couple, a standard calibration table has now been established, conventionally and internationally recognised, and giving the e.m.f.-temperature relationship.

The standard for the Pt-PtRh thermo-electric table set up by Adams. After the development of optical pyrometry had enabled reference tables to be drawn up, more accurately representing the characteristics of thermocouples, an investigation was made by Roesser and Wensel of the U.S. National Bureau of Standards, the new table, based on the international temperature scale, being published in February, 1933. Standard specifications published by the U.S. Bureau of Standards and approved by the International Convention, have determined the conditions for purity, reproducibility, and stability of the couple wires. These standards are summarised below. The wire diameter has been standardised at 0.5 mm. to ensure best conditions for stability and thermal conductivity. The chemically-pure platinum kept by the U.S.A. as a National Standard under Ref. N.B.S. Pt. 27, is the reference standard for all production. Rhodium is preferred to iridium as a platinum alloy constituent by reason of its better resistance to contamination at high temperatures.

The standard for the Pt-PtRh thermo-electric couple is founded on the Pt 27 National Standard in accordance with conversion tables set up by Roesser and Wensel. The proportion of rhodium in the alloy is fixed at 10 per cent. The specific e.m.f. value according to the tables, and used in calibration, is 10.301 millivolts at 1,063 deg. C. The degree of purity of the platinum is calculated by means of a coefficient α, depending on the values of the electrical resistance recorded at 0 and 100 deg. respectively, in such manner that:—

$$\alpha = \frac{R_{100} - R_0}{100\,R_0} \geqslant 0{\cdot}00392$$

The degree of purity of the platinum/rhodium is likewise calculated by a resistivity coefficient α as follows:

$$\alpha = \frac{R_{100} - R_0}{100\,R_0} \geqslant 0{\cdot}00434$$

Furthermore, American pyrometer makers and suppliers of platinum wire have agreed the text of a test and inspection specification, of which the following is an abstract:—

(*a*) *Platinum Wire.*—The maximum deviation against a standard N.B.S. Pt 27 wire shall not exceed 10 microvolts at 1,200 deg. C. The deviation shall be approximately linear between 0 and 1,500 deg. C. The maximum difference in e.m.f. over a continuous length of wire measured at intervals of 1.2 metre, shall not exceed 4 microvolts.

(*b*) *Platinum/Rhodium Wire.*—The maximum deviation against a standard N.B.S. wire shall be positive and equal to 24 microvolts. Negative deviations are not permitted. Deviation shall be approximately linear between 0 and 1,500 deg. C. The maximum difference of e.m.f. over a continuous

* Prepared by the Cie. des Forges de Chatillon, Commentry et Neuves Maisons, Usines Saint-Jacques, Montlucon, and presented at the Newcastle-upon-Tyne conference of the Institute of British Foundrymen.

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length of wire measured at intervals of 1.20 metre, shall not exceed 3 microvolts.

At the present time, all thermo-electric pyrometry is based on these standards, and the method of the standard curve is in current use, both by laboratories and in industry. It is obvious, however, that this method, which *in no case* allows modification of the millivolt or degree scales, requires as a *sine qua non*, the complete accuracy, interchangeability, and stability of the thermocouple wires.

The conditions stipulated in the international standards call for particular care in the manufacture of thermocouple wires, and a degree of purity of the metal exceeding that hitherto usual. Correct application of the method, however, does not depend solely on the use of new wires: the stability of the wires in service, also requires consideration. It is convenient, therefore, to know and have ways and means of calculating the purity, homogeneity and degree of contamination, of the thermocouples used.

Survey and Application of Methods for the Testing and Inspection of Platinum and Platinum/rhodium Wires for Thermo-electric Couples

The first tests made on the control and checking of thermocouple wires, furnished a mass of numerical results which it proved impossible to interpret and to evaluate for lack of proper documentation and practical experience. For this reason, researches were commenced in the Laboratory of the Usines St.-Jacques at Montlucon, as described in the following chapters, on the testing and inspection methods most suitable for checking platinum and platinum/rhodium wires, and on their application. The specifications of the Bureau of Standards have enabled an opinion to be stated, on the value of the testing methods used: measurement of the electrical resistance of the wires, and measurement of the e.m.f. In the first instance, resistance measurements were eliminated, as not furnishing practical and easy evaluated data, and recourse was had to the classical and conventional method of fixed points.

In this form of application, the method is not used for plotting the calibration curve of a thermocouple, but only to determine the e.m.f. values at suitably selected points. The differences between the values found and the corresponding values in the standard calibrating table, represent the absolute error of the tested thermocouple at the temperature in question. This method is a checking technique: it may be considered as difficult and delicate in application, and of restricted interest, since it has little chance of being useful in the study of the behaviour of thermocouples in service, as already pointed out by Sourdillon and Rolet.

In view of the inadequacies of the method, it was necessary to seek another technique, and particular attention was presently directed on the method of deviations against a standard reference wire, complying with the test specification of American makers. The method consists of checking each wire separately and comparing it with a standard reference wire of the same type. For each test, a separate couple is made up: platinum reference/platinum test wire, or platinum/rhodium reference/platinum/rhodium test wire. The purity and homogeneity are determined for each temperature of the hot joint (cold joint at 0 deg.) by measuring the positive or negative e.m.f., Δe, usually stated in microvolts, μv. Two wires will thus be identical, if they give a reading of $\Delta e = 0$ at all test temperatures.

The method of determining the deviation against a standard reference wire, or differential method using comparison standards, is dependent on the following requirements:

(1) Platinum and platinum/rhodium standard wires with thermo-electric characteristics perfectly defined with regard to the N.B.S. International Reference Standards. It is advisable to have available for each test sample, two reference standards:—

(*a*) primary and secondary reference samples of platinum wire, and

(*b*) primary and secondary reference samples of platinum-rhodium wires. The thermo-electric characteristics of the primary reference samples should be determined against the N.B.S. International Reference Standards. The suppliers of the wire shall supply a Certificate of Calibration of their reference samples. The properties of the secondary reference samples can be verified by the users themselves, against the primary samples. All actual measurements are made against the secondary samples; the primary samples being purely intermediate reference standards against which the secondary or calibration samples are periodically checked.

(2) A potentiometer instrument enabling the electromotive force Δe, to be measured. Generally, the measurable e.m.f. is very low, of the order of a few microvolts. The instrument itself, should therefore be accurate within one microvolt.

Fig. 1 shows the circuit arrangement used. The source of heat is formed by an electric platinum resistance furnace enabling temperatures up to 1,300 deg. C. to be obtained. The differential thermocouple is placed in the furnace simultaneously with a standard couple which actually measures the temperature. The hot junction of the two couples are placed side by side at the same height in the furnace. The cold junctions of both couples are maintained at 0 deg. The potentiometer has a measuring range of 160 millicolts, the potentiometer slide indicating 0.5 μv per scale division. The counter e.m.f. is provided by a standard Weston cell with a potential known within 0.25×10^{-6} volt nearly, according to the cell temperature. The potentiometer is used in conjunction with a zero-point galvanometer and photo-electric amplifier. Fig. 2 shows the assembly of the equipment.

The primary and secondary reference and calibration wires used, had characteristics within the limits of tolerance prescribed by the Bureau of Standards. E.m.f. tests at the fixed point of gold

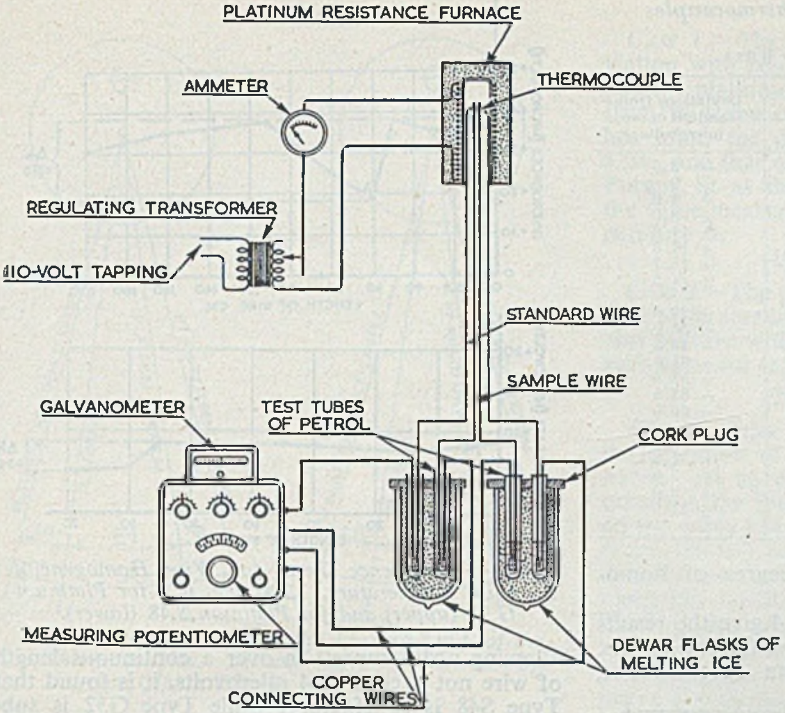

FIG. 1.—*Circuit Diagram of the Differential Arrangement for Thermocouple Checking.*

give, with a couple formed of platinum primary sample + platinum/rhodium primary sample, values between 10.289 and 10.304 mv., which values are within the limits specified for N.B.S. wires.

The secondary samples gave no measurable divergencies against the primary samples; all the experimental results given in this report have been referred to these samples as standards. In making a test, the furnace is brought to the temperature required and as soon as this is stabilised the e.m.f. value Δe of the differential couple is determined. The tests are then repeated, under the same conditions, for different temperatures.

This method has been used for checking the purity of thermocouple wires: Table I gives results obtained with wires of various origin and quality. If there are plotted (Fig. 3) the deviations Δe in micro-volts as ordinates, against the temperatures in milli-volts as abscissæ, it will be seen that for any grade of wire, platinum or platinum/rhodium, the experimental points are arranged along straight lines, within the temperature range of the tests (3.6 to 13 mv., *i.e.*, 440 to 1,300 deg.); Δe is directly proportional to the temperature, and the straight lines slope differently towards the axis of the abscissæ. All the platinum wires tested gave positive deviations with respect to the standard platinum sample. The platinum/rhodium test-wires gave either positive or negative deviations against the reference standard.

Following the American specifications which permit a maximum deviation of $+10\mu$v. at 1,200 deg. (1,200 deg. = 11.924 mv.) for platinum; a positive deviation corresponding to 24μv. for platinum-rhodium, it will be seen that the type S48 wires are within standard limits, while the other wires are sub-standard. Within the limits of the experimental temperatures, the deviations were found to be practically linear with reference to temperature, as stipulated in the standard specifications; and this linearity was found to persist even in the wires showing the greatest deviations from the reference standards.

The method was then applied to the determination of the homogeneity of the test wires, using the same equipment. The set-up of the differential thermocouple was, however, modified; after each test, the end of the reference wire was placed in contact with a different point on the test wire. Measurements were effected at a temperature of 1,200 deg. The difference between the highest and

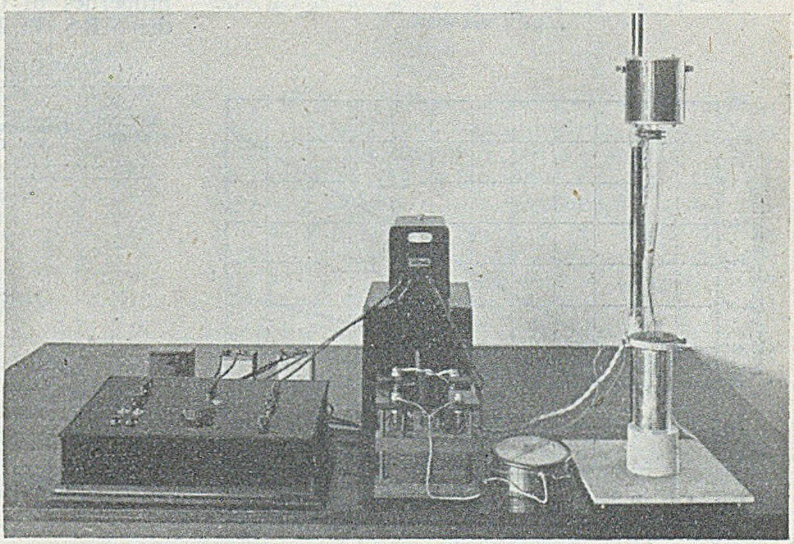

FIG. 2.—*Actual Apparatus required for the Differential Method of Checking.*

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TABLE I.—*Purity Tests on Thermocouple Wires.*

Ref. No. of Couple.	Test Temperatures, millivolts.	Δe, millivolts. Pt	Δe, millivolts. Pt-Rh	Deviations from standard curve, microvolts.
S 39	3.62	+ 7.0	+ 3.5	− 3.5
	5.17	+ 12.0	+ 12.0	0
	6.75	+ 17.0	+ 21.0	+ 4.0
	8.00	+ 19.5	+ 27.5	+ 8.0
	9.00	+ 21.5	+ 32.8	+ 11.8
	10.00	+ 25.0	+ 39.5	+ 14.5
	11.42	+ 28.8	+ 47.5	+ 18.7
	13.00	+ 33.0	+ 57.5	+ 24.5
S 46	3.61	+ 19.0	− 10-0	−29.0
	5.21	+ 27.0	− 9.0	− 36.0
	7.37	+ 38.0	− 8.0	− 46.0
	8.67	+ 43.5	− 7.5	− 51.0
	9.02	+ 45.0	− 7.5	− 52.5
	11.56	+ 58.0	− 5.5	− 63.5
	13.00	+ 66.0	− 3.5	− 69.5
S 48	5.20	+ 5.0	+ 3.0	− 2.0
	7.33	+ 6.0	+ 8.5	+ 2.5
	9.57	+ 7.0	+ 13.0	+ 6.0
	11.34	+ 8.0	+ 17.0	+ 9.0
	12.97	+ 9.0	+ 20.5	+ 11.5

lowest readings represented the degree of homogeneity of the wire, *i.e.*, Δh.

Table II and the curves in Fig. 4 give the results obtained with platinum wires of different grades. In accordance with the American specifications,

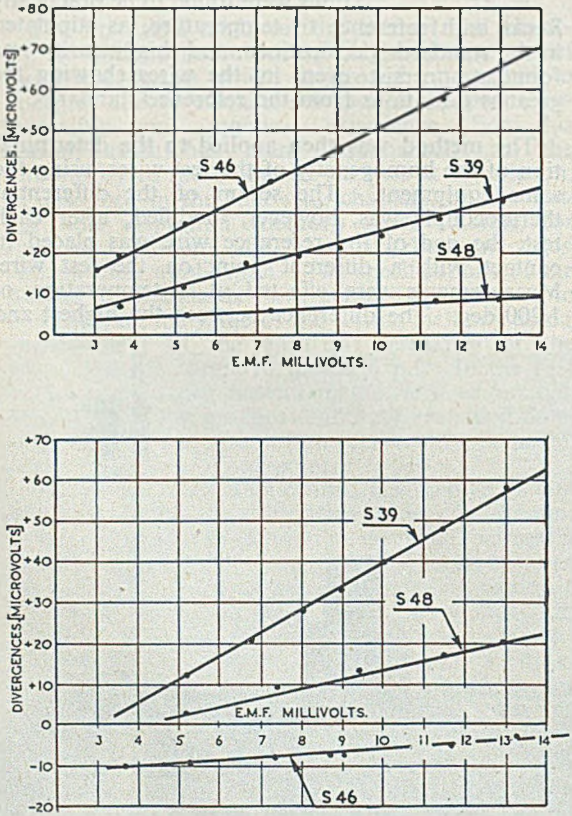

FIG. 3.—*Reference Tests for Wire Purity for Platinum (upper) and for Platinum/Rhodium (lower)*

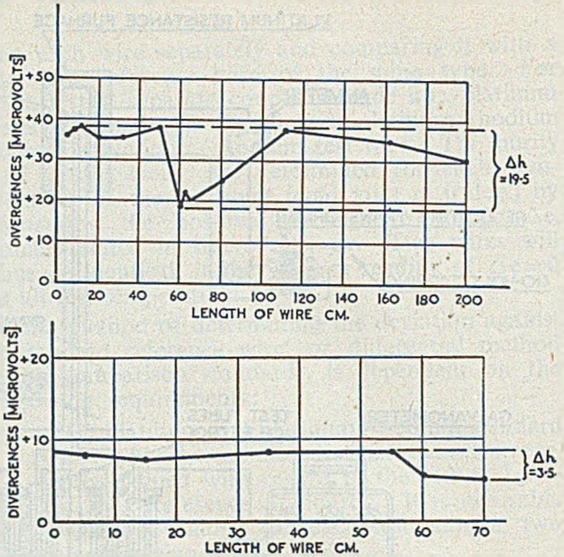

FIG. 4.—*Reference Tests for Wire Homogeneity (Test Temperature, 1,200 deg. C.), for Platinum G.32 (upper) and for Platinum S.48 (lower).*

allowing a difference Δh over a continuous length of wire not exceeding 4 microvolts, it is found that Type S48 is satisfactory, while Type G32 is substandard (this latter type is, as a matter of fact, also substandard in purity).

The differential method using standard reference samples, enables each wire to be tested separately and compared with a standard sample of equivalent type. Since the whole research is concerned with the use of wires in thermocouples, the method affords the possibility of determining the properties of thermocouple wires in association.

If the properties of the two wires of a couple are referred to the properties of the appropriate standard samples, the properties of the thermocouple in question can likewise be referred to the properties of the standard thermocouple. Since the N.B.S. Pt 27 International Standard applies to

TABLE II.—*Homogeneity Tests on Thermocouple Wires.*

Ref. No. of Couple.	Test Temperature deg. C.	Distances, cm.	Δe, microvolts.	Homogeneity factor.
G 32	1,200	4	36	
		8	37	
		12	38	Δh = 19 5
		20	35	
		30	35	
		50	38	
		60	18.5	
		62	22	
		64	20	
		80	25	
		111	37.5	
		162	35	
		200	30	
48	1,200	0	8.5	Δh = 3.5
		5	8	
		15	7.5	
		35	8.5	
		55	8.5	
		60	5.5	
		70	5	

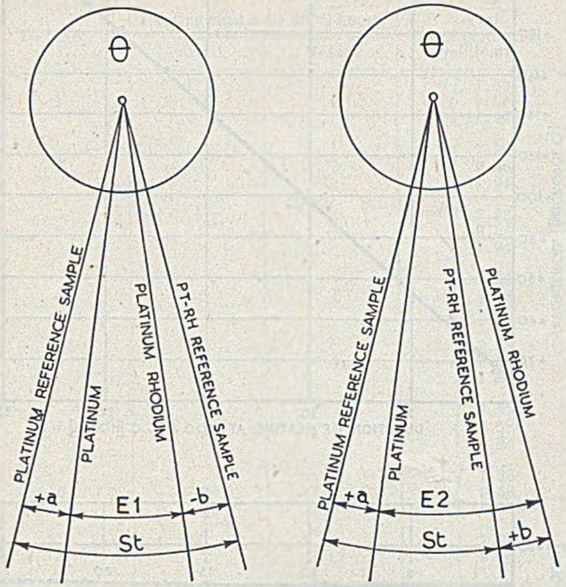

FIG. 5.—*Determination of the Thermo-e.m.f. of the Thermocouples. 1st case (left),* $E1 = St - (a + b)$; *2nd case (right),* $E2 = St \quad (a + b)$.

chemically-pure platinum, all platinum wires will give positive deviations with reference to this standard. Platinum-rhodium wires, on the other hand, may give either positive or negative deviations with respect to the corresponding N.B.S. standard. Two cases are thus possible, as shown diagrammatically in Fig. 5.

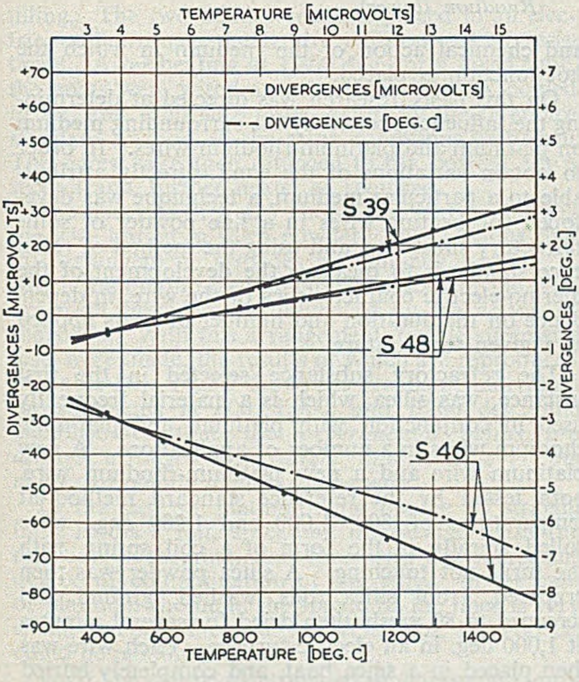

FIG. 6.—*Divergences of the Thermocouples from the Standard Curve.*

Case 1.—The platinum wire gives a positive deviation with respect to the corresponding standard, and the platinum-rhodium wire a negative deviation from its standard. For any temperature θ of the hot joint, the deviation of the platinum wire is a.μv., and that of the platinum-rhodium wire b.μ.v. Putting St as the standard e.m.f. value, and E as the value measured on the test couple, then for temperature θ:

$$(1)\ E = St - (a + b) \quad \ldots\ldots\ldots$$

Case 2.—The platinum wire is positive with reference to its standard, and the platinum-rhodium wire also positive with reference to its own standard. In such case, for temperature θ:

$$(2)\ E = St - (a - b)$$

The algebraic sum of a and b thus represents the deviation of the test couple from the standard curve. As an example of the application of this principle, the results of Table I for the purity tests on the wires enable calculation for the temperature range 440 to 1,300 deg., of the deviations from standard of the thermocouples S39, S46 and S48. The numerical results are given in the last column of Table 1, and plotted in Fig. 4, which also shows the errors in deg. C. calculated from the mean conversion factors of milivolts per degree, according to the standard tables.

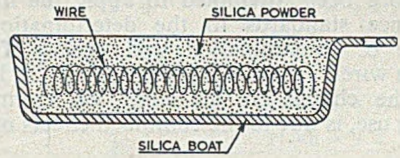

FIG. 7.—*Arrangement of the Wire in the Combustion Boat.*

The curves of error of Fig. 6 have been exterpolated to 1,500 deg. At this temperature, the deviations are:

+2.7 deg.	for Couple	S 39
−6.7 deg.	„ „	S 46
+1.4 deg.	„ „	S 48

It will be seen that Couple S 48, the constituent wires of which have thermo-electric characteristics within the standard limits, has a practically negligible error up to 1,500 deg. For the Couple S 39, the error at 1,500 deg. is still acceptable, indicating that in practice it is still possible to use wires with substandard characteristics, by coupling a platinum wire having a pronounced positive deviation, with a platinum/rhodium wire having similarly a pronounced positive deviation. In such case, however, the requirement of complete interchangeability of the wires is no longer maintained, and the problem becomes more complicated.

These preliminary tests have shown the differential method of comparison with reference standards to be a very suitable technique for checking thermocouples and thermocouple wires. The method is most satisfactory for testing wire purity and homogeneity, and allows the straight-line curves of Δe against e.m.f., to be accurately plotted. According to

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American sources, such straight-line curves can be exterpolated to 1,500 deg. without great error, and the method thus affords the advantage that the properties of wires and couples can be verified beyond test limits, for temperatures which it would be difficult to attain and to determine by ordinarily-available means.

The principal difficulty of the method concerns the extreme sensitivity of measurement required, in view of the very low electromotive forces to be determined: measurements must be made with greatest care, and precautions taken to ensure good electric contact at all points; in particular, the hot joint made by twisting the wires, should be properly closed.

Test Measurements of the Contamination and Ageing of Thermocouple Wires

It is generally found that Pt-PtRh thermocouples cease to work satisfactorily owing to contamination of the wires in service, causing the appearance of parasitic couples modifying the thermo-electric characteristics of the assembly, and in numerous cases, considerable doubt exists as to the accuracy and reliability of the temperatures measured. It has therefore been attempted to apply the method of reference standards to the determination of the degree of contamination and ageing of thermocouple wires. As already pointed out by Le Chatelier, the change in the e.m.f. of thermocouples during use, is due to the combined effects of physical and chemical action of the medium in which the hot junction is placed.

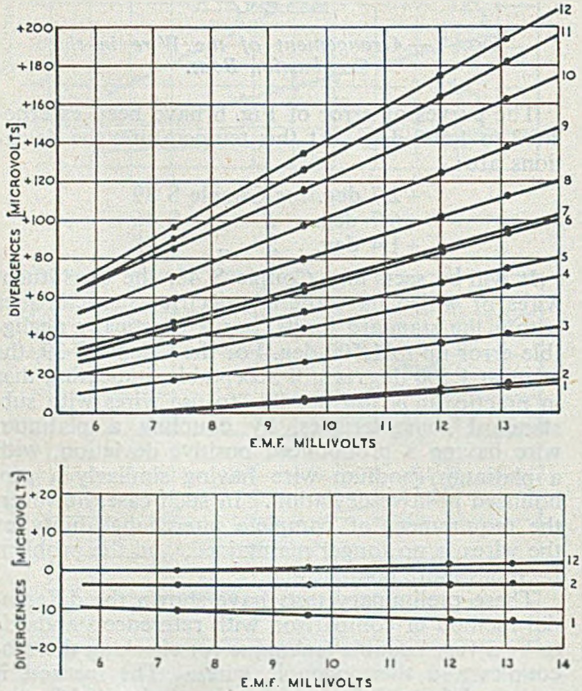


FIG. 8.—*Measurement of the Degree of Contamination of Wires in Silica; for Platinum (upper) and for Platinum/Rhodium (lower).*

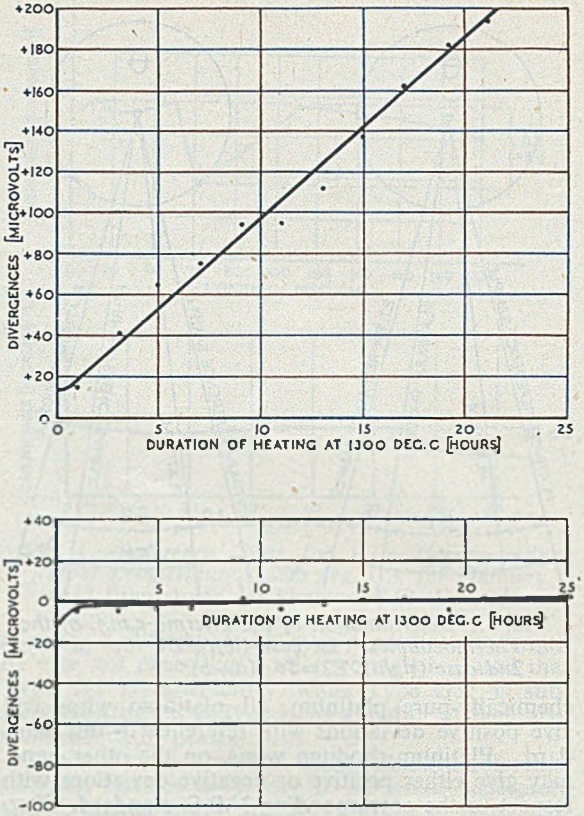


FIG. 9.—*Test carried out in Silica; Characteristic Curves for Platinum (upper) and Platinum/Rhodium (lower).*

On this basis, research was directed at determining the influence exerted by the surrounding medium on platinum and platinum-rhodium wires. In order to obtain variations of the e.m.f. directly attributable to a particular medium, a technique was developed for heating wires in a fine powder of some refractory substance, and using the method of reference standards to measure the development of the thermo-electric characteristics of the wire, in dependence on the duration and number of heats applied at a given temperature.

The refractory substance selected in the first instance, was silica, which is a material frequently used in conjunction with platinum and platinum-rhodium wires in a number of applications. A new platinum wire and a new platinum-rhodium wire, both tested by the reference standard method at temperatures of 800, 1,000 and 1,200 deg., were rolled spirally in the form of a coil spring, with the turns not touching. A silica powder was then prepared, from silica rods, washed, ground and screened to 80 mesh, then dried for several minutes at 1,000 deg. in an electric furnace. Each wire was then placed in a silica boat, and completely buried in the powder. Good contact between the powder and the metal, was ensured by tapping the boat while

TABLE III.—*Contamination Tests on Thermo-Couple Wires, in Silica.*

Test No.	Heating time at 1,300°, hours. Partial.	Total.	Test Temperatures, millivolts.	Δe, millivolts. Pt	Pt-Rh	Δe, μv, exterpolated to to 1,300° (13.120 mv.)
1	0	0	7.33	+ 2	− 11	Pt = + 13.5
			9.58	+ 6	− 11.5	—
			11.94	+ 11	− 12	Pt/Rh = − 12.5
2	1	1	7.33	+ 2	− 4	Pt = + 15
			9.58	+ 6.5	− 4	—
			11.94	+ 12	− 3.5	Pt/Rh = − 3.5
3	2	3	7.33	+ 17	− 6	Pt = + 41
			9.58	+ 26	− 5.5	—
			11.94	+ 36	− 5.5	Pt/Rh = − 5
4	2	5	7.33	+ 30	− 3.5	Pt = + 65.5
			9.58	+ 44	− 3.5	—
			11.94	+ 58	− 3	Pt/Rh = − 5
5	2	7	7.33	+ 37	− 2.5	Pt = + 75
			9.58	+ 52	− 2.5	—
			11.94	+ 67	− 2	Pt/Rh = − 2
6	2	9	7.33	+ 44	− 2	Pt = + 93
			9.58	+ 62	− 2	—
			11.94	+ 83	− 1.5	Pt/Rh = − 1.5
7	2	11	7.33	+ 47	− 2	Pt = + 95
			9.58	+ 65	− 3	—
			11.94	+ 86	− 3.5	Pt/Rh = − 4
8	2	13	7.33	+ 59	− 1.5	Pt = + 112
			9.58	+ 80	− 1.5	—
			11.94	+ 101	− 1	Pt/Rh = − 1
9	2	15	7.33	+ 70	0	Pt = + 138
			9.58	+ 97	0	—
			11.94	+ 124	+ 1.5	Pt/Rh = − 2
10	2	17	7.33	+ 85	+ 4.5	Pt = + 162.5
			9.58	+ 115	+ 4	—
			11.94	+ 147	+ 3	Pt/Rh = + 2.5
11	2	19	7.33	+ 90	− 6.5	Pt = + 182
			9.58	+ 125	− 7.5	—
			11.94	+ 163	− 7.5	Pt/Rh = − 8
12	2	21	7.33	+ 96	0	Pt = + 194
			9.58	+ 135	+ 1	—
			11.94	+ 175	+ 1.5	Pt/Rh = + 2

filling. The two boats were then placed in an electric muffle furnace, heated by a silicon carbide resistance. After heating at 1,300 deg. for a given time, the boats were withdrawn from the furnace, cooled in air, and each wire tested again by the reference standard method, in the same conditions as before. The wires were then returned to the powder for a second and further heats, as required.

The diagram in Fig. 7 shows the boat containing the wire buried in silica powder. It is obvious that this arrangement provides an ambient medium in which the thermo-electric characteristics of the wire are most considerably influenced by the action of the silica. With this arrangement, twelve successive tests were made, the results of which are reproduced in Table III. Fig. 8 shows the results of individual measurements at 800, 1,000, and 1,200 deg., and demonstrates that the *experimental points are always arranged in straight lines, whatever the degree of contamination of the wire.*

In the case of platinum, the bundle of straight lines forms a fan, spreading increasingly with the duration of heating, and thus with the increasing degree of contamination of the wire. In the case of platinum-rhodium, the spread of the lines is very small, and only the results of Tests Nos. 1, 2 and 12, could be reliably plotted.

Each line can be exterpolated to determine Δe for a temperature of 1,300 deg. (1,300 deg. = 13.120 mv) which is exactly the temperature of the electric heating furnace. If these values of Δe found by exterpolation to 1,300 deg. are plotted as ordinates against the duration of heating at this temperature, characteristic curves are obtained as shown in Fig. 9, which particularly well illustrates the development of the thermo-electric properties of the wires.

For platinum, it is found that, after a first heating of 1 hr., the thermo-electric characteristics are practically unchanged; with successive heats of 2 hrs. each, the thermo-e.m.f. increases directly with the total heating time. For platinum-rhodium, the thermo-e.m.f. increases slightly during the first two heats, and even more slowly thereafter.

To summarise, these results show that, when tested in silica, platinum at first resists contamination in some degree, but subsequently experiences very pronounced modifications of its thermo-e.m.f. In the case of platinum-rhodium, on the contrary, the thermo-e.m.f. is at first slightly influenced, and subsequently becomes substantially constant.

Following on an acid oxide such as silica, tests were then made with a basic refractory oxide, *viz.*, magnesia. The product used was chemically pure, powdered magnesia, first heated to 1,000 deg. in an electric furnace, then ground and screened to 80 mesh. The technique was the same as in the silica tests, the wires being imbedded in the magnesia powder.

TABLE IV.—*Contamination Tests on Thermo-Couple Wires, in Magnesia.*

Test No.	Heating Time at 1,300 deg., hours.		Test Temperatures, millivolts.	Δe, microvolts.		Δe, μv, exterpolated to 1,300 deg. (13.120 mv.)
	Partial.	Total.		Pt	Pt/Rh	
1	0	0	7.33	+ 2	− 11	Pt = + 13.5
			9.58	+ 6	− 11.5	—
			11.94	+ 11	− 12	Pt/Rh = − 12.5
2	2	2	7.33	+ 2	− 6	Pt = + 13.5
			9.58	+ 6	− 9.5	—
			11.94	+ 11	− 12.5	Pt/Rh = − 14
3	2	4	7.33	+ 1	− 11	Pt = + 10.5
			9.58	+ 5	− 15	—
			11.94	+ 9	− 21	Pt/Rh = − 22.5
4	2	6	7.33	+ 2	− 13	Pt = + 12.5
			9.58	+ 6	− 19.5	—
			11.94	+ 10	− 26.5	Pt/Rh = − 30
5	2	8	7.33	+ 2	− 15	Pt = + 12
			9.58	+ 5.5	− 23.5	—
			11.94	+ 10	− 34	Pt/Rh = − 37.5
6	2	10	7.33	+ 3	− 19.5	Pt = + 15.5
			9.58	+ 8	− 27.5	—
			11.94	+ 13	− 36.5	Pt/Rh = − 41
7	2	12	7.33	+ 3	− 22.5	Pt = + 16.5
			9.58	+ 8.5	− 31.5	—
			11.94	+ 14	− 44.5	Pt/Rh = − 47.5
8	2	14	7.33	+ 2	− 28.5	Pt = + 9.5
			9.58	+ 5	− 39.5	—
			11.94	+ 8	− 52	Pt/Rh = − 57.5
9	2	16	7.33	+ 2	− 27.5	Pt = + 6
			9.58	+ 2.5	− 40.5	—
			11.94	+ 3.5	− 58.5	Pt/Rh = − 62
10	2	18	7.33	+ 2	− 32	Pt = + 6
			9.58	+ 2.5	− 46	—
			11.94	+ 3.5	− 60.5	Pt/Rh = − 68
11	2	20	7.33	+ 1.5	− 31	Pt = + 3.5
			9.58	+ 2	− 47	—
			11.94	+ 3	− 65.5	Pt/Rh = − 73.5
12	6	26	7.33	+ 3	− 50	Pt = + 15
			9.58	+ 7.5	− 68	—
			11.94	+ 13	− 87	Pt/Rh = − 96.5

A similar series of 12 consecutive tests was made at a temperature of 1,300 deg., and the results obtained are shown in Table IV. The results of the individual measurements in all cases furnish experimental spots arranged along straight lines, whatever the degree of contamination of the wire. The characteristic curve of these results in given in Fig. 10. For platinum, the variation in the thermo-e.m.f. is practically nil. Tests were continued for a total of 26 hrs. without detectable variations exceeding the limits of experimental error. For platinum-rhodium wire, the thermo-e.m.f. decreases perceptibly in the second hour's heat and then varies proportionally with the duration of heating.

Summarising these results, platinum in magnesia remains passive and resists contamination to such an extent that even prolonged heating showed no variation of the thermo-electric characteristics. Platinum-rhodium, on the contrary, experiences a rapid change in its thermo-electric properties.

After silica and magnesia, tests were made with a neutral refractory oxide: alumina. The product used was powdered alumina as used for metallographic purposes, screened at 80 mesh and dried for several minutes at 1,000 deg. in an electric furnace. The technique remained the same, the wires being buried or imbedded in the powdered alumina. Eleven consecutive tests were made at 1,300 deg., the results of which are summarised in Table V. The results of the individual measurements produce, as before, experimental spots arranged among straight lines irrespective of the degree of contamination of the wire. The corresponding characteristic curve is represented in Fig. 11. In the first three hours of heating, the thermo-electric characteristics of the platinum wire remained constant, and thereafter varied proportionally with the heating time.

Platinum-rhodium showed a diminution in thermo-e.m.f. after 2 hrs.' heating. In alumina, both platinum and platinum-rhodium show some initial resistance to contamination, after which their thermo-electric properties become increasingly modified with increased duration of heating.

The technique of these tests having thus been developed and perfected, platinum and platinum-rhodium wires were further tested in other refractory media. Results are now given, obtained with chemically pure thorium oxide, ThO_2. The experimental technique was the same, the oxide being dried before use for several minutes at 1,000 to 1,100 deg. C. Thirteen consecutive tests were made, at a temperature of 1,300 deg. Table VI gives the results, and Fig. 12 the characteristic curve.

Platinum remains stable over a long period, of the

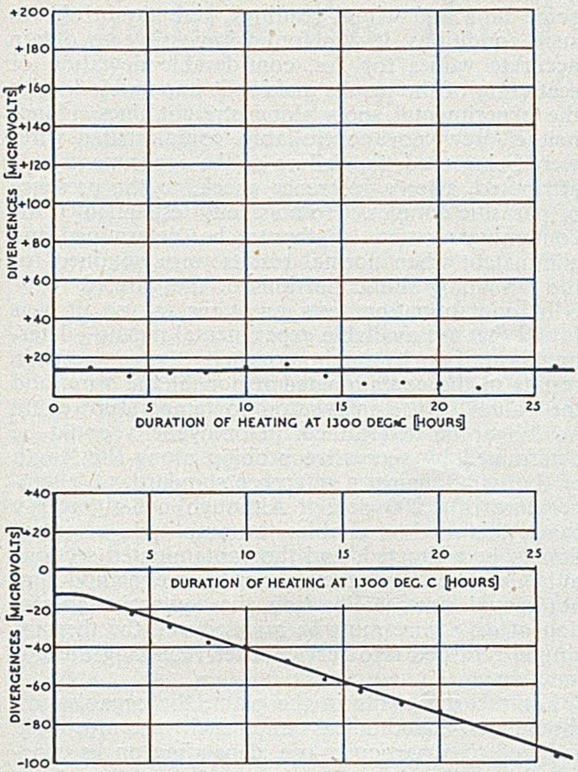


FIG. 10.—*Test in Magnesia; Characteristic Curves for Platinum (upper) and Platinum/Rhodium (lower).*

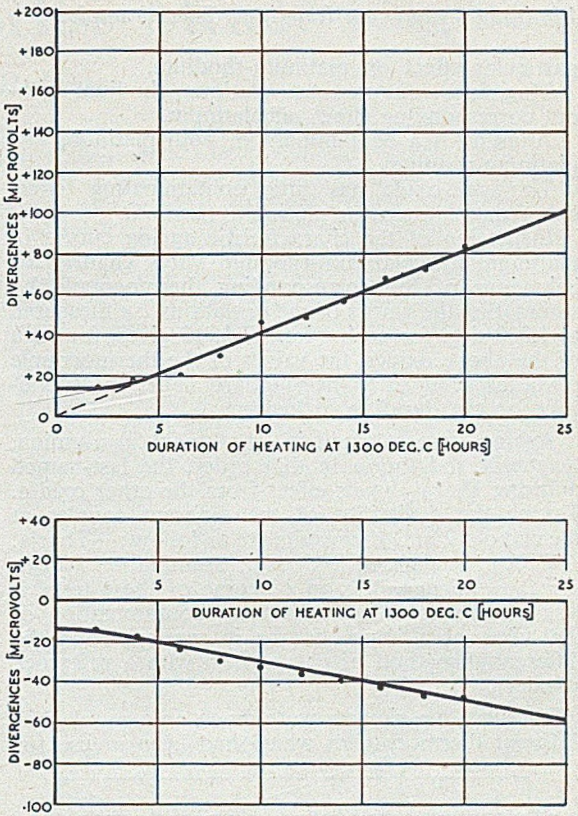


FIG. 11.—*Test in Alumina; Characteristic Curves for Platinum (upper) and Platinum/Rhodium (lower).*

order of 10 hrs., followed by a regular, small variation of the thermo-e.m.f. Platinum-rhodium, similarly, shows variations of small amplitude, the curve ascending slightly at the origin. All these results show clearly that comparison with a reference standard is a very good method of determining the degree of contamination and ageing of platinum and platinum-rhodium thermocouple wires. Individual measurements at 800, 1,000 and 1,200 deg. furnish experimental spots arranged along straight lines irrespective of the degree of contamination of the wire, and the contaminating agent.

It will be noted that the characteristic curve for platinum shows an initial stage in which the thermoelectric characteristics remain constant over a greater or less period of time. After this passive stage, the characteristics begin to vary with time. The straight lines corresponding to this period of proportional ageing will be found (except in the case of silica) to cut the co-ordinate origin. For silica, the extended line cuts the axis of the abscissæ at a point in the negative region, apparently indicating inherent contamination of the wire at the origin. This point has been verified and confirmed in other tests.

The summarised results further show that the method is capable of revealing the specific behaviour of the sample in different contaminating media, *viz.*:—

Silica is a contaminant of platinum, but has no

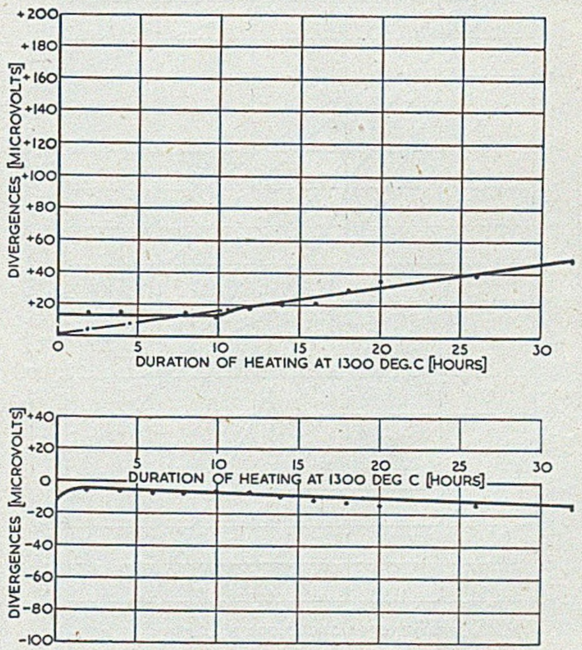


FIG. 12.—*Test in Thorium Oxide; Characteristic Curves for Platinum (upper) and Platinum / Rhodium (lower).*

Platinum—Platinum/Rhodium Thermocouples

particular effect on platinum-rhodium.

Magnesia contaminates platinum-rhodium without corresponding effect on platinum.

Alumina is a contaminant of both platinum and platinum-rhodium.

Thorium oxide has little contaminating effect either on platinum or platinum/rhodium.

Inspection of the characteristic ageing curves of platinum and platinum-rhodium wires enables the behaviour of the corresponding thermocouple by summating the values of the deviations Δe measured at 1,300 deg. for each wire. Fig. 13 gives, for each of the above oxides, the values of the thermocouple deviation referred to the Standard Table, in dependence on the duration of heating.

Ageing is most rapid in silica, next in alumina, magnesia and thoria in that order, the last-named differing sharply in its effect from the other oxides. Taking the deviations of the different couples at the end of 12 hrs., the results are as follow:—Thoria, − 2 deg.; magnesia, − 5 deg.; alumina, − 7 deg.; silica, − 9.5 deg. As an outcome of these tests, it was attempted to investigate the contamination of the wires of a thermocouple in service, using the differential method of comparison with a reference standard.

The first experiments were made on a number of different thermocouples which had been in use for

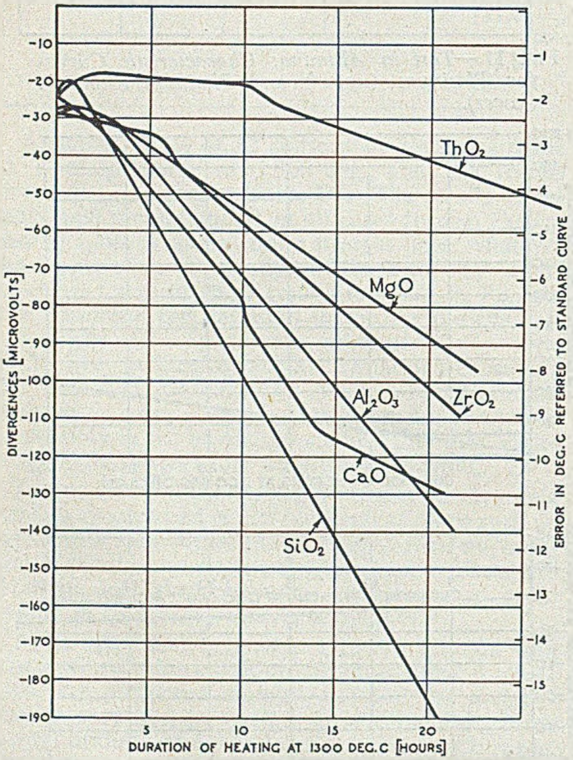


FIG. 13.—*Development of Characteristics of Thermocouples with Reference to the Duration of Heating in Refractory Powders.*

some time and whose readings were doubtful. In such conditions, it was found impossible to obtain accurate values for Δe, considerable deviation or scattering of the results making it impossible to plot the experimental spots along straight lines. Since neither new nor controllably contaminated wires were being used, the failure of the experiments was attributed, after a reference check, to the presence of parasitic couples. Homogeneity tests enabled the contaminated wire lengths to be determined and eliminated, when normal results were obtained for the remaining sound portions of the wire.

In contamination tests on wires in use, it was found that the available experimental means—determination of purity and homogeneity—gave uncertain results in the contaminated region of the wire, and the values of Δe in relation to temperature could no longer be determined. Homogeneity could be determined by successive probing along the length of the wire, against a reference standard, at a temperature of 1,200 deg. Although not rigorously exact, this method enables the amplitude of variation to be estimated, and the contaminated sections to be defined. Since the standard curve method does not provide for recalibration, the contaminated section of each wire must be rejected and the thermocouple returned into service after remaking the hot junction.

For measurements in the plant, the organisation should be methodical and each thermocouple assigned to a particular use, depending on its characteristics, the origin and properties of the wires and their degree of ageing being permanently on record. The laboratory will then test new couples received and check those in use.

REFERENCES

[1] H. le Chatelier. *Mesure des températures élevées par les couples thermo-électriques—Génie Civil.* Vol. X, No. 18. March, 1887.

[2] The present tendency, particularly abroad, is to use the thermocouple with 13 per cent. rhodium.

[3] Sourdillon and Rolet. *Sur les couples thermo-électriques Platine—Platine/Rhodié—Revue de Métallurgie No. 2.* February, 1928.

(*To be continued*)

U.S. Tribute to U.K. Industry

The productivity team from the American pressed-metal industry, the second of the "reciprocal" teams to visit industries in this country under the auspices of the Economic Co-operation Administration, sailed for the United States recently after a five weeks' tour of British factories. The team was impressed with the speed and efficiency of British manufacture, which, as a whole, was found to be higher than had been anticipated.

At a London Press conference on July 27, the Americans said that they had been impressed by the speed and efficiency of British manufacture in the 13 pressing plants which they had visited. They were most surprised by the newness of the factory buildings and the excellence of the machinery, which they had expected to be of the 1930's, "in not a particularly good shape" after severe usage in the war. One of the visitors said that they had all envied the modern layout of our factory buildings in which the standard of cleanliness was high and the lighting excellent.

Castings for the Corliss Steam Engine*

By D. Redfern

Adaptability, ingenuity and self-reliance are good qualities, and it is doubtful if there be any individual in any branch of industry who possesses these virtues in such a high degree as the jobbing founder. The very nature of his work makes it impossible for him to standardise to any great extent, and consequently it is essential that management, foremen and all employees are capable of assuming personal responsibility and working with a minimum of supervision. Ninety per cent. of the jobbing foundry production is of the one-off type, therefore, trial and error methods of production are useless in this side of foundrywork; years of experience, particular attention to detail, and ability to visualise the finished casting before even the mould is started are essential characteristics in every jobbing moulder who produces castings.

Jobbing Foundry Philosophy

WHILE THE CASTINGS dealt with in this Paper are of the heavy type, the firm with which the Author is associated produces all the castings required for the Corliss engines and also the cane cutter and cane crusher mills for which the engines are required: these castings range from a few pounds upwards, and it is quite possible that the moulder who produces the large castings, also produces some of the smaller castings as well—a sure proof of adaptability. After moulding the larger castings, days and sometimes weeks are required to dry the moulds. To prevent overlapping under these circumstances, the management usually finds jobs that are easily made for the moulders concerned so as to fill in the time. In some cases a moulder may even make his own cores for the job, and as he is engaged on piecework at all times, he is in no way pampered. The Author often wonders if the engineering trades will ever realise just how much they owe to the foundryman.

With all the wealth of accumulated experience, knowledge and "know-how," the jobbing foundry is still a chancey business. Weeks can be spent making a casting, split-second timing in pouring the mould, dressing the casting, inspection and final despatch to the customer, then weeks, sometimes months later, one is called to the engineering shops and finds that an oversight in venting or perhaps a shifting or breaking of internal cores has shown up in machining and months of work is rejected. Finding the winner of the "Grand National" or the "Derby" is no more difficult than producing a good casting, yet, whoever heard of a foundryman receiving even twice the amount in return for his outlay for the finished casting; it is not unknown for the successful punter to receive up to 100 to 1 for finding the winner in a race. There is no doubt in the Author's mind that pride of achievement is still the main reason for keeping the foundryman in his job, for there are far better and less worrying ways of earning a living.

Making a Half Flywheel

The first casting to be described is the half flywheel, shown in Fig. 1, for the 32 by 60 in. Corliss steam engine. A flywheel is quite a simple casting to make and is common in most jobbing foundries. However, even a simple casting of this nature can be made in various ways, and the over-riding clause for all types of jobbing work is to find what equipment is available, and what vacant moulding pit is most suitable.

In this case, the pattern equipment provided is a sweepboard and the spokes have to be set in the mould. The first part follows the usual sweep practice; a cross is bolted on to the bottom plate, a spindle is then set in the cross and the shear arm attached to the spindle after plumbing. The next operation is to level the sweepboard and then set to size; usually two sprigs are set in a clay ball to the inserts on the sweepboard, then the board is taken the full diameter, and the gauge stick is used to set the correct diameter. The bottom of the pit is rammed up to 2 in. from the lower edge of the

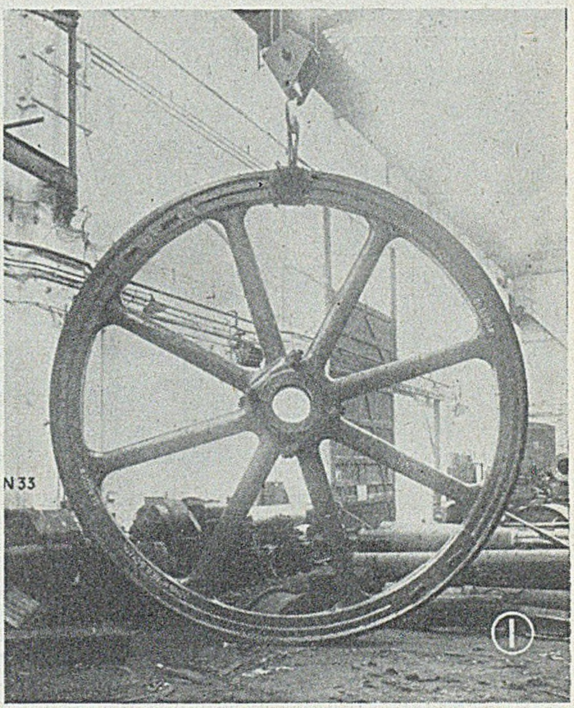
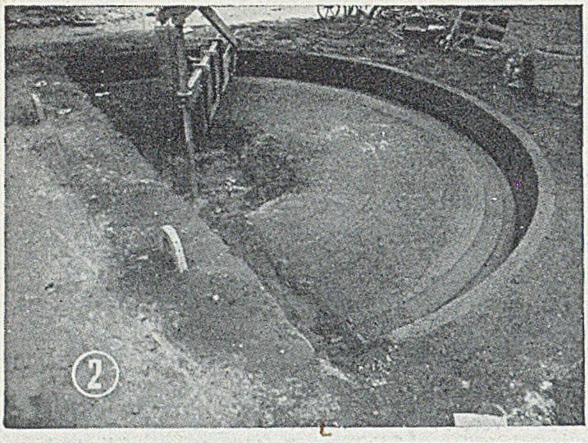
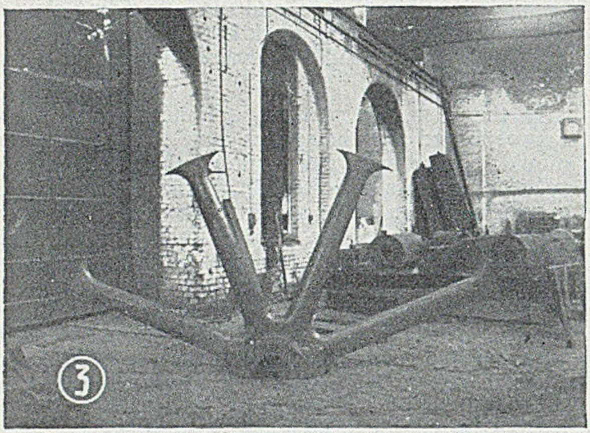


FIG. 1.—*Two Finished Castings assembled to form the Flywheel, 20 ft. dia., weighing nearly 20 tons.*

* Paper read before the Lancashire branch of the Institute of British Foundrymen, Mr. C. R. van der Ben presiding. The Author is general manager of G. M. Hay & Company, Limited.





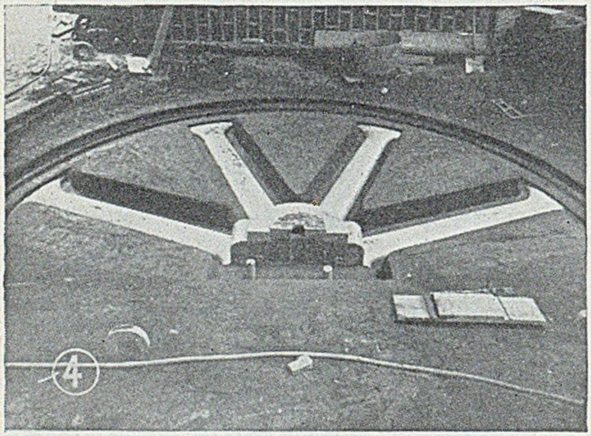
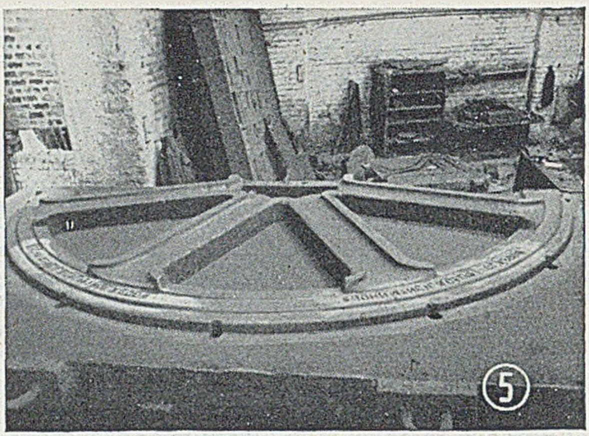
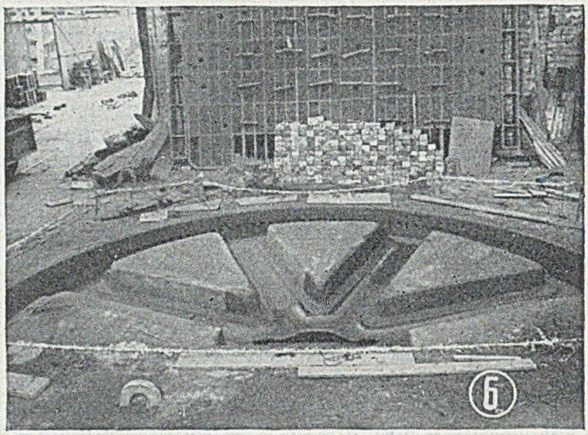


FIG. 2.—*Mould after applying the Finishing Loam.*
FIG. 3.—*Pattern for Forming the Spokes.*
FIG. 4.—*Mould ready for taking the Top-part.*





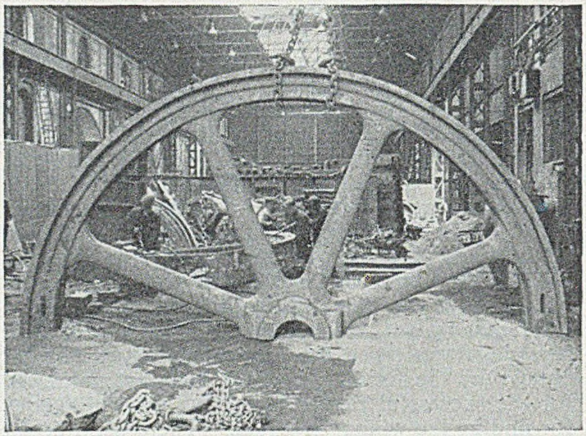


FIG. 5.—*Top-part of Finished Mould ready for Drying.*
FIG. 6.—*Bottom Half of the Mould ready for Drying.*
FIG. 7.—*Finished Casting in the Fettling Shop.*

sweep, then facing sand is used for the top of the bed. This is rammed up to the board, and then swept up level with the underside of the sweep-board. All the pits in the foundry have cinder beds. The outer rim of the mould is then rammed to within $\frac{1}{2}$ in. of the outer diameter of the sweep-board with facing sand; a coating of loam is applied and the mould is left for approximately 12 hrs. to stiffen up. Later the whole of the mould face for the time is sprigged, and a fine coat of finishing loam is applied. The whole is then allowed to dry off (Fig. 2).

The next operation is to take off the sweep board and set in the spokes (Fig. 3). The sweep board is then replaced minus the bottom board, leaving the sweep for the top-half of the rim. The spokes are then rammed-up in position to the halfway radius on the spokes, and the gap between the end of

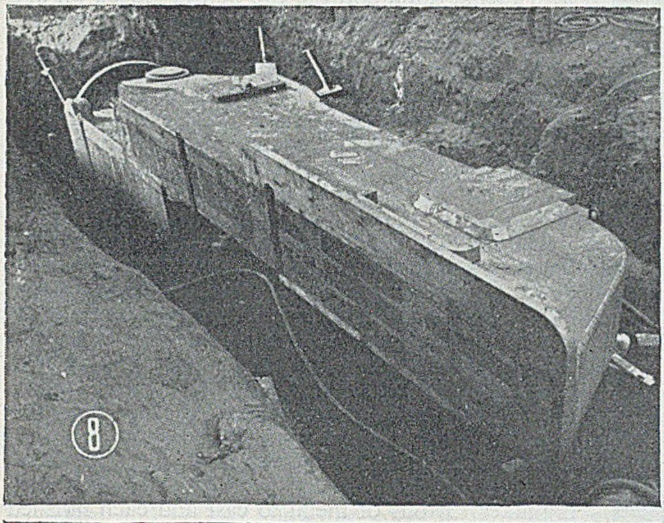
FIG. 8.—*Soleplate Pattern being bedded down.*

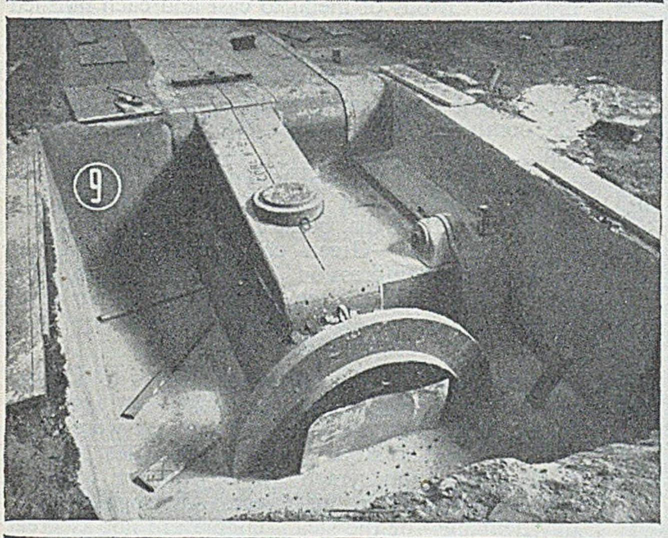
FIG. 9.—*Ramming of the Mould completed.*

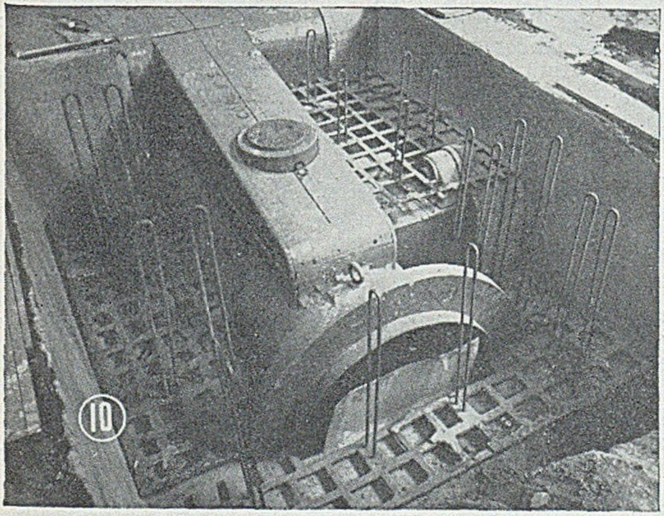
FIG. 10.—*Drawback Grids in position.*

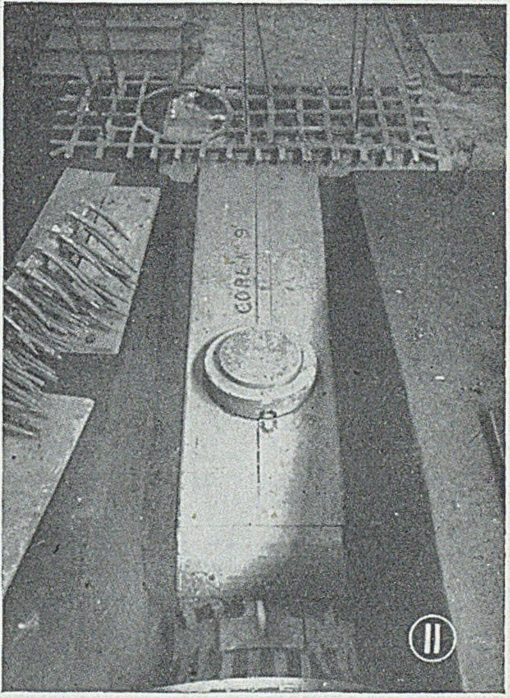
FIG. 11.—*Grating for the Top Section of the Mould.*

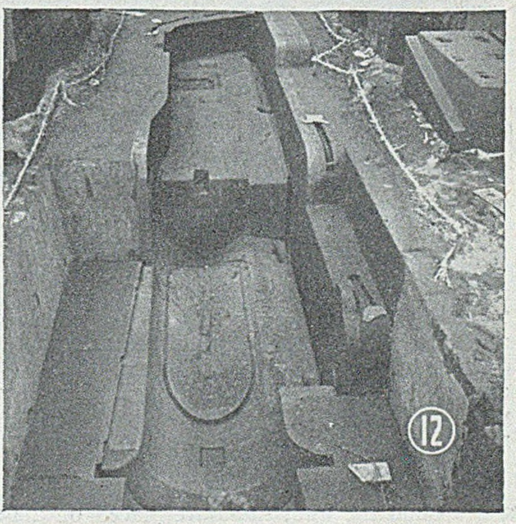
FIG. 12.—*Mould ready for Drying.*

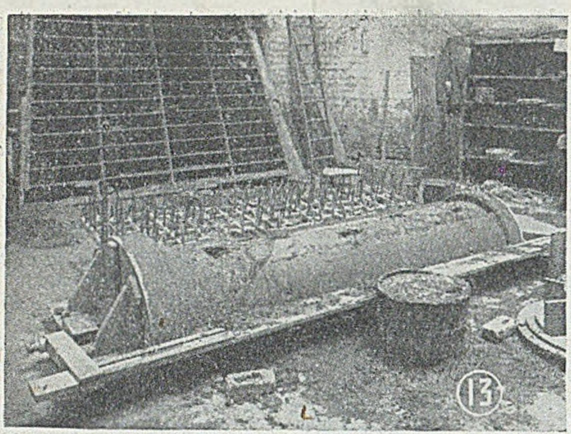


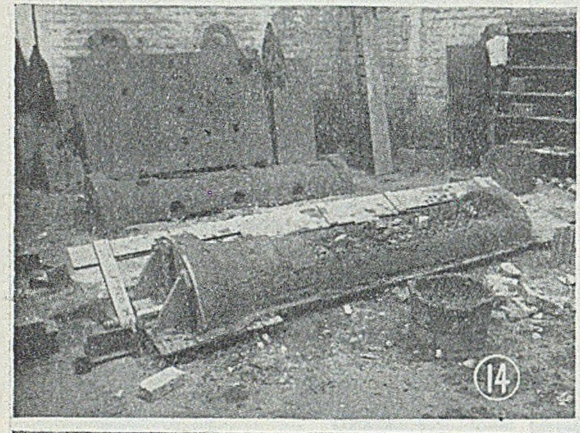












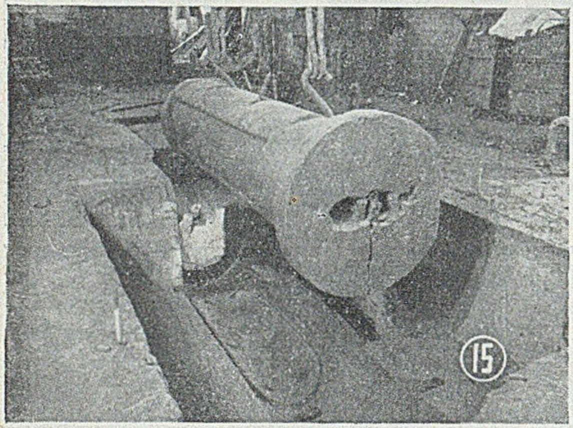


FIG. 13.—*Making a Half-core for a Soleplate.*
FIG. 14.—*Showing the Use of Ashes for Venting.*
FIG. 15.—*Lowering the Core into the Mould.*

the spokes and the face of the outer rim is filled up, usually with half-bricks and rubble, and about 2 in. of backing sand is rammed on top of the rubble to about ½ in. from the sweep board. Loam is then used to form the outline of the upper rim, and the mould is then rammed up and the joints made ready for the top part (Fig. 4).

Gratings are made and cast to fit over the spokes and around the hub; these are placed on a bed of facing sand and hand-rammed to the level of the joint. The whole of the mould face is then covered with facing sand, and the top-box is placed on and rammed-up. The gratings are toggled up, the top lifted and finished off ready for drying (Fig. 5). The rubble is then taken out of the bottom of the mould and a template is used to put core-prints around the outside of the rim. These are to receive cores which leave a 2-in. square hole, used to balance the finished wheel: the mould is then finished, cores are placed in the prints and it is ready for firing (Fig. 6).

The only core to be put in the mould is the bearing core in the boss. Two down-runners are used, 3½ in. dia. and connect with two inlet runners 2½ in. by ¾ in. by 6 in. long; 7 risers 3 in. dia. are equally spaced on the outer rim and two risers 4 in. dia. are placed on the boss. All risers are fed with malleable rods and at intervals hot metal is poured in the risers as required. Feeding takes place for approximately ¾ of an hour after casting.

The diameter of the wheel is 20 ft. The metal thickness is from 5 in. up to 15 in., each half casting takes 13 tons of metal to cast and each finished half-wheel weighs 9 tons 15 cwt. (Fig. 7). The charge used was:—steel scrap, 7½, foundry returns, 30, ordinary scrap iron, 30, foundry pig-iron, 32½ per cent. The composition attained was:—Graph. C 2.5, comb. C 0.6, Si 1.9, Mn 0.6, S 0.07, P 0.28 per cent.

Physical Properties.—The tensile strength was 14 tons per sq. in., and the transverse strength was 23 cwt. on 1.2 in. dia. bar, 18-in. centres.

Facing Sand:—Green compression 8.0 lb. per sq. in., dry compression 140 lb. per sq. in., dry permeability 55 per cent., flowability 68 per cent.

Trunk Guide Soleplate

In recent years, the steam engine has to a great extent been superseded by electricity as a motive power. Years ago, steam-engine castings were quite common in the larger jobbing foundries and no doubt older foundrymen will be familiar with the castings described in this Paper. Although present-day demands for the steam engine are not as great as they were in past years, there are still a small number of foundries engaged on this work. The Author's foundry makes a number of these engines every year: these are for various sizes of engine, mostly smaller in size and stroke. The castings detailed are for the biggest size of engines now being made.

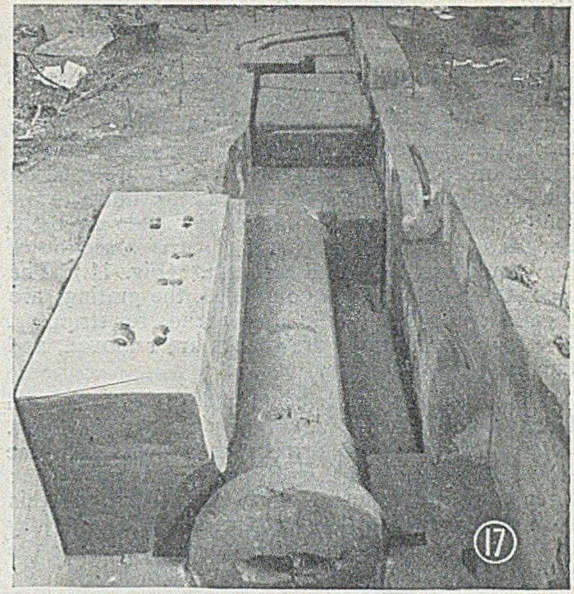
Normally the soleplate is made in two sections—the trunk guide is made as a separate casting. In this instance, the two sections are combined and made as one casting, and probably the following description of the making of the trunk guide and soleplate will be of great interest to most foundrymen, and in particular to those who are engaged on medium and heavy jobbing castings.

When the pattern arrives at the foundry, it is measured for length and depth and a suitable pit is chosen for the pattern. The pit is dug to a rough size, and is then partly rammed at one end by the labourers. At the centre is a cinder bed underneath the soleplate section—the pit is then ready for the pattern. Wooden blocks and wedges are laid on the bed and the pattern is placed on these: the purpose of the blocks and wedges is to set the pattern level and also to allow the moulder to ram underneath it. (Fig. 8.)

The moulder completes the ramming of the underside of the pattern and then places the ingates in position; these are six in number 3 in. by 1 in. by 12 in. long. The first is on the flange of the trunk guide and the other five are equally spaced along the pattern and around the bevel end of the soleplate. The mould is then rammed about halfway up the pattern: at this stage, face-boards are then secured across the pit at the junction of the pattern where the trunk guide meets the soleplate section. The work then continues at the soleplate end of the pattern and ramming continues until the top of the pattern is reached on this section, every course is reinforced with either old gratings or malleable iron rods. As soon as this stage is reached, work is transferred to the other end of the pit.

It is necessary on castings of this nature to use drawbacks, both to enable the pattern to be withdrawn and also to allow the cores to be placed in position: in this case there are five drawbacks required, all at the trunk-guide end of the pattern. The face-boards are set in various positions and the ramming of the mould is completed and joints are roughly made. (Fig. 9.)

While the joints are roughly made, the moulder concerned makes the templates for the drawback gratings, marks them out and stamps them in the bed. After casting, the gratings are taken on the



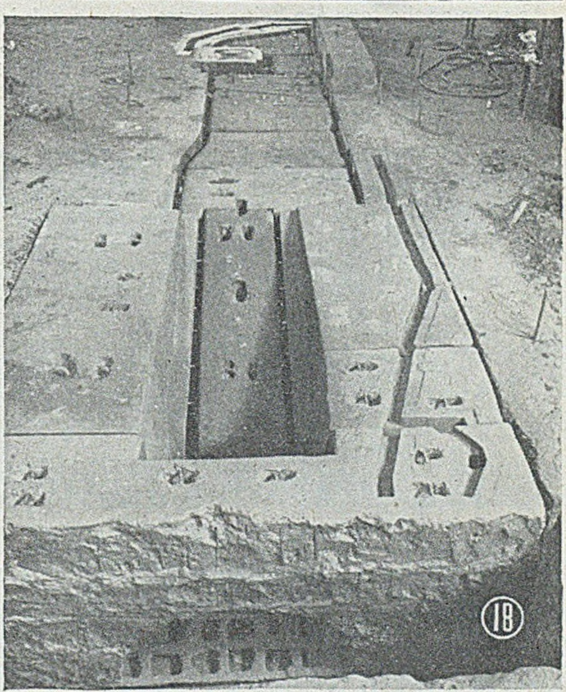
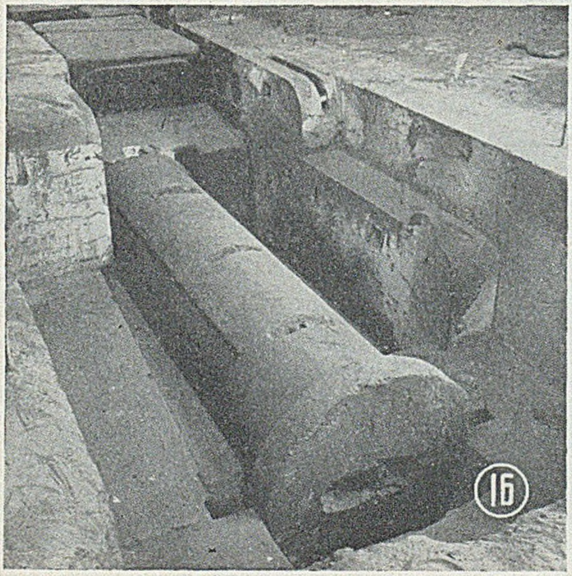


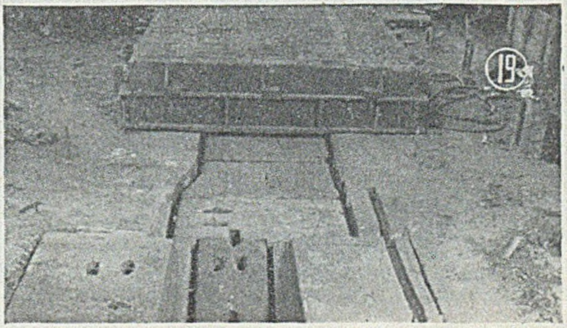
FIG. 16.—*Coreing-up completed ready for Placing the Drawbacks.*

FIG. 17.—*One of the Drawbacks shown in position.*

FIG. 18.—*Stage before trying on the Top-part.*

FIG. 19.—*Top-part Moulding Box in position.*





job, placed in the various positions and the joints are then made up to their full size. (Fig. 10.) The drawbacks are then rammed individually. While these are in progress the first top-part is also in course of being rammed; two top-parts are used on this casting. After the drawbacks are finished and joints made, a small drawback is made over the flange: a grating is also made to carry a section of the mould in the second top-part. (Fig. 11.) The second top-half is then completed, the gratings are toggled up and the mould is now ready for stripping. The tops and finished drawbacks are removed, and the pattern withdrawn.

The drawbacks and the mould are finished and blackwashed; all are now ready for drying. (Fig. 12). The tops and drawbacks are dried in the stove, whilst the mould is dried by portable dryers: three are used, mostly on medium heat, as this ensures thorough drying without burning or injury to the mould face. The time usually taken for the drying of the mould is five to six days.

As soon as the tops are being rammed-up, work is started on the cores. These, with one exception, are made in the same sand as that used for facing the pattern, and both sands are identical with that used for the flywheel.

Coremaking

The main core is made from loam: the procedure for the making of this core is similar to that used in most foundries for the cores of this type using a template with two half-sections in size identical to the size of the core. The strickle-board is cut to the contour of the core, and a grating is then laid on a bed of loam and built up to form the half-core. (Fig. 13.) Another view of the core is shown in Fig. 14. In the background is the first half-core, and the second one is being built. Note the ashes in the centre for venting.

After drying, the cores are placed together and calipered for size, after rubbing on the flat surface until the correct diameter is reached. The two halves are then bolted together, all seams are filled, and the core is blacked and returned to the stove.

The mould now being dry, the fires are removed and the mould cleaned out, and coring-up is started. The first core to be set is the journal core at the soleplate end, then the first of the panel cores are placed in position. The panel cores are all suspended on chaplets; commencing with the journal end there are two tiers of cores then three tiers, the remainder are single: in all there are fourteen panel cores. At this stage, the main core is placed before

(*Continued on page* 164.)

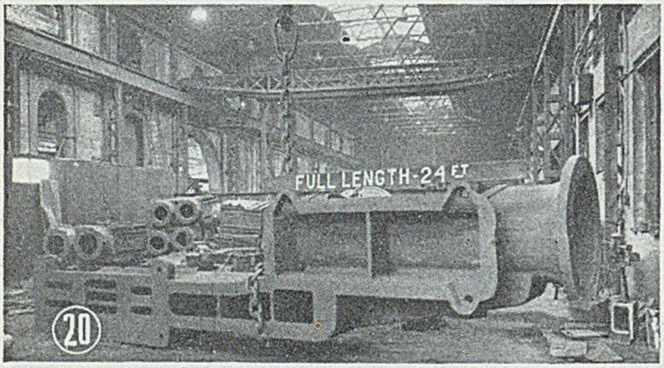
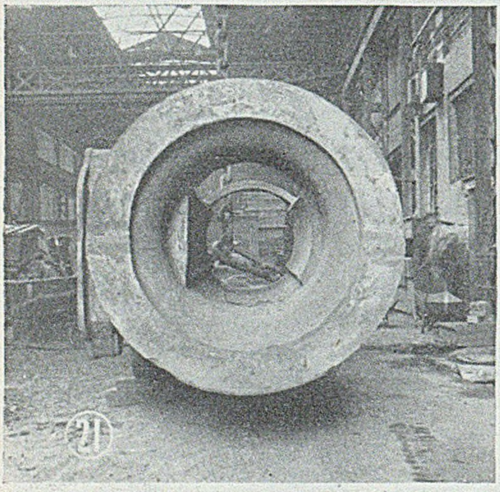
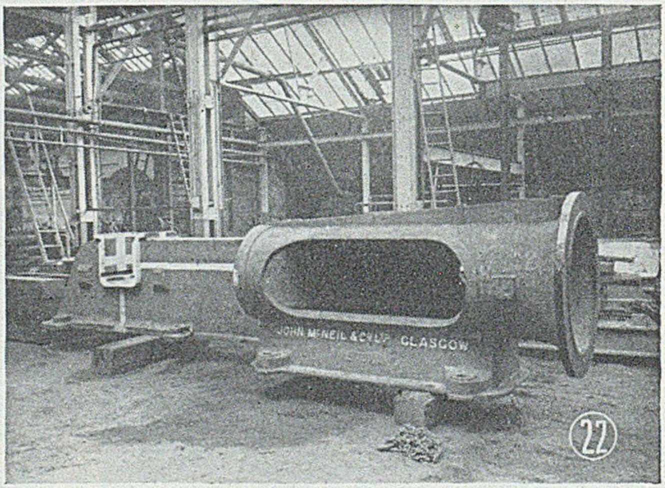


FIG. 20.—*The Finished Soleplate Casting.*

FIG. 21.—*Another view showing the Trunk and Guide Pads.*

FIG. 22.—*Soleplate Casting partly machined. The Casting weighed 12 tons 10 cwt.*





I.B.F. London Branch

Secretary's Report on 1950-51 *Activities*

At the Annual General Meeting of the London branch of the Institute of British Foundrymen held at the end of the session, Mr. W. G. Mochrie, hon. secretary, presented his report, from which the following is an abstract:—

Technical Meetings

On September 27, 1950, the president, Mr. F. E. Tibbenham, opened the 1950/51 session by giving his Address. This was followed by the account of the Jobbing Iron Founders' Team's visit to America, by the leader of the team, Mr. S. H. Russell. The meeting will be remembered not only for the able way in which Mr. Russell gave his account, but also for the manner in which he handled the discussion that followed. His philosophical conclusions went home to the 125 members and visitors present.

On October 6 the branch was well represented at the National Works Visit Day in Birmingham. [The London branch will be hosts to the Institute on Friday, October 12, 1951, when a series of foundry visits in the London area will be arranged.]

Mr. M. M. Hallett, of Sheepbridge Stokes, on October 25 gave his Paper on "Some Practical Experiences in Producing Nodular Cast Iron." It will be recalled that this was the first practical treatise ever made on this subject. Attendance was about 100. The evening of November 22 was devoted to the discussion on technical reports T.S. 23 and 26, entitled "Repair and Reclamation of Castings," which was led by Dr. Everest, of the Mond Nickel Company, Limited, for the ferrous report, and Mr. Ruddle, of the B.N.F.M.R.A., for the non-ferrous. Attendance was upwards of 80 members and the evening was marked by a record length of discussion.

The branch was the guests of the London section of the Institute of Metals on December 15, when Mr. Frank Evans, member, of John Miles & Partners, Limited, gave his Paper on "Modern Melting Furnaces." The foundrymen made the major contribution to the discussion that followed and their attendance numbered about 70. On January 31 F. H. Lloyd's films "Flawless and British," "All Star Casting" and "And Now" were shown before an interested audience.

Mr. René Dulché, member, from France, was unable to be present himself at the February 28 meeting, but his Paper "Valve-tappet Castings" was given on his behalf by Mr. E. Harwood Brown, who knew the foundry intimately, just as he did the subject itself. The audience of about 80 followed the French production methods with a very keen interest. The March 28 meeting provided one of the highlights of the session when Mr. Frank Hudson presented his film "The Brass Trail," and gave members a most interesting exposé of conditions in the U.S.A. There was an attendance of over 100 at this meeting.

In addition to the branch programme outlined above, each of the two sections has been busy. East Anglia have had seven well-attended technical sessions and Slough five.

Works Visits

Three works visits have been organised during the session. In April, a party of 32 with more than usual interest saw the functioning of foundry products in the very trying service of brewing; the branch is most grateful to the makers of "Guinness" for their hospitality accorded at their Park Royal Brewery. In the summer, at the invitation of the president, a party of between 20 and 30 were to have an all-day excursion from London to see the never-ending battle, or perhaps concord, between casting and welding, at Suffolk Iron Foundry, Stowmarket. In addition, the branch had arranged for a Continental trip to wind up the session's activities. [On May 24 a party of over 30 left for a visit to the French Ardennes foundries.]

Including all the branch and section technical meetings the programme this year, so far as can be ascertained from the records, has exceeded anything ever before. With 24 such functions, with an aggregate total attendance of well over 1,200, it will be agreed that there has been a fairly busy session.

Social Functions

No programme would be complete without the dinner and dance and "men only" evenings. On December 15 at the Café Royal 185 attended and thoroughly enjoyed the dinner, dance, and cabaret. The president of the Institute, Mr. John Sheehan, and Mrs. Sheehan, paid their official visit to the branch on that occasion, and they were accompanied by Mr. Tom Makemson, the Institute's secretary. The "men only" engagement is now regarded as an institution in itself; the event this year at the Horse Shoe Hotel, on March 16, with 116 present was, in the opinion of those taking part, the most successful so far held.

Membership

In the last five years the total branch membership has increased by 200 and in seven years it has increased by not less than 50 per cent. The total figure to-day, standing at 750, represents the highest ever recorded in the history of the branch and, of course, any branch of the Institute. The net increase since the estimated figure of last year is 25 and on the official figure published in the Institute's general report as at April 30, 1950, is 34. It is not anticipated that there will be any wide difference between the final figure at the end of this month and the figure just given. This increase is higher than was anticipated in view of the tightening-up in approval of new applications by virtue

I.B.F. London Branch Secretary's Report

of the new bye-laws, and the impending increased subscriptions which are now, of course, in force. Subscriptions from members for the calendar year 1950 reached the all-time high record of £1,683 7s. 5d. This is the highest amount for any one branch in the Institute, and members may be interested to know that per member they are still the biggest contributor to the Institute funds.

All these things, however, do not just happen. The council have held seven meetings, dispensing about 92 items on agendas, accounting for a very full 250 unpaid man-hours. In addition, there have been ten sub-committee meetings (two programme, three dinner-dance, three national-works-visit and two "men-only"). Next session's work has already started in the council, and although the summer months may be a holiday from the monthly meetings, they certainly are no holiday from the point of view of running the branch. The delegates to General Council have attended the usual four meetings, one in London, one in Bristol, one in Glasgow, and one in Birmingham.

[Mr. Hudson reported later on the work on members' behalf of the Institute's Technical Committee. This was printed in the JOURNAL on June 21.]

Mr. Mochrie concluded his Report by thanking the past-presidents, the council, the representatives and delegates to General Council, Mr. Hudson, the stewards, Mr. Ellis, the president himself, who had attended every meeting of the council, as well as every branch meeting, Mr. Templeton and Mr. Hardy, the section presidents, and Mr. Hoesli and Mr. Sanders, section secretaries.

Invitation to the Fair

Plans for the 1952 British Industries Fair are already well advanced. In fact, applications for space at the London sections at Earls Court and Olympia close officially on August 25, after which applicants may have to be placed on waiting lists. There is no set date for receiving applications for space at the heavy-engineering section at Castle Bromwich, Birmingham, but, so far, space is being booked at a slightly higher rate than last year, when a peak level of bookings was recorded. One-third of the available space in the two London sections has already been sold. The organisers of the 1952 Fair are confident that it will compare with the best in the post-war period, which may well surprise those who felt that the 1951 Fair would, in view of the Festival of Britain, represent the peak achievement and be followed by a decline in size, representation, and influence.

The organisers of next year's Fair, which will be held from May 5 to 16, are now engaged on an extensive overseas promotion campaign. The story of Britain's "shop window," with its coverage of 90 separate industries, will be told in 26 languages by means of advertisements in the leading newspapers and trade journals of the world, in booklets, and on showcards.

International Telephone Directory

Due to be published next year is a commercial telephone directory in four of the chief languages—English, French, Spanish, and German. The directory will gather in a single volume information on all engaged in international trade and relationships, and will give complete details of rates for international telephone calls. Represented in the directory, which is being compiled for universal use among official, trade, and professional organisations and societies, post offices, libraries, hotels, and travel agencies, will be every country in Europe and some from other continents as well.

An invitation is extended by those responsible for the publication of the directory for the insertion of two entries—one in the alphabetical section and the other under classified lists of trades and professions. Both entries are entirely free and without any obligation either to purchase the directory or to take advertising space in it. Entry forms can be obtained from the International Telephone Directory, 12, Sackville Street, London, W.1.

Castings for the Corliss Steam Engine

(*Continued from page* 162)

the last of the panel cores are set, the reason being that the vent of the main core is connected to the cinder bed under the mould (Fig. 15). "Clays" are used under all cores to check metal thickness and the main core is first tried for thickness to ensure it is central with the rest of mould. All being correct, the core is then set finally in position (Fig. 16).

The next operation is to try one of the drawbacks over the main core to ensure that the correct metal thickness is obtained before the main core vents are made up: this step is necessary to save re-making, in case the main core has to be removed. (Fig. 17.) The remainder of the panel cores are then placed and also the internal core over the bore of the frame; all the drawbacks are now replaced, and at the same time, the other end of the mould is cleaned out, and the joint whitened ready for trying on the top (Fig. 18).

The first top is now in position (Fig. 19) and all that now remains is to seal up all vents, fill in all hook holes, seam all joints of the drawbacks, clean-off the top and clean-out the mould, replace the small drawback over the flange, replace the second top-part and make all ready for casting.

The amount of metal required for casting is 15 tons, the actual weight of the casting being 12 tons 10 cwt., and length 24 ft. (Fig. 20). Another view showing the trunk and guide pads is shown in Fig. 21. A further view of the trunk soleplate lined off, and a rough cut taken of the flange can be seen in Fig. 22.

Material

The iron used is identical with that used for the flywheel, giving similar physical properties and conforming to the same analysis. The sand used in both cores and mould is as described for the flywheel. As a point of interest, section thickness ranges from 1 in. to 3½ in.

(*Other castings will be described in future sections.*)

Conference on Isotope Techniques

Radio-Isotopes in Blast-furnace Practice and Founding

An international conference on isotope techniques was held at Oxford from July 16 to 20, the general arrangements being made by the Atomic Energy Research Establishment, Harwell, and the Medical Research Council. The opening sessions were largely devoted to therapy, biochemistry, and agriculture, but the whole period of July 19 and 20 was given over to industrial and research applications.

Dr. H. Seligmann, Isotope Division, A.E.R.E., opened this part of the proceedings by discussing types of applications. Other specific uses of radio isotopes were then described by Dr. J. Guéron, of the department of physical chemistry, Commissiàrat à l'Energi Atomique, Paris. Extracts of some of the Papers read at the conference which are of more general interest to our readers are given below.

Experiments in a Blast Furnace

Mr. E. W. Voice, British Iron & Steel Research Association, described the use of radon to determine gas transit times in a driving blast furnace and the use of cobalt^{60} indicators for determination of blast-furnace refractory wear. He considered a typical furnace to be a brick-lined shell containing a column of burden some 20 ft. dia. and 70 ft. high, the burden consisting of iron ore, coke and fluxes, loaded intermittently. Air was blown into the side of the furnace at the bottom through 10 or 12 tuyeres and the total rate would be about 30,000 cub. ft. per min.

The time of contact between the gaseous and solid materials was of obvious importance, and attempts were therefore made to measure it.

Any material injected into the air stream would suffer extreme dilution and would have to pass through the very-high-temperature zone. Argon, helium, radioactive krypton and radon were considered; it was calculated that radon should be detectable after this dilution and was available at a reasonable price provided a pulse technique was adopted.

The air in the tuyeres was at about 12 lb. per sq. in. and a burster chamber was used such that gold tubes containing 40 mC. of radon were mounted on a detonator, this being surrounded by some propellant such as gunpowder. On firing the detonator the gold tubes were shattered and the propellent burned. The gaseous products and radon then burst a copper seal and the gases were forced into the tuyere. Some of the air entering the furnace at a known time was thus tagged with radon.

Simultaneously, gas samples were taken from two positions at the top of the charge—one from the centre and one near the wall of the furnace. A sampling method was necessary, such that separate samples could be taken at known time intervals and stored for analysis. The method used was to construct a large circular water-filled pan containing 30 gas-jars on a peripheral bee-hive shelf. The two gas supplies were led into a radial arm so that by rotating the arm the gas was directed into the appropriate jar. Gas was collected for one second in each jar and it was arranged that the first movement of the radial arm fired the detonators and injected the radon into the furnace. Knowing the volume of gas collected per second, it was possible to calculate the gas velocity in the gas sampling pipe and a correction could then be applied for the time spent in the pipe. By using pumps this was kept down to 0.4 secs. for a 25-ft. sampling pipe.

The sample gases were then transferred to 500 ml conical flasks, stored for four hours, and the open neck of the flask was placed against a mica-end-window counter. Counts were taken for 1-15 min., as necessary, from which results curves could be drawn showing the intensity against time. Typical results for one furnace showed a peak between 1 and 3 sec. for the sample taken at the wall and between 6 and 9 sec. for the sample taken at the centre.

By controlling the size grading of the burden and the radial distribution of solids, Mr. Voice considered it possible to control the time of passage of gases through the furnace, thus leading to greater efficiency of operation.

Refractory Wear

The furnace shell was usually lined with from 2- to 3-ft. of firebrick or carbon and this lasted for a campaign of 6 or 7 years before relining. The operator asked for information on the rate of wear of firebrick, enquiring if the furnace soon made its final lines, or was there a progressive wearing-back?

Small pellets of Co^{60} could be built into the brickwork and their γ-ray activity detected by using a portable counter outside the furnace. If pellets were built into deep refractory such as under the hearth, the cobalt, if released, could be detected in the iron output from the furnace. 10 mC. of Co^{60} could be detected provided it was within two feet of the furnace shell and 10 mC. could be detected if it entered 2 or 300 tons of iron. Samples were kept from each cast and were assessed in the laboratory using a scintillation counter.

Cobalt^{60} could also be used to measure the transit time through the furnace for solid materials. A 5 mC. pellet was embedded in a lump of ore and by taking metal samples at each cast it was possible to know how long the ore took before it released the cobalt into the molten metal.

Steel Castings

The use of radio isotopes for the non-destructive testing of steel castings was discussed by Mr. H. S. Peiser and Dr. J. L. Rait (Hadfields Limited) as a simple and obvious industrial application. After a brief description of a recently-built laboratory set

Conference on Isotope Techniques

out for the gamma radiography of steel castings, the use of this method was explained. Emphasis was placed on a few examples where the method has proved superior or more economical than radiography by X-rays.

The most valuable application of radio isotopes in the steel foundry was considered to be for the examination of pilot castings during the development of foundry methods. Quite small changes in these could be shown to have significant and apparently unpredictable effects on the quality of castings. The use of radio isotopes thus gives the steel founder additional scientific control in his manufacturing processes such as was previously economically, if not scientifically outside his reach.

Safety Precautions

DR. J. S. BLAIR (Stewarts and Lloyds, Limited, Corby), who has been associated with the examination of welds between steam pipes and structural tubes using isotopes Ir^{192}, Ta^{182} and Co^{60}, considered that gamma-rays are much easier to use than X-rays, requiring far less equipment, and taking less time and trouble to get it into position for taking the exposure. The flatter and less-contrasting radiograph obtained with the gamma-ray may be much more useful for many purposes.

He claimed that his firm had made great use of a proprietary type of container which they find meets all the requirements as far as operating is concerned without the complication of having to handle the bare source at the end of a long rod. In this container the isotope is carried on the end of a rod inserted through the back, and lies inside a lead sphere having a conical plug, the end of which can be removed to expose the source during the taking of gamma-ray photographs. An important advantage of this container is that by means of 15-ft. of Bowden cable the source can be protruded from the end for taking "all-round" photographs without the operator having to aproach it. It can, of course, be retracted in the same way.

Describing the general health precautions which are followed at Corby when handling isotopes, DR. BLAIR said that the isotope is collected from Harwell in a special container of their own design which is unsymmetrical, and when placed in the boot of a car has greater shielding towards the driver than towards the back of the car. This container weighs about 60 lb. and is made of lead and can hold two isotopes. It is lifted out of the car by a rod passed through two horns on it, the rod ensuring that the isotope is not carried close to the body, it being necessary for two people to carry it, one holding each end of the rod. The same rod, after the container has been put on the ground, is used to remove the cap which fits into the end of the rod and is retained by a spring after it has been unscrewed. The rod also contains inside it another screwed rod which is then pulled out and used to remove the isotope on its short bar which is inside the container. Should the isotope be dropped on the ground, the special handling tongs can be used to pick it up again and re-insert it in the container or re-screw it on to the handling rod. The isotope is transferred to the working container, inserting it through the back and it is then ready for use and requires no further handling. The working container is put on to a small trolley, which not only avoids having to lift it, but also keeps the isotope a considerable distance away from the operator while it is being moved.

The trolley and container are stored when not in use in a special enclosure. The trolley is run down a slope underground so that no appreciable radiation can get out, and another underground pit is used to hold radio-isotopes when they are not wanted. These are stored in holes in an 18-in. thick steel ingot, there being long steel plugs inserted in the holes so that the protection upwards is adequate. Even with the pit full of isotopes (it can hold 13), there is no appreciable radiation from it.

Personnel Protection

As far as protection of personnel is concerned, distance is by far the most important item, and provided the working area is roped off at 15 ft. or 20 ft. radius, there is no need to worry about workmen occasionally walking past. Pocket dosimeters, which are most convenient, are carried by all operatives and these tell immediately what dose the operator has received, and allow him to stop further operations should that dose become excessive. Periodical blood counts also help to check the health of the operators, and monitors are used to check the level of radiation around any work in progress.

In conclusion, DR. BLAIR reported that these precautions were quite satisfactory, since although radio-isotopes have been used at his works for about two years, no operator has ever received more than one-fifth of the permissible dose in any one week.

Tnngsten Ores Control

As from July 30, the Ministry of Materials became the importer of tungsten ores and concentrates. Imports continue to be allowed under licences already issued.

Import and distribution of tungsten ore will be conducted through agents drawn from the trade, and for this purpose it is proposed to form a company, the management of which will include representatives of the following companies:—Derby & Company, Limited, 62-63, Cheapside, London, E.C.2; Metal Traders, Limited, 7, Gracechurch Street, London, E.C.3; H. A. Watson & Company, Limited, 115, Old Broad Street, London, E.C.2, and Exchange Buildings, Liverpool. Pending formation of the company, offers of tungsten ore may be made to any of these three firms, who will make bids on behalf of the Ministry. Consumers will be approached individually about their requirements.

The price of concentrates of standard 65 per cent. grade and ordinary quality will be 535s. per long ton unit delivered consumer. The price will be reviewed at the end of the quarter, but no change is contemplated before then.

Boliden's New Ore-concentration Works

A new ore-concentration plant, reported to be one of the largest and most modern in Europe, is being built by the Boliden Mining Company in North Sweden.

Steel Consumers' Council

The names of the members of the Iron and Steel Consumers' Council, which has been set up under the Iron and Steel Act, 1949, to consider any matter, including prices, affecting the interests of consumers, were announced by the Minister of Supply on July 31.

The council will have as its independent chairman Sir William Palmer, who has been chairman of the Oil Consumers' Council since 1949. Chairman also of the British Rayon Federation, Sir William was Second Secretary, Ministry of Supply, 1939-42, Second Secretary, Ministry of Production, 1942-44, and Principal Industrial Adviser to the Board of Trade, 1944-46.

Members appointed to represent the iron and steel consuming industries are:—Sir Amos Ayre, chairman of the Shipbuilding Conference; Mr. Ralph Bennett, chairman and managing director of Smethwick Drop Forgings, Limited; Mr. A. L. Shuttleworth, managing director of the Pressed Steel Company, Limited; Sir Andrew McTaggart, president of the Civil Engineering Contractors Association; Mr. C. M. Spielman, managing director of Whessoe, Limited; Mr. Robert Arbuthnott, joint managing director of the North British Locomotive Company, Limited; Mr. W. Moray Lines, a director of Lines Bros., Limited; and Mr. W. D. Wilson, chairman and managing director of Geo. Wilson Gas Meters, Limited.

Representing the iron and steel merchants and stockholders are Mr. M. C. Wade, Mr. J. W. Annetts, and Mr. H. Basil Darby, while the representatives of workers in the consuming industries are Mr. W. B. Beard (United Pattern Makers' Association), Mr. Jack Tanner (president of the Amalgamated Engineering Union), and Mr. F. Hayday (National Union of General and Municipal Workers). The nationalised industries are represented on the council by Sir John Hacking (deputy chairman, operations, British Electricity Authority) and Gen. Sir Daril G. Watson (a member of the Railway Executive).

The Iron and Steel Corporation of Great Britain has nominated Sir John Green and Mr. W. H. Stokes, two of its members, to serve on the council.

It will be recalled that, earlier this year, the Minister of Supply stated that he had invited nominations to the council from the Federation of British Industries, the National Union of Manufacturers, the Engineering Industries Association, the Association of British Chambers of Commerce, the National Association of Iron and Steel Stockholders, the National Federation of Iron and Steel Merchants, and the T.U.C.

The Minister of Supply has this week made the following additional appointments to the Consumers' Council:—Sir Harry Railing (General Electric Company, Limited, London) and Mr. R. G. D. Ryder (Thomas Ryder & Son, Limited, Bolton).

Board Changes

British Tabulating Machine Company, Limited—Mr. A. H. Haworth has been appointed a director.

Revo Electric Company, Limited—Mr. D. J. Vaughan has resigned from the board and Mr. F. D. Felton and Mr. P. Tonks have been appointed joint managing directors.

Imperial Chemical Industries, Limited—Mr. P. C. Allen, chairman of the plastics division, Mr. E. A. Bingen, the company's solicitor, Capt. R. C. Todhunter, purchases controller, and Mr. A. T. S. Zealley, chairman of the Billingham division, have been appointed directors.

New Ore-carrying Organisation

The formation is announced of Ore Carriers, Limited, a joint enterprise of the British Iron and Steel Corporation and the Houlder group of companies. Its function is to build and operate a fleet of ore carriers to bring ore to Port Talbot and other United Kingdom ports. The capital is £2,000,000, all in ordinary £1 shares and all found from the joint promoters' own resources, 51 per cent. being provided by the Houlder group and 49 per cent. by the iron and steel industry (through British Iron and Steel Corporation).

Contracts are about to be signed between the company and William Gray & Company, Limited, West Hartlepool, for six motor vessels specially designed for the rapid handling of iron ore. The first four will be of 8,600 tons deadweight each, and the first vessel is expected to be laid down early next year. All of them should be in operation about the middle of 1955. The total cost of the fleet is expected to be in the neighbourhood of £3,000,000.

The chairman of the new company is Mr. W. C. Warwick, chairman of the Royal Mail Lines, the Houlder group, and other undertakings. Of his nine director colleagues, five are nominated by the corporation (Mr. J. B. Cowper, Sir John Green, Mr. D. H. Kyle, Sir Andrew McCance, and Mr. C. R. Wheeler) and four by the Houlder group (Mr. C. G. Alexander, Mr. John M. Houlder, Mr. J. Huntley, and Mr. Cyril W. Warwick). The secretary will be Mr. F. W. Whittle, secretary and chief accountant of the Houlder Line.

The formation of Ore Carriers, Limited, follows settlement of the dispute between the Iron and Steel Corporation of Great Britain and the British Iron and Steel Federation over the organisation to be set up to ensure supplies of raw materials to the steel industry. The announcement points out that the Houlder companies have had close and continuous trade connections with South Wales for over half a century and that to ensure best use of the new vessels their operation will be carried out to the requirements of the corporation.

Need for More Use of Hot-metal Process

In the course of his review at the recent annual meeting of the Lancashire Steel Corporation, Limited, Sir John James, the chairman, stated that in order to supply the advancing requirements of iron and steel users in this country, either for home or export, the iron and steel industry would need to make a more extended use of the hot-metal process; in this scrap consumption per ingot ton could be reduced and pig-iron substituted. They were looking to the great works at Margam as a classic example of how they could become less dependent upon scrap gathered from all parts of the world for ingot production, and rely more upon the efficient conversion into iron and steel of the iron-ore deposits of the world, including our own.

The meeting was attended by Mr. S. J. L. Hardie, chairman of the Iron and Steel Corporation of Great Britain, and Sir John Green, deputy chairman. Mr. Hardie expressed the thanks of the meeting to Sir John James in a short speech. All the retiring directors were re-elected.

"If we lose a day's production from one man, it means that the whole of the plant and organisation used by three men has to work for no profit on that day to pay the unearned overheads on his plant," says Mr. V. J. Jobson, chairman of Qualcast, Limited, in a circular to shareholders and employees announcing extra holiday pay for the latter.

British Association

Forthcoming Edinburgh Meeting

The British Association Edinburgh meeting, being held from August 8 to 15, lays special emphasis on the progress of science in the last 100 years, as it is intended that it should be part of the Festival of Britain. A feature of this, the 113th meeting, at which the Duke of Edinburgh is president, is that the public will see the first demonstration of large-screen television with a wireless link between the transmitting and receiving end.

The Chancellor, the Marquess of Linlithgow, is conferring the honorary degree of Doctor of Laws on the Duke of Edinburgh, who has chosen for the presidential address "The British Contribution to Science and Technology in the Past 100 Years."

The Association, founded in 1831, has held meetings annually, except during the two wars, and has already visited Edinburgh five times, but not within the past 30 years. The Prince Consort was president at Aberdeen, in 1859, and the Prince of Wales at Oxford, in 1926.

The object of the meetings, which are the largest gathering of scientists in Britain, is to enable scientists to meet and discuss their work against the background of science as a whole; to enable scientists and laymen to meet; and to inform the public of the progress of science, with a view to familiarising it with the objects and methods.

Osborn's New Chairman

Samuel Osborn & Company, Limited, Sheffield, announces that Mr. Frank Arnold Hurst has been elected chairman of the company following the death (reported last week) of Mr. S. Eric Osborn. Mr. Hurst joined the company in 1897 as an office boy. After two years' working under Henry Mushet and Edward Mushet, sons of the celebrated Robert Forester Mushet, he moved for a short time to other Sheffield steelmakers in order to widen and improve his knowledge of the art of steelmaking and manipulation.

On returning to Samuel Osborn & Company in 1904, he became manager of the high-speed steel department and was responsible for the crucible melting of high-speed steel and its subsequent manipulation, along with research and testing. Mr. Hurst was later appointed steelworks manager, and to this was added the management of the twist drill and small tool departments, followed by his appointment as general works manager, covering the many and various operations of the company. In 1923 he was appointed a managing director of the company.

A member of the Iron and Steel Institute and the Society of Engineers and Metallurgists, Mr. Hurst is a founder member of the Sheffield Metallurgical Association. He was president of the Sheffield and District Rollers' and Tilters' Association, 1945-46, and is chairman of the technical committee of the High Speed Steel Association, and a vice-president of the Sheffield and District Engineering Employers' Association.

Austin Extension

The Minister of Supply officially opened new shops of the Austin Motor Company, Limited, at Longbridge recently. The site on which this new plant stands was originally a hill, and when designing the building it was necessary to cater for the reception of major assemblies from existing plants situated at a lower level. To this end a totally enclosed bridge was built from the lower building to connect with a main tunnel running under the entire frontage of the new factory.

The assembly tracks, enclosed on either side, start in a marshalling stores which contain some 750,000 chassis parts. Some half-way down the tracks are electrostatic spray-booths where chassis receive a coating of protective paint. They are lifted off the track automatically and passsed through an electrode system charged to a potential of 150,000 volts. During the passage through the high-potential grid they meet a finely-atomised paint mist, the particles of which become highly charged with electricity and are drawn to all surfaces to form an even coating.

One of the most striking features of the building is the amount of glass—nearly 60,000 sq. ft.—used in walls and roof to ensure the maximum interior daylight; special manual gearing enabling 58 ft. runs of windows to be opened for ventilation.

Freight Handling in United States

The recommendation to trade unions to encourage the development of "machine-consciousness" among their members is made in the report of the specialist team on long-distance freight handling which recently returned from a visit to the United States, sponsored by the Anglo-American Council on Productivity. The team advocates that both sides of industry and the appropriate government departments should engage in intensive propaganda to dispel any idea that there is anything new or frightening in the idea of mechanisation.

Because the handling of freight during transportation is akin to the handling of materials in factories, in that it increases the cost of the goods without increasing the value, the specialist team on materials handling, which visited the United States and issued its report last year, was followed by the present report on freight handling. This team was representative not only of the nationalised railways, roads and docks organisation, but included officials of private road, dock and transport undertakings.

Overseas Trade and Rearmament

Exports of some commodities from the United Kingdom during the first half of this year were appreciably below the level of the first six months of 1950, but the full impact of rearmament has yet to be reflected in our oversea trade. The value of U.K. exports in the first half of this year was £1,304,200,000, with imports at £1,856,400,000, raising the visible adverse balance to £552,000,000. This increase, however, is largely due to the sharp rises in import and export prices during the period.

Imports and Exports of Iron and Steel in June

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in June. Figures for the same month in 1950 are given for purposes of comparison and totals for the first six months of this year and of 1950 are also included.

Total Exports of Iron and Steel

Destination.	Month ended June 30.		Six months ended June 30.	
	1950.	1951.	1950.	1951.
	Tons.	Tons.	Tons.	Tons.
Channel Islands ..	583	885	4,064	4,528
Gibraltar	95	92	842	363
Malta and Gozo ..	480	596	2,698	1,044
Cyprus	564	359	4,424	2,652
Sierra Leone	372	1,286	2,131	2,581
Gold Coast	1,502	1,246	14,027	9,601
Nigeria	4,385	5,438	32,053	31,220
Union of South Africa	18,212	9,990	86,792	70,022
Northern Rhodesia ..	3,165	1,064	15,473	8,100
Southern Rhodesia ..	6,666	4,563	38,368	19,252
British East Africa ..	8,915	8,519	50,900	45,051
Mauritius	1,066	538	4,832	3,742
Bahrein, Kuwait, Qatar and Trucial Oman	730	227	3,781	3,861
India	10,131	6,273	45,456	49,186
Pakistan	16,007	5,479	49,192	43,942
Malaya	6,518	6,380	42,952	38,030
Ceylon	3,023	2,735	19,067	16,054
North Borneo	689	737	3,645	2,602
Hongkong	2,575	4,321	25,229	35,680
Australia	29,835	20,364	162,950	176,950
New Zealand ..	19,344	3,150	90,722	56,467
Canada	19,736	21,125	76,823	122,524
British West Indies ..	7,084	4,401	33,367	30,562
British Guiana ..	521	411	4,153	2,340
Anglo-Egyptian Sudan	2,418	787	9,741	5,056
Other Commonwealth	674	1,005	6,954	6,218
Irish Republic ..	7,564	5,937	46,745	47,569
Soviet Union ..	73	—	484	2,230
Finland	4,152	1,744	31,558	17,987
Sweden	8,666	9,425	47,151	52,433
Norway	9,565	6,315	45,319	35,666
Iceland	204	200	2,373	1,438
Denmark	7,564	5,298	70,545	44,767
Poland	94	34	1,022	543
Germany	17	122	203	625
Netherlands	7,055	8,292	41,392	45,724
Belgium	876	765	6,945	6,738
France	1,918	123	12,754	3,765
Switzerland	636	830	6,308	6,584
Portugal	2,642	834	10,757	8,126
Spain	820	244	4,388	2,132
Italy	965	3,908	5,006	18,161
Austria	50	31	550	276
Hungary	—	—	256	23
Yugoslavia	143	2	3,262	5,009
Greece	217	197	3,096	1,570
Turkey	675	315	5,236	2,380
Indonesia	685	1,081	8,121	3,823
Netherlands Antilles ..	757	26	4,804	1,554
Belgian Congo ..	246	200	867	1,242
Angola	205	143	1,453	1,459
Portuguese E. Africa	599	254	2,712	2,022
Canary Islands ..	211	641	1,011	1,320
Syria	161	1,609	707	2,168
Lebanon	565	2,216	5,835	8,455
Israel	2,446	4,551	9,963	16,036
Egypt	6,390	2,502	34,763	19,624
Morocco	9	12	1,572	1,292
Saudi Arabia ..	505	64	1,732	236
Iraq	1,217	716	21,104	11,806
Iran	6,658	8,897	58,347	49,298
Burma	1,110	1,566	5,623	7,644
Thailand	222	1,905	3,132	8,939
China	1,141	164	2,092	4,597
Philippine Islands ..	539	274	6,078	1,919
USA	2,929	12,817	10,482	99,630
Cuba	251	270	810	2,521
Colombia	968	282	3,377	3,432
Venezuela	2,439	1,296	18,870	15,438
Ecuador	746	204	2,024	701
Peru	1,797	1,699	5,996	6,316
Chile	2,352	160	1,0104	5,137
Brazil	2,850	1,431	15,288	11,893
Uruguay	379	577	4,738	7,614
Argentina	3,939	3,232	33,716	24,818
Other foreign ..	1,525	1,180	9,261	9,481
TOTAL ..	263,027	206,556	1,460,568	1,423,289

* The figures for 1951 are not completely comparable with those for the previous year.

Total Imports of Iron and Steel (tons)

From	Mth. ended June 30.		Six mths. to June 30.	
	1950.	1951.	1950.	1951.
India	—	1	22,884	2
Canada	4,645	3,495	22,031	22,764
Other Commonwealth and Irish Republic	88	163	891	788
Sweden	924	2,090	6,156	11,095
Norway	3,483	3,414	24,712	24,541
Germany	7,407	2,025	47,216	8,707
Netherlands	4,573	5,228	33,052	33,321
Belgium	12,028	19,516	50,827	75,177
Luxemburg	7,931	7,158	24,304	41,863
France	30,573	25,843	139,976	123,032
Austria	26	1,118	2,287	9,078
USA	6,707	2,650	35,787	17,955
Other foreign ..	1,339	694	5,079	1,418
TOTAL ..	79,724	73,395	414,292	369,741
Iron and steel scrap and waste, fit only for the recovery of metal	221,290	42,002	1,214,957	318,78 9

Exports of Iron and Steel by Products (tons)

Product.	Mth. ended June 30.		Six mths. to June 30.	
	1950.	1951.	1950.	1951.
Pig-iron	1,621	1,121	13,251	13,265
Ferro-alloys, etc.—				
Ferro-tungsten ..	88	30	596	284
Spiegeleisen, ferro-manganese ..	124	11	1,096	573
All other descriptions	112	67	794	602
Ingots, blooms, billets, and slabs	712	202	3,347	4,513
Iron bars and rods ..	212	993	2,487	5,623
Sheet and tinplate bars, wire rods ..	625	1,654	1,860	7,702
Bright steel bars ..	3,775	2,113	20,576	20,858
Alloy steel bars and rods	1,382	1,042	7,397	7,798
Other steel bars and rods	19,953	11,080	118,420	111,657
Angles, shapes, and sections	10,883	11,252	72,319	93,444
Castings and forgings	510	872	4,379	5,441
Girders, beams, joists, and pillars* ..	6,209	3,030	32,670	20,746
Hoop and strip ..	12,292	4,058	53,032	34,485
Iron plate	84	34	1,256	1,036
Tinplate	20,456	18,688	123,736	123,149
Tinned sheets ..	523	200	1,028	1,559
Terneplates, decorated tinplates	49	46	276	621
Other steel plate (min. ⅛ in. thick) ..	31,333	20,069	155,702	150,500
Galvanised sheets ..	10,175	2,508	57,446	29,063
Black sheets	11,890	13,973	69,095	78,894
Other coated plate ..	879	748	5,943	5,070
Cast-iron pipes up to 6 in. dia.	7,369	5,069	39,929	37,418
Do., over 6 in. dia. ..	7,182	4,783	42,623	34,690
Wrought-iron tubes ..	31,860	32,567	178,135	201,941
Railway material ..	28,654	22,175	148,778	125,181
Wire	7,432	3,940	35,929	32,121
Cable and rope ..	2,947	2,208	16,682	15,371
Wire nails, etc. ..	2,175	2,211	9,331	14,941
Other nails, tacks, etc.	479	758	2,621	5,356
Rivets and washers ..	863	913	4,113	3,718
Wood screws ..	337	233	1,847	1,868
Bolts, nuts, and metal screws	2,838	2,270	15,665	13,829
Baths	1,096	1,073	7,104	6,895
Anchors, etc. ..	552	682	4,408	4,514
Chains, etc.	1,150	1,046	5,342	5,442
Springs	727	472	4,902	3,259
Hollow-ware	6,415	2,745	44,986	18,941
TOTAL, including other manufactures not listed above	263,027	206,556	1,460,568	1,423,289

News in Brief

PLANS have been approved for a 200-ft. extension to a mill at Darlington for Darlington & Simpson Rolling Mills, Limited.

THE VICTORIAN DIVISION of the Institute of Australian Foundrymen, at their June meeting, heard a lecture on "Permanent-mould Practice" by Mr. S. Piece.

HOLDERS of the 941,250 £1 units of the Davy & United Engineering Company, Limited, are to be offered the right to subscribe at par for one new share for every £20 of stock held.

FOLLOWING FURTHER INCREASES in world prices, Shell-Mex & B.P., Limited, announce an increase under their inland trade price schedule of ⅛d. per gall. for B.P. Britoleum, effective from July 31.

THE FIRST of several United States ships expected in the Tyne with iron-ore cargoes has arrived from Bizerta with a cargo of 10,000 tons. American ships are newcomers to this section of Tyne trade.

AMONG THE OFFICIAL VISITS to the Engineering and Marine (Foundry) Exhibition at Olympia, London, on Friday, August 31, will be one by members of the Joint Iron Council Executive Committee.

TREASURY CONSENT has been obtained by General Refractories, Limited, Sheffield, to capitalise £390,000 of the reserves and make a bonus issue of three new 10s. shares for each five 10s. stock units held.

AN ORDER WORTH $600,000 from the United States for rectifier equipment has been obtained by the Hackbridge & Hewittic Electric Company, Limited, Hersham, Walton-on-Thames, in the face of keen competition.

AN EXHIBITION of a selection of Scottish minerals and some of the products made from them is being presented in the Engineering Centre, Sauchiehall Street, Glasgow, by the Mineral Resources Panel of the Scottish Council (Development and Industry).

H. & E. LITTOTT, LIMITED, of Horsham, Sussex, have taken over the control of the Portslade Ironworks. The controlling staff is, Mr. Frank H. Ayling, managing director; Mr. G. E. Gladwell, general manager; and Mr. J. A. Rodgers, secretary.

IN HIS STATEMENT with the report of Edgar Allen & Company, Limited, Mr. W. H. Higginbotham, chairman, says that the directors are considering the advisability of reorganising the capital structure to reduce disparity between capital actually employed and issued capital.

BRITISH INSULATED CALLENDER'S CABLES LIMITED announce changes of branch telegraphic addresses and telephone numbers:—Bicalbest, Liverpool, 1; Stoke-on-Trent 44256/7 and the B.I.C. Construction Company Limited, Clarence Chambers, Kingsway, Stoke-on-Trent, Stoke-on-Trent 44368.

THE BOARD OF TRADE announces that, after full consideration of the tenders submitted, it has been decided to accept the offer made by Associated Electrical Industries, Limited, for the purchase of the stock in Siemens Bros. & Company, Limited, now vested in the Custodian of Enemy Property.

A FINAL DIVIDEND on the ordinary shares of 10 per cent., making 25 per cent., less tax, for the year ended March 31 is announced by the Wellman Smith Owen Engineering Corporation, Limited. This compares with a total dividend of 12½ per cent., less tax, plus a cash bonus of 5 per cent., free of tax.

SIR ARTHUR MATTHEWS, of Sheffield, has been elected a director of Bradley and Foster Limited, Darlaston Iron Works, Darlaston, Staffs., Bradleys (Darlaston) Limited, and Bradleys (Concrete) Limited. Sir Arthur Matthews was recently elected to the Board of the parent company Staveley Coal & Iron Company, Limited, Chesterfield.

IN A RESERVED JUDGMENT, the House of Lords dismissed an appeal by Mobberley & Perry, Limited, manufacturers of firebricks and gas retorts, of Stourbridge (Worcs), from a decision of the Court of Appeal, London, that a 58-year-old ex-miner, Sidney Holloway, of Stourbridge Road, Lye, was entitled to workmen's compensation for pneumoconiosis which developed three years after he had left the pits in 1946.

AN INCREASED DISTRIBUTION on the £4,198,372 ordinary capital is announced by the directors of the General Electric Company, Limited. The increase is of 5 per cent. to 22½ per cent. for the year ended March 31. The dividend is unchanged at 10 per cent., but the cash bonus is raised from 7½ per cent. to 12½ per cent. The distribution of 17½ per cent. was maintained for each of the 10 preceding years.

THE INDEX NUMBER of United Kingdom industrial production (1946 = 100) prepared by the Central Statistical Office fell sharply by five points during May to 146. The decline was largely the result of the Whitsun holiday. The May index number was two points above the average for the first quarter of the year, but still six points above the average for the whole of last year. The figure for May, 1950, was 142.

IN A WRITTEN ANSWER to Mr. Lambert, Mr. M. Stewart, Parliamentary Secretary to the Ministry of Supply, said that he was aware that there was between 18 months' and two years' delay in delivery of 3-in. to 6-in. iron water pipes. Increased production depended on additional labour to work extra shifts. Plans were in hand to provide housing accommodation for additional labour for one of the largest producers in the country, but it was not expected that they would be completed before 1952.

THE ANNUAL REPORT for 1950 of the World Power Conference is now available from 201, Grand Buildings, Trafalgar Square, London, W.C.2 (1s. 6d. post free). It announces the election of Dr. A. Parker, C.B.E., as honorary secretary of the British National Committee, of which Sir Vincent de Farranti, M.C., is chairman, Mr. Harold Hobson vice-chairman, and Col. C. M. Croft, D.L., honorary treasurer. The next meeting is to be held in Brazil in the summer of 1954. Germany and Japan are now members.

MR. JUSTICE ROXBURGH, in the Chancery Division recently, confirmed a reduction of the capital of Pease & Partners, Limited, Darlington, from £1,566,733 10s. to £868,777 2s. by returning capital in excess of the wants of the company. Mr. Cecil Turner, for the company, said its paid-up capital was in 5s. shares, of which 3,489,782 had been issued. It was proposed to repay 4s. per share, which would require £697,956. The company had a large sum of cash and gilt-edged securities available.

Obituary

MR. H. J. SIMMONDS, for many years associated with, and lately secretary of, J. I. Blackburn & Company, ironfounders and engineers, of Godalming, Surrey, was found dead on July 15.

THE DEATH has occurred of Mr. George Conrad Bergius, a director of the Bergius Company, Limited, marine engine manufacturers, of Glasgow. He joined his brother, the late Mr. Walter Bergius, in the marine engine business in 1914.

MR. A. O. BAILEY, aged 51, joint managing director of the Bromsgrove Casting Company was killed in a most unusual accident on July 31. He was run-over by his own runaway car which he had parked on an incline and which he failed to stop when it began to move.

Personal

Mr. W. O. Adams, a past-president of the Institute of Australian Foundrymen, accompanied by Mrs. Adams is now in London.

Mr. Arthur Walkden, a shipwright apprentice with Vickers-Armstrongs, Limited, Barrow-in-Furness, is this year's recipient of the first prize in the prize scheme for shipyard apprentices of the Worshipful Company of Shipwrights.

Dr. A. J. Kennedy has been appointed Armourers and Brasiers' Company Research Fellow by the committee representing the company and the Royal Society. He will work at the Royal Institution of Great Britain on transient creep in polycrystaline metals.

Mr. J. Ovenstone is retiring as planning and progress engineer after almost 40 years' service with Babcock & Wilcox, Limited, Renfrew. He has been presented with a clock and wallet of notes from members of the firm's production planning and control department.

Mr. F. M. Owner, chief engineer of the engine division of the Bristol Aeroplane Company, Limited, has relinquished his position by mutual agreement with the company in order to take up another appointment. His successor is Dr. S. G. Hooker, previously deputy chief engineer.

To mark his retirement after 52 years' service with William Denny & Bros., Limited, shipbuilders and engineers, of Dumbarton, Mr. Alex. Porterfield, who was in charge of the orders department, has been presented with a wireless set and a cheque. In 1844 Mr. Porterfield's grandfather carried out the contract for the first vessel built in Denny's yard.

Sir John H. Woods, permanent secretary to the Board of Trade since 1945 and a member of the Economic Planning Board since 1947, is to take up an appointment with the English Electric group. He entered the Treasury as assistant principal in 1920, since when he has remained in the Civil Service. Sir John has been secretary to the Trade Facilities Act Advisory Committee, principal private secretary to the Chancellor of the Exchequer, and a principal assistant secretary in the Treasury from 1940 to 1943. After that, and until his transfer to the Board of Trade, he was permanent secretary to the Ministry of Production.

Major C. R. Dibben has been appointed by the Chancellor of the Exchequer to be chairman of the Midland Regional Board for Industry in succession to Mr. W. H. Stokes, who retired on his appointment as a member of the Iron and Steel Corporation. Major Dibben was for 31 years connected with the Midlands division of the Federation of British Industries until he left the organisation's service a year ago. He remained, however, a member of the F.B.I. Grand Council. Throughout the war he was a member of the regional board under the Ministry of Production and he has continued to serve as a member of the board since its reorganisation as an advisory body after the war ended. Major Dibben is a director (among other companies) of J. Brockhouse & Company, Limited, West Bromwich, and its associated companies.

Changes announced by Crompton Parkinson, Limited, include two new appointments for Mr. J. B. Scott, general sales manager of the plant division. He has been appointed an executive director of the company and, as from October 1, he will become assistant sales director (home). Mr. Scott commenced his association with the company in 1939, his commercial career being interrupted by a period of service with the R.A.F. He won the D.F.C. twice. Early in 1946 he was made manager of the Manchester plant branch, a year later becoming branch manager at the London office.

New Catalogues

Light-alloy Extrusions. High Duty Alloys, Limited, of Slough, have just issued a quite "out of the ordinary" catalogue covering extrusions made in Hiduminium alloy. It has a dust jacket in battleship grey, but on opening it becomes quite gay, because of the use of coloured thumb-pieces for locating the various sections. The properties of these extrusions are set out in loose-leaf tables carried in a pocket inside the front cover. Binding is by means of a spiral and excellent use has been made of the camera for the illustrations are noteworthy. We congratulate the publicity department of High Duty Alloys on their latest effort. Readers desiring a copy must write to Slough.

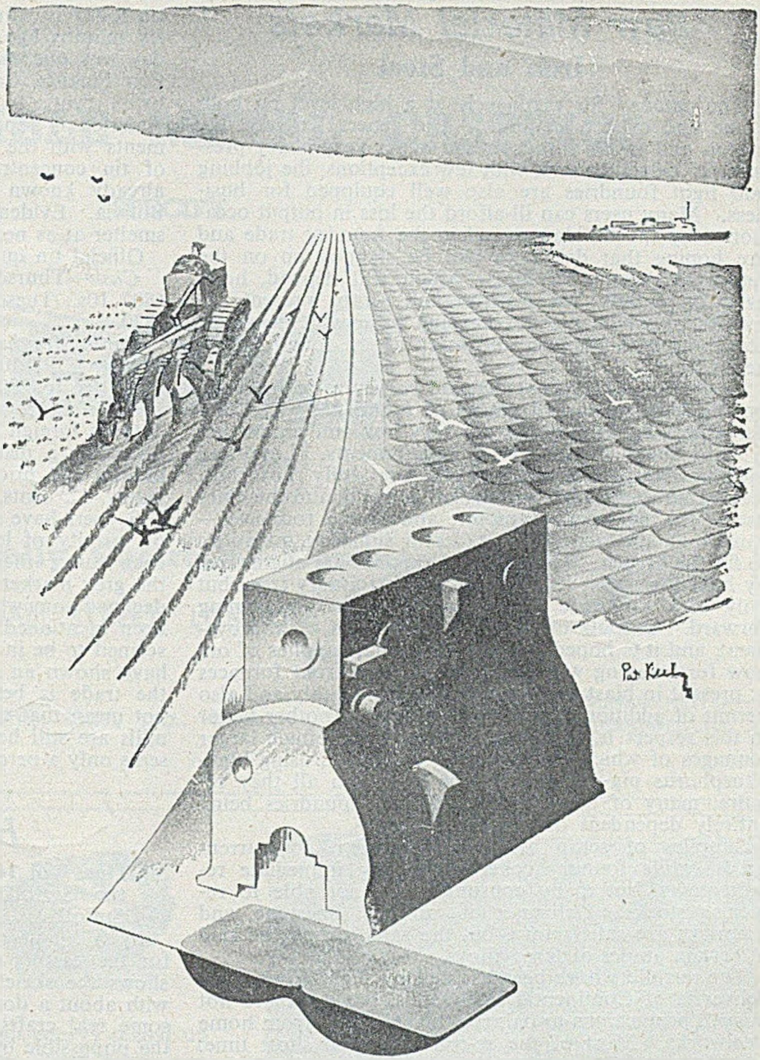
Safety Appliances. J. & R. Fleming, Limited, of 146, Clerkenwell Road, London, E.C.1, have just issued a 30-page, well-illustrated catalogue covering goggles, welding helmets, handshields, and dust respirators. The array of goggles is almost bewildering, but the duties required from them are so varied, ranging over welding, fettling and melting. In connection with the last duty, the model 1529X would not meet with approbation from the reviewer, whose personal opinion is that the circular spectacle shown would be dangerous, it being essential that a melter shall be able to look over the top of his goggles after staring inside a furnace. No. 1529 which has oval lenses would be preferable. Outstanding in this booklet is the evidence of the thought which has been given to appliances for personal use and therefore subject to the maximum of criticism. A study of the information in this brochure, which our readers should certainly undertake, should go far in resolving many of those reasons why the goggles supplied are not being used. The booklet is available to our readers by writing to Clerkenwell Road.

Iron and Steel Institute to Visit Austria

The Autumn Meeting of the Iron and Steel Institute is to be held in Austria at the invitation of the Technisch-Wissenschaftlicher Verein "Eisenhütte Oesterreich," over which Dr. J. Oberegger presides. Three Papers are to be presented:—"The 2,000-year Tradition of the Austrian Iron Industry," by R. Walzal; "The Present Metallurgical Bases of Austrian Iron and Steel Production," by B. Matuschka; and "Investigations into the Effect of Non-metallic Inclusions on the Hot-workability of Steel," by F. Rapatz and M. Strobich. The meeting lasts from September 6 to 18. A number of iron and steel works and magnesite factories are to be visited, mostly during the mornings, with the afternoons free to visit the countryside. The programme is most attractive and details of the meeting can be obtained from the offices of the Institute, 4, Grosvenor Gardens, London, S.W.1.

British Standards Institution

The British Standards Institution has recently published addendum No. 1 (weights of special castings (P.D. 1166:1951) to B.S.78—"Cast-iron pipes (vertically-cast) for water, gas and sewage." This addendum sets out the weights of special castings dealt with in that standard which was last revised in 1938. At the time of preparation of the revision, the weights of special castings had not been calculated but it was felt undesirable to withhold publication on that account. Copies of this addendum may be obtained from the British Standards Institution, Sales Department, 24, Victoria Street, S.W.1, price 3s. post free.



Raw Material Markets

Iron and Steel

The demand for castings is at a high level on both home and export account. The general engineering, motor, and textile foundries are under very heavy pressure for deliveries and, with few exceptions, the jobbing and light foundries are also well equipped for business. Many users can ill-afford the loss in output occasioned by the holiday period in the foundry trade and are hoping that deliveries will be stepped up on the return to normal working. Much will depend, however, on supplies of pig-iron and scrap, present deliveries of which are not keeping pace with demands. Stocks of both pig-iron and scrap at the foundries are negligible.

A strong and insistent demand continues to be made on the furnaces for all grades of foundry pig-iron and hematite. Furnace stocks are very low and production is inadequate to satisfy all requirements. Low- and medium-phosphorus descriptions are fully absorbed, leaving an appreciable unsatisfied demand, and the chief users—the engineering, motor, and textile foundries—cannot obtain alternative grades in sufficient quantities to fill the breach. Their normal supplies are augmented by hematite, refined iron, and Scotch foundry iron, but only very moderate quantities of these are coming forward. Outputs of hematite show signs of improvement, and it is hoped that the additional supplies of ore now forthcoming will enable production from furnaces at present in blast to be increased considerably and also permit of additional units being blown. Another factor in this respect is, of course, coke supplies, much larger tonnages of which are required. Foundries using high-phosphorus pig-iron are unable to obtain all they require, many of the jobbing and light foundries being entirely dependent on current deliveries.

Supplies of scrap are barely sufficient for current needs, while foundry coke is covering immediate requirements, but many consumers are not able to replenish stocks. Deliveries of ganister, limestone, and firebricks are satisfactory, but the same cannot be said of certain grades of ferro-alloys.

The re-rollers have been assisted by slightly improved deliveries of Continental steel semis, but these are not in such proportions to balance the shortages from home steelworks. Most of the re-rollers are on short time, and some, in fact, are closed pending receipt of sufficient material to enable them to make a restart. Orders for their products are plentiful and there is a heavy pressure for all sizes of bars, sections, and strip from home and oversea customers. The sheet re-rollers are also heavily booked for supplies, and they require larger quantities of sheet bars than are forthcoming. With reduced outputs at the steelworks, available tonnages of defectives and crops are on a reduced scale, and those arising are disposed of quickly.

Non-ferrous Metals

The last two weeks have been quiet in the non-ferrous metals industry, and probably there will not be a lot going on for another week or two. Several works are closed down for holidays this week, while others have only just reopened. The Metal Exchange closed its doors after midday trading on Friday and did not reopen until Tuesday.

There was a fairly active market in tin last week, but selling predominated and the quotation lost ground. The market has recently been lower than at any time since October last, and the fall since the peak was reached in February has been fully £800. In fact, tin today is valued at approximately half what it was six months ago. The weakness before the Bank holiday was due mainly to the action of the Reconstruction Finance Corporation in lowering its selling price by 3 cents to 103 cents for domestic consumers. America is reported to have made purchase arrangements with the Dutch and the Belgians for a supply of tin concentrates to the Texas smelters, and it is already known that negotiations are in hand with Bolivia. Evidently the intention is to run the domestic smelter at as near capacity as possible.

Official tin quotations were as follow:—

Cash—Thursday, £806 to £807; Friday, £805 to £807 10s.; Tuesday, £805 to £807; Wednesday, £819 to £820.

Three Months—Thursday, £796 10s. to £797; Friday, £795 to £797 10s.; Tuesday, £796 to £798; Wednesday, £806 10s. to £807.

In deference to pressure from consumers, the import duty on foreign lead entering the United States has been lifted for a matter of two years or so, unless in the interim the price on the domestic market should fall below 17 cents. There cannot be much doubt that U.S. users have some grounds for complaint on account of scarcity of lead, for the imports during 1951 have been lower than during the first part of 1950. On the grey market in Europe vales of lead have recently declined somewhat and indeed a price below £200 has been mentioned. In the U.K. a few months ago lead seemed to be in rather short supply, but the past weeks have shown an improvement in this respect and today the trade is better supplied than it was. That does not mean that the quotas have been increased, for the mills are still held down to an allocation which represents only a percentage of what was being used in 1950.

House Organs

Sip-Tips, Vol 14, No. 73, Spring 1951. Published by the Suffolk Ironfoundry, Limited, Stowmarket, Suffolk.

In this issue the reviewer was fascinated by Fig. 13, for the casting illustrated had been very unlucky. It shows the skeleton of a pump body, 5 ft. 9 in. high, with about a dozen broken bits and a few cracks. Yet some real craftsman solved a jig-saw puzzle and did the impossible by making it as good as new. The little sketch on page 17 has really no place in a publication of this type. For the rest the contents are of the same interesting character as is usual with this magazine.

Carron Cupola, Vol. 2, No. 3. Issued by the Carron Company, Falkirk.

This issue contains a full-length description of bath making in their mechanised foundry. The sketches which illustrate it are of exceptional interest. Mr. R. Lorn, a loam moulder, has been the recipient of a gold watch. He has been 66 years with the company, and both his father and grandfather worked for Carron. This indeed is a record of which to be proud!

New Scrap Price Control Order

A new Order made by the Minister of Supply—the Iron and Steel Scrap (No. 3) Order, 1951 (SI 1951, No. 1359), provides maximum prices for scrap alloy steel. It reimposes price control on the main specifications of alloy steel scrap and it also brings all the important specifications of stainless-steel scrap under statutory price control for the first time.

The Order came into effect on August 1.

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

(Delivered, unless otherwise stated)

August 8, 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., £40 15s., basis 45% Si, scale 15s. per unit; 70/84 per cent., £56, 2s. 6d., basis 75% Si, scale 16s. per unit.

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

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

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

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

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

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

Ferro-chrome (6-ton lots).—4/6 per cent C, £74, basis 60% Cr, scale 24s. 6d, perunit; 6/8 percent. C, £70, basis 60% Cr, scale 23s. 3d. per unit; max. 2 per cent. C, 1s. 8¼d. per lb. Cr; max. 1 per cent. C, 1s. 8½d. per lb. Cr; max. 0.15 per cent. C, 1s. 9½d. per lb. Cr.; max. 0.10 per cent. C, 1s. 9¾d. per lb. Cr.

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

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

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

Ferro-manganese (blast-furnace). — 78 per cent., £37 19s. 10d.

Manganese Briquettes (5-ton lots and over).—2lb. Mn, £46 18s.

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.—47s. 9½d. per basis box.

NON-FERROUS METALS

Copper.—Electrolytic, £234; high-grade fire-refined, £233 10s.; fire-refined of not less than 99.7 per cent., £233; ditto, 99.2 per cent., £232 10s.; black hot-rolled wire rods, £243 12s. 6d.

Tin.—Cash, £819 to £820; three months, £806 10s. to £807; settlement, £819.

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

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

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

Other Metals.—Aluminium, ingots, £124; antimony, English, 99 per cent., £390; quicksilver, ex warehouse, £73 5s. to £74; nickel, £454.

Brass.—Solid-drawn tubes, 25¼d. per lb.; rods, drawn, 28¼d.; sheets to 10 w.g., 30⅛d.; wire, 31⅜d. rolled metal, 28⅞d.

Copper Tubes, etc.—Solid-drawn tubes, 26⅞d. per lb.; wire, 261s. 9d. per cwt. basis; 20 s.w.g., 288s. 9d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £277 to £281; BS. 1400—LG3—1 (86/7/5/2), £282 to £300; BS. 1400—G1—1 (88/10/2), £345 to £360; Admiralty GM (88/10/2), virgin quality, £345 to £350 per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £350 to £390; L.P.Bl, £309 to £322 per ton.

Phosphor Bronze.—Strip, 38½d per lb.; sheets to 10 w.g., 40⅝d.; wire, 42⅝d.; rods, 38½d.; tubes, 43½d.; chill cast bars: solids 3s. 11d., cored, 4s. (C. Clifford & Son, Limited.)

Nickel Silver, etc.—Ingots for raising, 2s. 7¼d. per lb. (7%) to 3s. 7¼d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 3s. 1½d. (7%) to 4s. 1½d. (30%); to 12 in. wide × .056, 3s. 1¾d. to 4s. 1¾d.; to 25 in. wide × .056, 3s. 3¾d. to 4s. 3¾d. Spoon and fork metal, unsheared, 2s. 10¼d. to 3s. 10¼d. Wire, 10g., in coils, 3s. 7¾d. (10%) to 4s. 7d. (30%). Special quality turning rod, 10%, 3s. 6¼d.; 15%, 3s. 11d.; 18%, 4s. 3¼d. All prices are net.