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Pioneers of 1950

Last week, we undertook a journey with the object of investigating and recording the solid progress being made in this country in some of the newer fields of metallurgy. Our mind went back to the days nearly 40 years ago when we too were pioneering the economic and technical exploitation of the electric-arc furnace for the making of steel. At Brymbo and at Edgar Allen's we saw and admired the development of what is now known as the "oxygen blow." The difficulties to be associated with the establishment of the two processes were much the same. Then, as now, the effect of higher temperatures on refractory materials presented new problems. "Know hows" have had patiently to be built-up from experience, but above all real courage has been shown. There is, however, one major difference between 1910 and 1950, and that is, pioneers of to-day have recourse to their own research department and the national research associations.

The application of the oxygen blast is not undertaken for a common object. At Brymbo, where 30-ton capacity, electric-arc furnaces are used, the main ends sought are (1) a speeding-up of the process; (2) a reduction in the electricity consumption, and (3) a superior finished product. These have now been thoroughly established. At the Imperial Steelworks, a quite different problem has been solved. The 18:8 quality of stainless has been manufactured for many years and the process scrap has been accumulating. It became a drug on the market because a cardinal requisite is that the steel must be exceptionally low in carbon. When re-melted in the arc furnace, the carbon pick-up was sufficiently high to ruin it. A little could be processed in the high-frequency furnaces, providing the scrap was very carefully selected. With the oxygen blow, the silicon and carbon, but not the chromium and manganese, are removed. Because of the high temperatures involved, something of the order of 300 deg. C. higher than normal practice, a new set of conditions are set up. The success of both these projects has been due to a determination to replace "fiddling about" by "whole-hogging." Thus, to ensure success, liquid oxygen is piped to the shop wall, where a flexible pipe and mild-steel tubing threaded through a hole in a shield ensures practical conditions. For the big furnaces, the oxygen lancing takes about half an hour, but with the smaller plant at Allen's only a matter of 10 minutes or so.

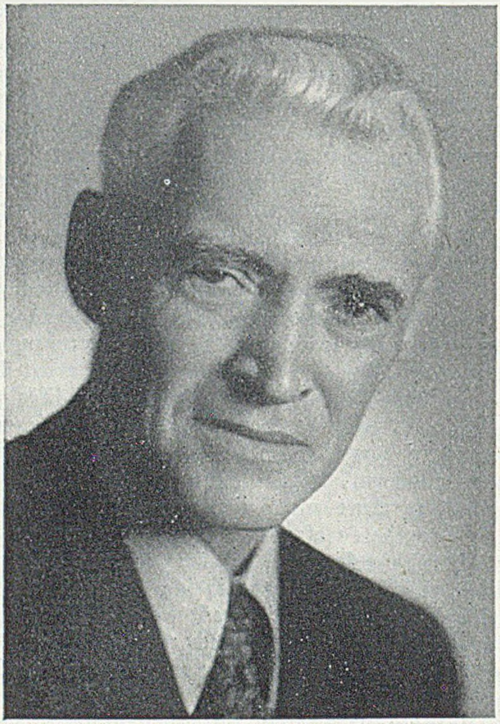
Our tour also included sections of the works of William Jessop and Sons, where outstanding work is being done in the precision heat-treatment and non-destructive testing of aeroplane components. In addition, we were able to inspect in great detail the precision casting of turbine blades in a pilot plant, the main factory for this process being located in Birmingham in the works of an associated concern. It is obvious that, in the field of high-temperature metallurgy, the house of Jessop is well to the forefront. All this pioneering work is of major interest to the foundry industry. Much of it has a direct bearing, but we think the major lesson is that different or at least modified reactions must be expected, when temperatures much in excess of those currently encountered are handled. Never before has a series of works visits so strongly imprinted on our minds that the pioneering spirit, well worthy to be associated with Bessemer, Siemens and Thomas, still animates British industry.

Contents

Institute's New President

MR. J. J. SHEEHAN, B.Sc., A.R.C.Sc.I., who was yesterday elected president of the Institute of British Foundrymen for the year 1950-51, is one of the most popular figures in the foundry industry.

Mr. Sheehan is managing director of the Coneygre Foundry, Limited. He graduated in applied chemistry and physics at the National University of Ireland and obtained in 1919 the Associateship of the Royal College of Science. After graduation he went to America where he worked as assayer and metallurgist in the Rocky Mountain Mining &



MR. J. J. SHEEHAN

Smelting Companies of the United States and Mexico. Subsequently he was employed in the metallurgical laboratories and foundries of the Ford Motor Company in Detroit, Cork and Dagenham, becoming chief chemist and metallurgist at Cork, and foundry metallurgist at Dagenham. Later he worked in the foundries of Austin Motor Company, of which he became superintendent. Mr. Sheehan has served on the Council and Technical Committees of the Institute, is an Oliver Stubbs Gold Medallist, and is also on the Council of the British Cast Iron Research Association.

Mr. Sheehan, who is a keen amateur oil-painter, includes in his hobbies the study of geology—particularly the geology of the Midlands. A gracious speaker and a man of sterling character, Mr. Sheehan is distinguished by a charm of manner which will ensure that his already large circle of friends amongst foundrymen will be greatly widened during his term of office.

New Vice-president

MR. COLIN GRESTY, who was elected senior vice-president of the Institute of British Foundrymen for 1950-51, is general foundry manager and chief metallurgist of The North Eastern Marine Engineering Company (1938), Limited, Wallsend-on-Tyne and Sunderland, and their associated companies, Richardsons, Westgarth & Company, Limited, Hartlepool, and George Clark (1938), Limited, Sunderland. He entered the metallurgical laboratory of North Eastern Marine early in 1912 and became chief metallurgist in 1926 and foundry

MR. COLIN GRESTY

manager in 1927. In 1938, he was appointed to his present position.

Mr. Gresty joined the Institute of British Foundrymen in 1917, was secretary of the Newcastle branch from 1924 to 1927 and branch president in 1928/9 and again in 1937/8. During his long period of membership he has had many years experience on the General Council and was appointed junior vice-president of the Institute in 1949. In March this year he was elected president of the National Ironfounding Employers' Federation and he is also a member of the Council and of the Technical Committee of the Council of Ironfoundry Associations. He was a member of the " Garrett " committee on conditions in iron foundries and is now on the Joint Standing Committee which arose from it. Amongst other activities are membership of the Council and of the Research Board of the British Cast Iron Research Association and membership of the Iron and Steel Institute and of the Institute of Metals.

Institute of British Foundrymen *Annual Conference*, 1950

A Way of Living

Presidential Address by J. J. Sheehan, B.Sc., A.R.C.Sc.I.

The Institute of British Foundrymen was founded with a definite technical and scientific objective. This fact has been analysed, elaborated and expounded in many previous presidential addresses, and it is true to say that the Institute has achieved adequately those objectives envisaged by its founders through the efforts of its members. It has, however, in doing this, not been a soulless system of efficiency, but has achieved, perhaps because of the type of its constitution, or perhaps more because of the type of its membership, a definite function as a social institution, and helps to make a way of living.

The Institute is a social organisation, a friendly society, a debating society and a benevolent organisation. It is none of these things mainly, but all of these things certainly, in a degree worthy of noting and mentioning, and indeed studying and extending.

It is reassuring to think that the organisation of the Institute is based on ordinary membership, from which derives both membership of the local councils, the general council and the various technical committees. In the Institute decisions are arrived at and work done through committees. These committees cannot function except through agreement arrived at after discussion, and it is in the processes of arriving at agreement that we arrive at a knowledge of one another. With most people—to know them is to like them.

Work, relaxation, rest—that is the pattern and rhythm of our lives.

Work and rest should be equal and opposite, that is, balanced. Work and rest are mainly materialistic and certainly physical. Relaxation can be both physical and mental, and is very often of a spiritual nature, and is most valuable and sustaining in its mental and spiritual manifestations. That period of relaxation must not be solitary always or, indeed, even mainly so. Relaxation is best in the company of our friends.

Modern Living Conditions

Now, under the conditions of modern civilisation —company and friends are difficult to form and keep, not that people are in any major sense inherently different now from people of recent civilisation, but because conditions are definitely so, and particularly in the world of industry. One of the sound and reasonable needs of a balanced existence is the need for security, not necessarily the material security most needed in old age, but security in the mental and spiritual sense, emotional security based on steady, reliable and affectionate human relationships and the security of firm friendships. Generally, our present civilisation offers little of this kind of security. Our lives are influenced by impersonal happenings over which we have no control. We miss the deep social roots provided by an older agricultural way of life, with life among large clannish families spread over an area of the countryside and thus occupied for generations.

Agriculture is such that it is usual to spend a lifetime on one farm, or perhaps more likely, in one district. The pattern of industry differs—it proceeds from school to apprenticeship, to technical college or university or to factory, and then factory after factory in town after town and, indeed, in country after country.

Such a pattern of life and living does not conduce to knowledge of your neighbour. You have no neighbour. This progression leads you to exist as the foundry industry does, mainly in towns and cities, usually residing in a dormitory suburb, the product of the rapid growth of our towns. These suburbs are not neighbourhoods, you have no neighbours except in the sense of propinquity; you certainly do not know them, and what you do not know you cannot like or indeed dislike. You live in a friendless vacuum. This condition may lead to single mindedness and greatness, because it is void of distraction, but it does not make for living. and surely the business of life is living.

Compensations

All this sounds a trifle gloomy. We have, however, many compensations; there is, too, a very possible escape from the conditions which produce this stagnation—participation in the activities of the professional and technical institutions, and in our particular case, through the activities of an Institute which seems to be specially designed for that purpose.

Dr. Harold Hartley, in his presidential address to the Institution of Gas Engineers in 1948, said "It must be remembered that men do not unite in professional institutions for mundane matters only, but to retain freedom for creative thought and full development of the mind." Our Institute, combining these two concepts of "knowledge of oneself through creative thought and full development of the mind," and "knowledge of one another through friendly association," deserves our attention and the further consideration as to how far it fulfils these functions, for, as already said, the Institute seems to have been specially designed for the purpose, or at the very least it has the structure on which such concepts can be built.

A Way of Living

Structure of the Institute

The structure of the Institute is best indicated by a definition of its objects, type of its membership and the constitution of its Council and Committees. The objects are "to promote the intellectual welfare of its members by reading and discussing scientific Papers, and such other matters as may be considered within the scope of the Special Authority, to conduct research, and to organise systems of education."

The membership consists of honorary members (awarded on merit), members, associate members, associates and subscribing firms. The Council consists essentially of the president, two vice-presidents, treasurer, secretary and ten members elected according to bye-law 18, about twenty representatives from branches and the past-presidents of the Institute, presidents and secretaries of branches, representatives of kindred institutions—a very wide basis of selection indeed, with a very strong emphasis on branch nominations and election.

All main committees are nominated by Council, the branches are governed by Council, and both branches and committees are controlled through surrender of all subscriptions from the branches, and by the re-allocation of part-subscription and other funds to branches, to committees, and to other activities controlled by Council. The Institute offers medals, awards, grants, diplomas for research and for Papers, inventions and improvements of foundry work advances.

This structure is sound and balanced, and may be best likened to a healthy tree, well rooted, with a substantial body and flourishing in its branches. It is difficult to exaggerate the importance of the branches. At the branches, discussions are intimate and can afford to be personal with advantage, the branch activities provide a training ground for administrative and committee work, they are a listening post for very latest practice, the discussions continue in adjoining places of refreshment, licensed and otherwise, and often in one another's homes—loneliness vanishes, friendships grow. Passing from branches to Council meetings, which may be held at different branches, there is the possibility of meeting members outside the branch, and of further widening the circle of your friends.

The writing, presentation and discussion of Papers, first at branch meetings and later nationally or internationally, ultimately widens your knowledge. Presenting eliminates your shyness and enhances your confidence and courage. Discussion helps you to keep your sense of proportion and relative importance. Taken altogether, this is a very liberal education. You may go from strength to strength in going from branch to branch to present your Paper, and from a limited circle to wide horizons in presenting Papers to kindred institutions. From this again to international conferences, where further friendships await, so that there is no limit to your friendships except the limitations of time to allow you to enhance and enjoy them.

Your flair may not be in writing and presenting Papers, but in discussing them, and a Paper is a poor thing without discussion. Yet again your strength may be in committee work, a very excellent thing, an excellent and intimate mode of self-expression, with all the intimacy of team work, less suitable, perhaps, for the rugged individualist, but satisfying to one with a sense of community, a civic sense, a highly civilised person. This committee work, technical and administrative, is an excellent training ground for all the activities of our particular brand of democracy and also, indeed, helps us to understand our national and local processes of administration and government.

Specialised Activity

Attendance at the Foundry Foremen's Training Course is an activity of immense social benefit, apart altogether from its merits in technical training. The following quotation is fully taken from the introduction to the booklet issued at the second Foundry Foremen's Course held at Ashorne Hill in March, 1950, which helps to explain the function of these courses and illustrates very well the means used to achieve the success these courses undoubtedly have. The more illustrative sentences are italicised:—

"As an experimental extension of its educational activities on behalf of the foundry industry, the Council of the Institute of British Foundrymen organised a Foundry Foremen's Training Course which was held at Ashorne Hill in April, 1949. The enthusiastic support accorded this effort was manifested not only by an overflow of applications, but by numerous requests for a further course. The Council of the Institute has therefore been encouraged to undertake the present venture in the shape of a second Course. The object of the Course is to bring together a large number of foundry foremen in charge of men, to hear the views of experts on various problems of great practical interest. The authors of the lectures forming the Course have been selected with great care to ensure that the guidance given is authoritative *and the instructional value of the proceedings will be greatly enhanced by the ample opportunities which will be provided for the exchange of experience during discussion of the lectures and in personal contact with other visitors.* Everyone is therefore urged to take a full part in all activities, and to contribute his views during the discussion of the various lectures. *An innovation designed to increase the benefits derived by those attending the Course is the arrangement of discussion groups to debate the lectures.* Officials of the Institute will be in attendance throughout the whole of the Course, and will be glad to render any possible assistance to all visitors."

The value gained from these Courses is great, but an immeasurable amount of this value is that which consists of the friendship found, formed and enhanced at the lectures and discussions, but assuredly more particularly in those periods of leisure and relaxation between the technical activities.

Student Activities

The student sections of the Institute give our very junior members an opportunity of starting their friendships early in life, indeed operate for students at an age when friendships are more readily formed, and are of most benefit in forming disposition and character. There are two student sections in the Institute, one of about 50 members and one of about 34, both active, both following closely the technical activities of the senior branches and anxious to have an independent part in some future annual conference and, perhaps, eventually in some future international conference.

Social Activities

The social activities of the Annual Conference of the Institute need no elaboration, they are, indeed, self-evident. Receptions, dances, theatre, cabaret, concerts, dinners, luncheons, morning coffee, visits of scenic and artistic interest are all organised and designed to enable us to get together in social comfort and relaxation, so that we may get to know one another's dispositions under conditions of pleasant ease and so help us to forgive one another's behaviour under conditions of unpleasant stress.

Adding the consequences of all these activities together it is no exaggeration to say that our Institute is indeed a benevolent organisation in quite a marked way. Not perhaps in the more definite and rigid sense of benevolent societies or foundations, which are specially formed to administer monetary donations for charitable purposes mainly, but surely in the sense that the members give of their time and knowledge for the benefit of their fellow members—the industry directly and the community indirectly. Their time and knowledge are very valuable and freely given, indeed benevolently so.

There is no part of the Institute's activities where this benevolence does not operate—in Council, among the higher offices of the Institute (treasurer, secretary, president and vice-presidents) and in the offices of the branches. It is particularly shown in the chairmen and members of the technical committees, and in the men of vision amongst you who initiated the various awards in the gift of the Institute and those who initiated the foundry schools, the Foremen's Training Course, the Students' Grants. Such men of benevolence, capacity, initiative and imagination are worth knowing, enjoying and imitating.

Surely with all those stimulating activities and personalities within our Institute it is possible to achieve a full knowledge of oneself, a knowledge of one another, and to obtain and "retain freedom for creative thought and full development of the mind," and surely, also, all this adds up to a full life and to a better way of living it.

Dr. Dadswell is a member of the executive council of the British Steel Founders' Association and of this Association's research council, also of the steel-castings panel of the British Iron & Steel Research Association, and the Institution of Mechanical Engineers and the Iron and Steel Institute.

Junior Vice-president

Dr. C. J. DADSWELL

C. J. DADSWELL, Ph.D., B.Sc.(Eng.), M.I.Mech.E., Ingenieur E.S.F., who has been elected as junior vice-president of the Institute of British Foundrymen, is a director of English Steel Corporation Limited, Sheffield. He was born at East Grinstead in 1906, and commenced his education at Shoreham Grammar School continuing at the Brighton Technical College and University College, University of London, at the same time doing part-time practical works training. He obtained his Ph.D.(Engineering) degree under the late Prof. E. G. Coker, F.R.S., and after a short time with one of the L.M. & S. carriage and wagon departments, gained steelworks experience with Cammell, Laird & Company, Limited, Sheffield, later becoming assistant to the steel-foundry manager at the Grimesthorpe Works of English Steel Corporation, Limited, Sheffield. Whilst in the steel foundry, in 1933, he won the Robert Blair Travelling Fellowship, and went abroad to study for 12 months at the Paris Foundry High School. On his return to England he worked for nearly a year as a moulder in the iron, brass and steel foundries of Vickers - Armstrongs, Limited, at Barrow-in-Furness. In 1935, he was the first British subject to be awarded the diploma of *Ingenieur de l'Ecole Superieure de Fonderie* (*Paris*).

DR. C. J. DADSWELL

On returning to Sheffield in 1934 he became steel-foundry manager at the Grimesthorpe Works of English Steel Corporation, Limited. During the last war he was attached to the Iron and Steel Control as director of Track Links to develop a number of specialist foundries for the mass production of manganese steel. In these foundries, new methods of holding liquid manganese steel for continuous casting were used for the first time in the world.

He went to America and Canada in 1942 on behalf of the Ministry of Supply as chairman of the British Armour Mission. In 1943, Dr. Dadswell returned to English Steel Corporation, Limited, as superintendent of the drop-forge department, later being appointed a special director. In 1946, he was elected to the Board of English Steel Corporation, Limited, and is now in charge of the sales and production of drop forgings, steel castings and springs.

Dr. Dadswell has served on technical committees of the Institute and other societies, is a past-president of the Sheffield branch of the Institute (1943-44) and has presented a number of Papers to branches and the Annual Conference. He recently presented a Paper to the French *Association Technique de Fonderie* on "The Steel Foundry in Great Britain."

(*Continued at foot of previous column*)

Institute of British Foundrymen

ANNUAL REPORT

May 1, 1949, to April 30, 1950

This report of the work carried out by the Institute of British Foundrymen during the year ended April 30, 1950, records a period of healthy activity at the highest level commensurate with the financial resources available. The year has been specially notable for the enthusiastic support which has been accorded to all the efforts of the Council, and in particular for the continued gratifying response made to the new developments on which the Institute has ventured. An instance of this was the unqualified success which attended the second foundry foremen's training course held at Ashorne Hill in March.

Accompanying the report are the income and expenditure account for the year ended December 31, 1949, and the balance sheet as at that date.

Finance

Although the income and expenditure account again shows a not unsatisfactory credit balance, the Council has felt increasing concern regarding certain administrative and other expenditure which shows a continuing tendency to rise. Further, it has been found necessary to relieve the almost overwhelming pressure of work devolving on the senior members of the staff by the appointment of a junior male assistant. For these reasons the Council has deemed it advisable to recommend the adoption of the special resolution concerning the increase of subscription rates, which will be submitted for approval at the forthcoming Annual General Meeting.

Membership

Changes which have occurred in the membership roll during the year are recorded in Tables I and II, which show the total membership at April 30, 1950, to be 4,588 as compared with 4,437 at the same date last year.

While this growth in the numerical strength of the Institute is less than the corresponding increase for the previous year, it cannot be regarded as unsatisfactory in the light of the fact that the figures relate to the first full year during which the new and much more stringent regulations governing admission to membership of the Institute have been in operation. Nevertheless, a diminished rate of recruitment inevitably will have a hampering effect on the Institute's work, and the Council therefore earnestly requests the cooperation of all members in securing an adequate flow of suitably-qualified candidates for membership.

Obituary

Among the twenty-seven losses by death sustained during the year are a number of members who were particularly well known in the Institute and in the industry; these include the following:—

William Bell, a past-president of the Scottish branch.

J. Davenport, a well-known steel foundryman who had been associated with Leyland Motors, Limited, and Hopkinsons, Limited, of Huddersfield.

G. E. France, a past-president of the Foundry Trades Equipment and Supplies Association.

W. J. Rees, O.B.E., D.Sc., a lecturer at Sheffield University and a well-known expert and consultant on refractory problems.

F. P. Wilson, J.P., president of the Institute in 1930/31 and previously president of the Middlesbrough branch. He was a well-known public figure in the Tees-side district.

A complete list of members whose deaths have been announced during the year ending April 30, 1950, is given below:—

Name.	Grade.	Branch.	Dat joined.
F. A. Allan	M.	Bristol & W.E.	1942
Wm. Bell	A.M.	Scottish	1910
Wm. Boyne	A.	Birmingham	1914
L. J. Button	M.	Lancashire	1926
E. H. Cottle	M.	Birmingham	1930
J. Davenport	M.	Lancashire	1926
W. M. Dick	M.	Scottish	1936
G. E. France	M.	London	1926
J. C. Gray	M.	London	1933
W. Hamilton	M.	Scottish	1935
C. S. Lines	A.	London	1948
D. W. Maddock	M.	Birmingham	1925
J. C. Mahindra	A.M.	General	1925
J. R. Maclachlan	A.M.	Lancashire	1922
E. Mann	A.M.	W.R. of Y.	1939
F. Marsden	M.	Lancashire	1929
J. Masson	M.	Wales and Mon.	1944
W. Parker	M.	W.R. of Y.	1922
R. O. Pritchard, M.B.E.	M.	Lancashire	1937
W. J. Rees, O.B.E., D.Sc.	M.	Sheffield	1933
J. Riley	A.M.	Lancashire	1911
L. Rogers	A.M.	East Midlands	1940
N. C. Shepherd	A.	Bristol and W.E.	1949
W. H. Smith	M.	Birmingham	1928
J. Tinkler	M.	London	1942
W. Turnbull	M.	Newcastle	1944
F. P. Wilson, J.P.	M.	Middlesbrough	1912

Honours Conferred upon Members

The Council congratulates the following members who have been honoured during the past year:—

Major R. A. Briggs, T.D., who has been appointed a Justice of the Peace.

J. Hill, who was awarded the Price-Abell Medallion for his Paper "Foundry Mechanisation," presented at a joint meeting of the Derby Society of Engineers, the Nottingham Society of Engineers, and the East Midlands branch of the Institution of Mechanical Engineers.

TABLE I.—*Changes in Membership*, 1949-1950.

	Subscribing firms.	Members.	Associate members.	Associates.	Totals.
At April 30, 1949	219	1,688	2,104	426	4,437
Additions and transfers from other grades ..	9	96	172	138	415
	228	1,784	2,276	564	4,852
Losses and transfers to other grades	4	86	121	53	264
At April 30, 1950	224	1,698	2,155	511	4,588

TABLE II.—*Analysis of Membership at April* 30, 1950.

Branch.	Subscribing firms.		Members.		Associate members.		Associates.		Totals.	
Birmingham	20	(21)	247	(249)	315	(284)	95	(64)	677	(618)
Bristol	6	(6)	82	(78)	66	(67)	7	(6)	161	(157)
*East Midlands	8	(10)	89	(110)	192	(249)	36	(34)	325	(403)
Lancashire	32	(28)	196	(193)	313	(291)	48	(38)	589	(550)
*Lincolnshire	1	—	19	—	54	—	9	—	83	—
London	33	(33)	362	(357)	288	(285)	33	(28)	716	(703)
Middlesbrough	2	(2)	41	(42)	82	(84)	68	(47)	193	(175)
Newcastle	20	(20)	45	(42)	83	(79)	63	(56)	211	(197)
Scottish	23	(22)	164	(163)	277	(273)	61	(60)	525	(518)
Sheffield	8	(8)	114	(112)	99	(95)	13	(8)	234	(223)
Wales and Monmouth ..	6	(6)	63	(65)	65	(65)	25	(32)	159	(168)
W.R. of Yorks.	12	(11)	94	(96)	180	(183)	22	(22)	308	(312)
South African	47	(47)	110	(117)	102	(108)	22	(27)	281	(299)
General	6	(5)	72	(64)	39	(41)	9	(4)	126	(114)
TOTALS	224	(219)	1,698	(1,688)	2,155	(2,104)	511	(426)	4,588	(4,437)

Figures in brackets are totals at April 30, 1949.

The Scottish branch figures for 1949 have been revised since publication of the last Annual Report and there has been a consequential revision o the totals for 1949.

* The Lincolnshire branch has been formed from the East Midlands branch during the year.

W. S. Kinsman, who was awarded the British Empire Medal in last year's Birthday Honours List.

F. A. Martin, who was awarded the O.B.E. in last year's Birthday Honours List.

Dr. J. G. Pearce, director of the British Cast Iron Research Association, who was awarded the O.B.E. in the New Year's Honours List.

R. O. Pritchard, who was awarded the M.B.E. in last year's Birthday Honours List.

John F. Webster, who was elected to the office of Provost of the Royal Ancient Burgh of Arbroath.

Awards

The following awards were presented at the Annual General Meeting held at Cheltenham, in June, 1949:—

Oliver Stubbs Medal.—To G. L. Harbach in recognition of his outstanding services by his work on the Technical Council and committees of the Institute, and in presenting numerous Papers of exceptionally high standard to many branches of the Institute.

E. J. Fox Medal.—To Sir Andrew McCance, D.Sc., LL.D., F.R.S., in recognition of the valuable contributions he had made to the progress of steel founding.

British Foundry Medal.—To D. H. Young of the Scottish branch for his Paper "The Manufacture of Some Large Castings for Marine Engineering," which was published in Vol. XLI of the Institute's Proceedings.

Meritorious Service Medal.—To Arthur Sutcliffe for the work he has done in raising the standard of craftsmanship in the foundry and for his efforts to apply scientific knowledge to the improvement of modern foundry technology.

Diplomas.—Diplomas were awarded to the following members for Papers presented to the branches names below:—

J. F. Barnes, East Midlands branch.
H. Haynes, several branches.
F. E. Ironmonger, East Midlands branch.
C. R. van der Ben, several branches.
J. H. Williams, Wales and Monmouth branch.
A. R. Wizard, Birmingham branch.

Honorary Members

The distinction of honorary member has been conferred upon the following members during the year under review:—

John Cameron, Senr., J.P.—In recognition of his services to the Institute and to the foundry industry.

V. C. Faulkner.—In recognition of the contribution which he has made to the progress of the Institute and of the foundry industry.

J. Hogg.—In recognition of his outstanding administrative services to the Institute for many years and for the help and encouragement he has given to numerous foundrymen throughout the country.

Edward Williams Lecture

The Edward Williams Lecture for 1949 was delivered at the Annual Meeting at Cheltenham, on June 15, by Professor H. O'Neill, D.Met., the title being "Metal Founding Through the Ages." The 1950 Edward Williams Lecture will be delivered at the Buxton Conference by Sir Andrew McCance, D.Sc., LL.D., F.R.S., whose subject will be "Gases and Steel."

Branch Activities

Reference to the "forthcoming meetings" column in the issues of the Institute Journal published

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during the year will assure members that the work of the branches and sections continues with undiminished vigour. The Council's special thanks must again be recorded to the branch presidents, branch secretaries and other officers for the unabated enthusiasm which has enabled the programmes of meetings, works visits and social functions, entailing a vast amount of detailed organisational activity, to be successfully carried out. The sustained effort of these branch officers is an indispensable factor if the Institute is to flourish and maintain the considerable influence which it is now able to exercise.

At the June Council meeting the Lincoln section was unanimously reconstituted as the Lincolnshire branch, and it has completed a highly satisfactory first year's work under the presidency of Mr. F. Dunleavy. In the Birmingham area, the interests of young foundrymen have continued to be fostered by the Birmingham students' section and by the recently established Coventry students' section. Growing interest in the newly-formed West Wales section is another very satisfactory feature.

Technical Development and Education

The Council is pleased to record that the Joint Iron Council has renewed the grant from the funds raised by the pig-iron levy, whereby the Institute is reimbursed in respect of expenditure incurred in extending its work in the field of technical development and education.

Included in the more notable projects which have been realised as a result of the availability of these funds are the second foundry foremen's training course, a new and greatly enlarged edition of the "Atlas of Defects in Castings," and the provision of additional facilities for the work of the Technical Council and its sub-committees. More detailed reference is made to these matters later in this report.

Educational Activities

The Training Centre at West Bromwich which was established by the Birmingham Regional Committee on Foundry Recruitment and Training under the auspices of the Council of Ironfoundry Associations has now been established as the National Foundry Craft Training Centre. It is available for the systematic and periodical training of apprentices, and members are urged to consider the desirability of sending their own apprentices to the Centre.

Pressure of work on some of the contributors has delayed the preparation of publication of lecture notes to cover the syllabuses of the intermediate and final examinations of the City and Guilds of London Institute in Foundry Practice and Patternmaking, but a special endeavour is being made to publish the notes during the current year.

Established on the initiative of the Institute, which takes an active part in the work of their management, the City and Guilds of London Institute examinations in Foundry Practice and Patternmaking continue to meet the needs of a large number of students in the foundry industry. The results of the 1949 examinations are recorded below:—

Number of candidates.	Pass 1st Class.	Pass 2nd Class.
Patternmaking—Intermediate		
208	28	77
Patternmaking—Final.		
72	29	30
Foundry Practice—Intermediate.		
134	14	51
Foundry Practice—Final.		
68	7	27

Prizes offered in connection with the Institute of British Foundrymen were awarded as follows:—

Foundry Practice, final grade.—Buchanan Medal and Buchanan Prize to D. F. Knight, Maidstone, and a Buchanan Prize to Gerald Horkin, Brighouse.

Patternmaking, final grade.—Buchanan Prizes to John Chambers and John Mortimer.

The P. H. Wilson prizes, established by Mr. P. H. Wilson, past-president, for award to the best candidates in the intermediate examinations were this year awarded for the first time. The recipients were:—

Patternmaking, intermediate grade.—
- Dennis Smedley, of Rugby, first prize.
- Norman Gerald Mason, of Wednesbury, first prize.

Foundry Practice, intermediate grade.—
- Norman Gerald Mason, of Wednesbury, first prize.
- Robert Glover Bretherton, of Preston, second prize.

Publications

In addition to preprints of all Papers presented at the Cheltenham Conference, which were made available without charge to all members on request, the following publications have been issued during the past twelve months: "Proceedings" for the year 1949, Vol. XLII; the "Atlas of Defects in Castings" (revised and enlarged edition), and the Journal of the Institute, which has been published at two-monthly intervals.

A very gratifying response was received to the publication of the revised and greatly enlarged edition of the "Atlas of Defects in Castings." The first impression of 1,500 copies was exhausted some weeks after the book was placed on sale, and a second impression which has since been printed is being disposed of at a satisfactory rate.

Foundry Foreman's Training Course

In view of the conspicuous success which attended the foundry foremen's training course held at Ashorne Hill, near Leamington Spa, in April, 1949, the Council decided to organise a second course which was held from March 23 to 25, 1950. Ashorne Hill was again the venue.

The subjects selected were mainly those which formed the first course, but new authors gave a number of the lectures and for those lectures for which expert alternative authors were not available, the original lecturers were asked to deal with their subjects from some new aspect. An innovation, intended to increase the benefits derived by those attending the course, was the arrangement of discussion groups to debate the lectures.

Over 200 attended the course and, in view of the very gratifying response made to this particular development in the Institute's educational work, it may be anticipated that further courses covering other subjects of special interest to foremen will be arranged.

Student's Grant

It will be recalled that, in last year's report, reference was made to the Council's announcement of an offer to select a promising young man in the foundry industry and to assist him financially in his studies or to further his practical experience. Wide latitude was allowed as to the nature of the assistance which would be granted and an open invitation to apply for consideration for the award was issued.

A panel of assessors consisting of Mr. L. W. Bolton, Dr. A. B. Everest, Mr. A. S. Worcester and Mr. G. L. Harbach considered the 20 applications received. On their recommendation the award was made to Brinley Edwards, of Bersham Foundry, Wrexham, North Wales, who chose to use the grant to enable him to take a course at the National Foundry College at Wolverhampton. Mr. Edwards commenced the course in September.

In view of the highly satisfactory response to the offer, which clearly meets a widely-felt need, the Council, as announced in the March issue of the "Journal," has decided to offer a second grant which will be awarded in 1950.

International Activities

A party of about 45 members of the Institute and ladies attended the International Foundry Conference in Amsterdam from August 29 to September 2. About half the period of the Conference was occupied in works visits and most of the remainder of the time by technical sessions at which over twenty Papers were presented. The exchange Paper presented on behalf of the Institute of British Foundrymen was by Dr. T. P. Colclough and was on the subject of "Developments in Blast-furnace Efficiency."

Meetings of the International Committee of Foundry Technical Associations and the International Committee on Testing Cast Iron were held during the period of the Conference. Mr. T. Makemson was re-elected secretary of both these committees.

The usual cordial relations have been maintained with the American Foundrymen's Society and with the various Continental foundry associations, with most of which an official exchange of Papers has been effected.

Relations with Other Organisations

A highly-desirable development during the year has been the noticeable improvement in the liaison between the Institute and the British Cast Iron Research Association, particularly at the level of technical sub-committee work.

The Institute continues to be represented on a large number of outside organisations, including the Joint Committee on Metallurgical Education, the Committee administering the Mond Nickel Fellowships, and many technical committees of the British Standards Institution.

Engineering and Marine Exhibition—Olympia

At the invitation of the organisers, a large party of members of the Institute, including the Council, paid an official visit on Friday, August 26, to the Engineering and Marine Exhibition at Olympia, London.

Council and Committees

Four meetings of the Council, four meetings of the Technical Council and numerous meetings of the executive and other standing committees and of the sub-committees of the Technical Council have been held during the past twelve months.

Of the members of the Council elected by ballot for two-year periods, five retire each year by rotation. Those who so retire at the Annual General Meeting in 1950 are:—Dr. A. B. Everest, Ph.D., B.Sc., Mr. Barrington Hooper, C.B.E., Mr. A. E. Peace, Mr. R. C. Shepherd and Mr. S. Unsworth.

The special thanks of the Council must again be recorded to the many members who have taken an active part in the work of the Institute during the past year. Of these, the names of Mr. A. E. Peace and Mr. L. W. Bolton, respectively chairman and vice-chairman of the Technical Council, and Mr. C. W. Bigg, honorary treasurer, call for special mention by reason of the onerous duties they have undertaken and discharged with such marked ability.

At the Annual General Meeting to be held at the Spa Hotel, Buxton, on June 7, the Council will nominate the following officers for the year 1950-51:—

As president: Mr. J. J. Sheehan, B.Sc., A.R.C.Sc.I., F.I.M.

As senior vice-president: Mr. C. Gresty.

As junior vice-president: Dr. C. J. Dadswell, B.Sc.

1949 Annual Conference

The Council takes this opportunity of expressing warm appreciation of the work of the conference committee, the conference secretary and all others who were responsible for the arrangements for the conspicuously successful Conference held at Cheltenham in June, 1949.

The forty-seventh Annual Conference will be held at Buxton from June 6 to 9 inclusive.

The Report is signed by N. P. Newman, president, and T. Makemson, secretary.

Brass-foundry Team in America

The productivity team from the brass and bronze foundry industry, which is visiting the U.S.A., has had most interesting experiences. It is due home on June 13 in the "Mauretania." The tour promises valuable results and an idea of the general line of investigation may be obtained from the interim reports. Large and small works have been visited and their special characteristics recorded. One small foundry, with no more than fifty workpeople, was making the utmost use of mechanical aids. The layout was simple but effective. There was standardisation of moulding methods and pattern equipment with the use of two sizes of snap-flasks rammed on Tabor pneumatic squeezing machines. The high standard of cleanliness and of good housekeeping impressed the team both in this and in other foundries.

In a large foundry with more than 3,000 workpeople the team observed "a spirit to work that is well worth studying" and attributed it to a combination of accurate time-study methods and good relations between management and workers together with social and domestic amenities. The firm was applying simplification to the use of materials and the range of products. For example, only four alloys were employed in the factory whereas sixty were formerly used. The foundry included a fully-mechanised lacquering plant—synthetic resin base—with a gas-fired conversion oven and a barrelling plant for polishing small cast parts which, in the team's opinion, was worthy of consideration in British practice. In the brass foundry an original mechanised plant was achieving a large output with a small, well-directed labour force.

In a foundry specialising in the manufacture of valves, which the team found to be highly efficient, outstanding characteristics were the close study given by the management to the methods of manufacture, efficient planning and production, labour relations and working arrangements and the effective technical control obtained without excessive routine testing. The theme of good labour relations occurs again and again in these interim reports in respect of both large and small concerns.

A medium-size plant, with about 140 workpeople, had made economic technical control of production, under laboratory supervision, a standard procedure. Full use was also made of mechanical aids and devices, such as moulding machines and gravity roller conveyors, to assist production. Moulds made by hand were cast on roller conveyors or on a movable steel rack standing about twelve inches above floor level to facilitate handling and pouring.

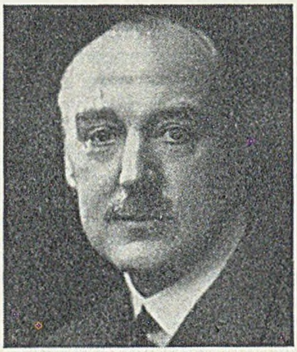
In America, the shortage of craftsmen is even greater than in Britain and to assist in overcoming this handicap one firm was assembling moulds, such as those for large pump impellers, entirely from oil-sand cores in order to make possible the use of semi-skilled labour. The conditions were an incentive to the management to instal new plant. The team saw that a high-speed cutting-off machine, using a 20-in. dia. unbreakable wheel, enabled risers, 6 by 6 in. section, to be quickly and cheaply removed from large castings.

Leaders of the Industry

Sir Andrew McCance

Sir Andrew McCance, D.Sc., LL.D., F.R.S., delivered the Edward Williams Lecture at the Annual Conference at Buxton this week. The lecture, entitled "Gases and Steel," is printed on page 615 of this issue.

Sir Andrew McCance first became associated with Scottish Industry in 1910, when he went to the Parkhead Works of Wm. Beardmore & Company, Limited, as metallurgist, being appointed assistant armour manager a year later. At the early age of 24 Sir Andrew received the degree of Doctor of Science of London University. In 1919 he founded and became managing director of the Clyde Alloy Steel Company, Limited, and was also advisory metallurgist to D. Colville & Sons, Limited, the board of which he was invited to join in 1930. When the new public company of Colvilles, Limited, was formed, Sir Andrew continued as director and general manager. In May, 1944, he was appointed chairman and joint managing director of the company. He is also a director of the Steel Company of Scotland, Limited, the Lanarkshire Steel Company, Limited, Smith & McLean, Limited, and Bruntons (Musselburgh), Limited. In 1943, Sir Andrew was elected a Fellow of the Royal Society, and was the first chairman of the British Iron and Steel Research Association. In 1948, the degree of LL.D. of Glasgow University was conferred on him. He is also a Fellow of the Institute of Physics, a past-president of the West of Scotland Iron and Steel Institute, and of the Iron and Steel Institute. In 1940, he was awarded the Bessemer Gold Medal in recognition of his outstanding services in the application of science to the iron and steel industry. The honour of knighthood was conferred upon him by the King in June, 1947. He is the author of a number of technical Papers of which those to the Faraday Society established the principles of balanced reactions in the manufacture of steel. These he applied to the open-hearth process as far back as 1918 with outstanding results. At the 1949 Conference of the Institute of British Foundrymen, Sir Andrew was awarded the E. J. Fox Gold Medal in recognition of his valuable contributions to the progress of steel founding.



SIR ANDREW MCCANCE

THE MINISTER OF FOOD announces that during the four-week period ending July 1, 1950, the following alterations in the prices of unrefined oils will apply:—Linseed oil, from £132 to £134 per ton, naked ex-works; linseed-oil fats from £82 to £84 per ton, naked ex-works. The prices of all other unrefined oils and fats will remain unchanged.

*The I.B.F. "Edward Williams" Lecture**

Gases and Steel

By Sir Andrew McCance, D.Sc., LL.D., F.R.S.†

Introduction

Everyone engaged in the practical art of making castings, no matter what metal he uses, is also engaged in a perpetual battle with two major antagonists—contraction cavities and blowholes. The perfect casting, it would be agreed, contains neither, but it would ill become me, speaking as a steel founder, to suggest how often perfection is achieved in everyday life. Nevertheless, on that subject at least, we all deserve the highest credit for our good intentions. The battle with contraction cavities is one in which the main forces deployed are the skill of the moulder and his experience in the art of founding, pitted against the physical behaviour of the metal in its transition from the liquid to the solid state. It seems a simple issue, but we know how complicated it can be in its practical consequences. The battle with the problem of blowholes has always been a major conflict and the more one wrestles with this issue the wider becomes the front on which the fight is carried on. But it must also be admitted that, to a metallurgist, the interest in the problems that arise extend far beyond the original field of enquiry.

It was for such reasons that the title of this lecture was chosen as the interaction of gases with metals. The effect of gases on the properties of metals has been the subject of intensive study in recent years, and I thought that a brief review of progress might well be justified. If my references are almost wholly devoted to the behaviour of steel, it is not only because that metal has been most studied but also because it has always been one of my own main interests.

Early Work

In the very earliest days of steelmaking, when Bessemer and Siemens were struggling with the difficulties of making mild steel in bulk, the presence of gases in liquid steel was most troublesome. It was no uncommon thing for a 5- or 10-ton lot of steel to be ejected completely from the ladle due to a sudden evolution of gas. The steelmakers of the day did not mention it very often in their public discussions, for reasons with which we can have every sympathy, but, when they did, it was always with an air of puzzled surprise. They were familiar with soda water as a typical example of the solution of gases in liquids, and Henry's law, discovered in 1803, controlled in their minds the relations between all gases and all liquids. So they made their steel hotter to get less gas in solution and the hotter they made it the more its effervescent and flighty nature was revealed when it got into the ladle. Henry Marion Howe,[1] in his monumental treatise on the "Metallurgy of Steel," devotes several pages in trying to bring the facts into line with current theory, although one detects in his discussion an underlying note of scepticism about it all.

In their methods of estimating the quantity of gas contained in steel, there was the same questioning, if questionable, approach. Drilling steel samples with sharp or blunt drills under water, oil or mercury, and collecting the gases given off was started by Muller (1879), followed by a number of other workers over a period of nearly forty years. Naturally, the results obtained, particularly when water was used, were highly variable and inconsistent. A blunt drill could produce 50 times more gas than a sharp drill but that, they argued, was only to be expected.

It was only with the work of Sieverts, commencing in 1907, that the beginning of a proper understanding of the relations between gases and metals was made and modern development began. His results for hydrogen and iron, and those of later workers, are typical, and the relative volume of this gas, absorbed by a thin mild-steel wire at different temperatures, is shown in Fig. 1. Both in the solid state and in the liquid, the solubility rises with temperature, a state of affairs quite contrary to the idea of solution as a gas. Under the same conditions of constant pressure, the amount of gas absorbed by a liquid decreases with rising temperature. The solubility of a solid on the other hand increases with temperature, so that the behaviour of hydrogen and iron is in keeping with the idea of solubility as a solid compound.

This is confirmed also by the fact that the amount S, dissolved, can be represented exactly by an equation of the type

$$S = S_0 . e^{\frac{-Q}{kT}}$$

where S_0, and Q, are constants. This equation has already been well established to express the variation in solubility with temperature for a large number of solids, so that its applicability in this case strengthens the inference that solid compounds are involved.

The quantity of gas which the metal is capable of retaining is negligible below 300 deg. C.; it increases rapidly to the melting point when the amount is approximately volume for volume, whilst there are discontinuous changes in solubility at each of the change points.

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* Delivered at the 1950 Annual Conference of the Institute of British Foundrymen at Buxton.

† Deputy chairman and managing director Colvilles, Limited, last year's recipient of the E. J. Fox Medal of the Institute of British Foundrymen.

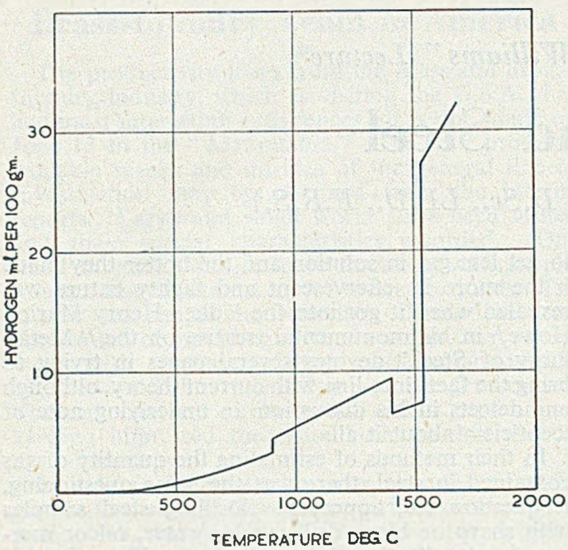


FIG. 1.—SOLUBILITY OF HYDROGEN IN IRON.

Hydrogen and Nitrogen Similar

While I have been dealing so far only with hydrogen, it is evident that with nitrogen the behaviour of iron is closely similar. The solubility in α-iron rises with temperature in a similar way, Fig. 2; there are even more marked differences at the change points and again a large increase at the melting point. Proof that nitrogen is concerned as a solid compound is moreover quite definite, since the appearance of nitrogen needles under the microscope, due to the precipitation of Fe_4N, is universally accepted and the equilibrium diagram for this and other nitrogen compounds has been worked out accurately and fully. While visual evidence in the case of hydrogen has not so far been obtained, it is likely that it can be expected. Definite hydrides of other metals are known.

With both gases, there is greater solubility in γ-iron than in α-iron, but the variation with temperature is reversed—nitrogen decreasing in amount as the temperature rises. These results are for atmospheric pressure, and at other pressures the amounts absorbed can be taken as being proportional to $\sqrt{P}$—at least for small pressures. This is further evidence of a departure from the normal behaviour to be expected from gases for which the solubility varies directly with the pressure.

On melting, there is a large increase in the solubility of approximately 50 per cent., and it is at once obvious that it is this fact which gives rise to blowhole formation during solidification. If the amount of gas present is in excess of that which the solid is capable of holding in solution, the excess must be rejected at the surface of separation, giving rise to cavities filled with gas.

The most convincing evidence of this can be obtained by melting small samples of iron in an atmosphere of any given gas and allowing the sample to solidify under the same conditions, using a similar sample melted in a vacuum as a control. In Fig. 3,[2] four such samples, sectioned through the centre, are shown after melting in a vacuum and in argon, hydrogen and nitrogen. The first two in a vacuum and in argon are completely solid, whilst those in hydrogen and in nitrogen show very definite cavity formation.

Contraction Cavities and Gas Content

Whilst the conditions which give rise to blowhole formation are quite clear, when the amount of gas in the metal is in excess of the solubility for that temperature, it is conceivable that on many occasions this excess is just not enough to make the creation of a blowhole a certainty under ordinary atmospheric pressure. Any pressure less than atmospheric on such occasions would help the gas to come out of the metal and to form a gaseous bubble. Such conditions of negative pressure exist in those parts of a mould filled with liquid metal which, during solidification, are on the point of forming contraction cavities. Similarly, liquid metals containing definite but small quantities of gas—quantities which can be much below those required for blowhole formation—will have a greater tendency to cavity formation than gas-free metals.

While contraction cavities and blowholes have been regarded as belonging to two entirely separate sets of phenomena, I am of the opinion that there are many occasions when they are not quite so separate and independent as has generally been thought. A gas content below that necessary for the formation of idiomorphic blowholes can make the production of contraction cavities an easier occurrence. A small quantity of dissolved gas can greatly assist in the formation of a surface of separation which is the essential first stage in the birth of a cavity.

Founders are accustomed to describe steels which do not form contraction cavities easily as "good feeding steels"—meaning that the risers and heads

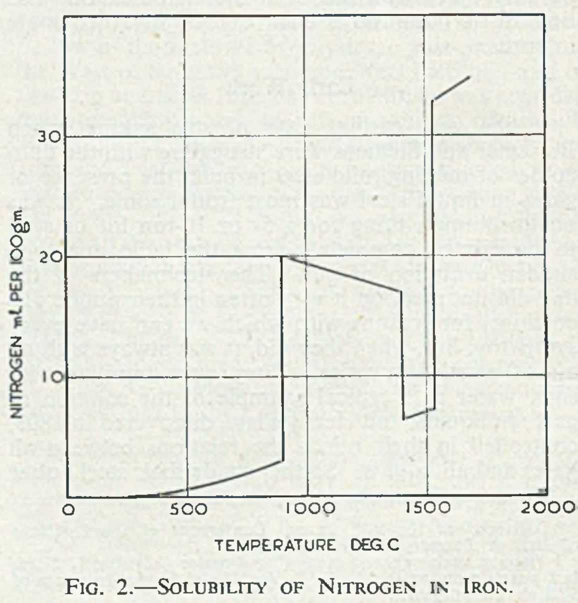
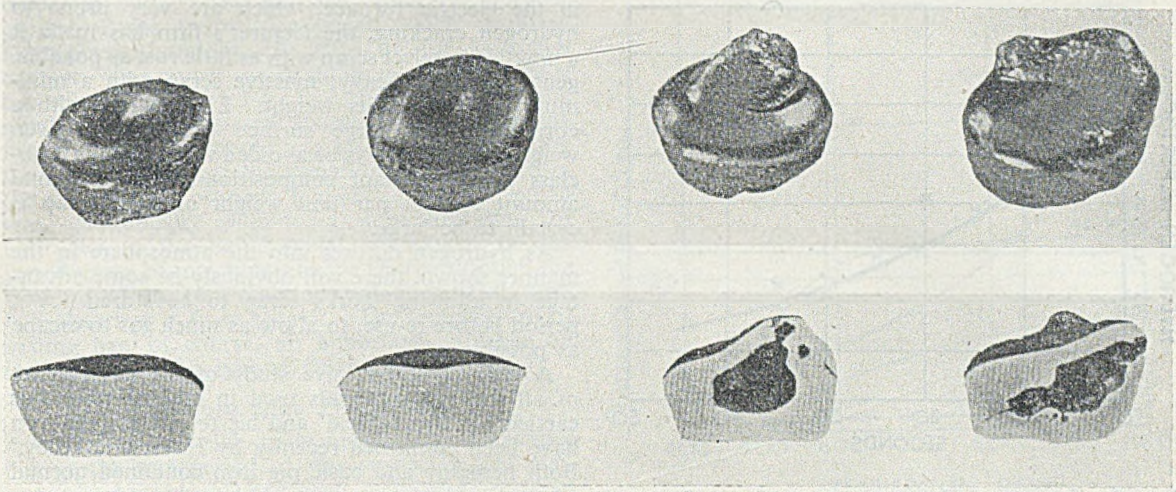


FIG. 2.—SOLUBILITY OF NITROGEN IN IRON.



[Courtesy Phillips Technical Review

FIG. 3.—SOLIDIFICATION OF IRON IN ATMOSPHERES OF DIFFERENT GASES.

on a casting feed their metal into the body of the casting without much difficulty. There are clear-cut differences in this respect. Converter steel is reckoned the best, acid open-hearth steel is next, and it is agreed that basic electric-furnace steel requires by far the greatest care in the size and placing of heads to get sound castings free from cavities.

It is not without significance that the average content of hydrogen for steels made by these processes increases in the same order. Acid steel averages 4 to 6 ml. per 100 gm., while basic steel, both open-hearth and electric, averages 6 to 9 ml. Even taking unusual precautions to exclude moisture and moisture-bearing materials from electric-furnace charges, only reduced the hydrogen to 4 to 4.5 ml. per 100 gm.[3] There do not seem to be any reliable figures available for converter steel, but the turbulence caused by air being blown through the converter and the general oxidising conditions which exist during the refining period would lead one to expect a low hydrogen content.

In regard to nitrogen, the above steels should be placed in a different order—open-hearth (both acid and basic), electric-furnace then converter, but the amounts retained under normal practical conditions are generally well below the saturation limit for the solid at the melting temperature and it is probable that this gas, at least in comparison with hydrogen, contributes in a very minor extent only towards assisting the formation of contraction cavities in steel castings. There is also support for this in the very much slower rates of diffusion for nitrogen in comparison with these for hydrogen.

Measurement of Gas Content

I have mentioned figures for the gas content which come within the range of 5 to 10 ml. per 100 gm. of steel. Such amounts are frequently referred to in terms of the volume of gas relative to the volume of steel from which it was extracted. In this case, the range would be approximately 0.40 to 0.80 relative volumes RV and this is often a convenient way of stating and comparing results.

The most reliable method of estimation is the vacuum-fusion method, which gives the oxygen content as well as the hydrogen and nitrogen. A great deal of work has been done in perfecting this method and making it reliable, particularly at the National Physical Laboratory during the last decade, and we owe much to the enthusiastic encouragement originally given by Hatfield to this class of research.

There have been many puzzling differences in the quantities of hydrogen found by different analysts, even in the same billet, and it has only been recently appreciated that the amount of hydrogen in steel is never static—it is always diffusing from the centre to the surface, always escaping from the surface to the atmosphere even at ordinary temperatures.

Hydrogen is a very light element with the lowest atomic weight and, under similar conditions, its atoms will move nearly four times faster than a free nitrogen atom would and fifteen times faster than the movement of a nitrogen atom bound in solution to an iron atom. People who wish to determine the true hydrogen content in a sample of steel, therefore, have to get off their mark quickly or they will be left well behind. In Fig. 4, the amount of hydrogen expelled from a sample of steel withdrawn from a liquid bath and quickly immersed in a U-tube filled with mercury[1] is expressed in terms of the number of seconds which have elapsed since the sample was taken. The rapidity with which the excess hydrogen is discarded is somewhat astonishing and illustrates very clearly the difficulties of trying to obtain accurately the quantities of gas which are really present under the conditions of any series of experiments. The

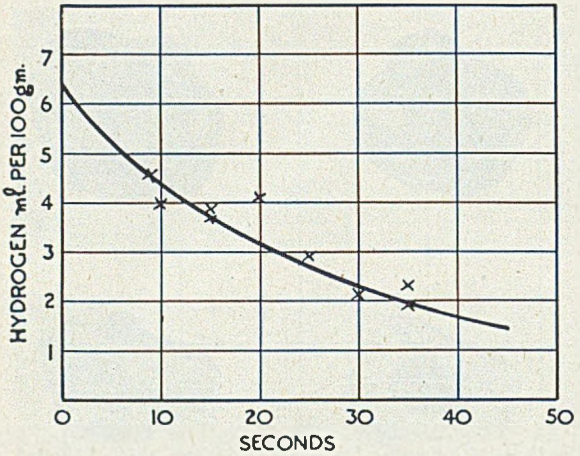


FIG. 4.—ESCAPE OF HYDROGEN FROM STEEL SAMPLES (WENTRUP, FUCKE AND REIF).

lack of full appreciation of this behaviour has, without doubt, accounted for much of the variability in the results of earlier workers.

To counteract this, samples for gas determination are now held at low temperatures in carbon-dioxide snow[5] or in a deep freezer to make this diffusion-loss negligible. At ordinary temperatures, the loss goes on for days and follows a curve of the type—

$$L = L_0 \left(1 - e^{-\sqrt{at}}\right)$$

which is the theoretical curve for this kind of diffusion-loss, an example of which is shown in Fig. 5, plotted from the recent results of Carter.[6] Since the loss varies as the square root of the time, the initial stages of casting are extremely important in determining the liability of any gas content to form either blowholes or cavities. One can well imagine, in fact, that if conditions are such that troubles due to gases are liable to occur, they will have taken place in some part of the casting before pouring is complete. The only method of control indeed is to reduce the total gas content to the lowest practicable limit during the steelmaking period.

Sources of Gas

A good deal of information is available regarding the variations in the hydrogen content of open-hearth and electric steels, although there are many matters not yet understood. The first question to be answered is, of course, the content of hydrogen in the raw materials used and the additions that are made to the bath when the steel is being made.

The raw materials are essentially pig iron and scrap, and I should think that in every case where cold charging is used (and that covers practically all foundries), such materials are in a rusty condition when charged into the furnace. The composition of rust is FeO (OH), so that there is here an important source of hydrogen, for rust, when heated, gives off moisture which is immediately reduced by the steel and the hydrogen absorbed.

In making certain classes of nickel-chrome steel in the electric furnace, which are very prone to hydrogen cracking, the lecturer's firm has made it a practice to select scrap with as little rust as possible, generally using heavy, massive scrap with a minimum surface for its weight. Light scrap, with a correspondingly large surface area for a given weight, should always be avoided when making high-class and important compositions, since the total amount of rust per unit weight of such scrap is certain to be large.

As hydrogen diffuses into the atmosphere in the manner shown, there will obviously be some advantage in allowing works scrap to be stored for a period before re-use, to allow as much gas to escape as possible.

A very comprehensive study of the gas content of all the raw materials used in making steel was carried out by Hatfield[7] and his results for pig iron have been confirmed recently by Hurst and Riley.[8] Both hematite and basic pig iron contained normal amounts of hydrogen, as might have been expected—on the average about 2-5 ml. per 100 gm.—although Swedish iron, strangely enough, has been reported as containing much larger quantities. Such figures should, however, be taken with reserve since they will be minimum rather than average amounts, owing to the time factor not having been taken into account. Nevertheless, they are representative of the amounts which can be expected to exist in the pig iron as used under normal works conditions.

Any materials used as additions which contain moisture will add to the hydrogen content of the steel. Thus lime, which is so very hydroscopic, and iron-ore are potent sources. It is common practice in many works when making high-grade electric steel to dry these materials and to keep them in air-tight containers until required for use. It is also an advantage to substitute limestone for lime, since it seldom contains much moisture and does not require to be kept in this way. Dolomite, for furnace bottoms, is another source and since the moisture in this case is mainly confined to the dust, the wisdom of using only lumpy well-fired dolomite for fettling is fully justified by both theory and practice.

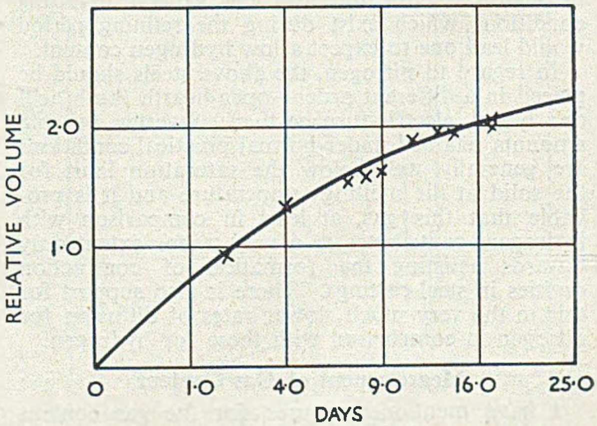


FIG. 5.—DIMINUTION OF HYDROGEN CONTENT WITH TIME (CARTER).

An observation on the behaviour of stainless steel made in the electric furnace[9] indicates another aspect of the indirect influence which ordinary atmospheric humidity can have on the hydrogen content. The curves are so illuminating that I have reproduced them in Fig. 6. They show that the number of stainless-steel charges, from which the ingots rose in the mould and bled, followed during the course of a year the variations taking place in the seasonal atmospheric humidity. Such bleeding was undoubtedly due to a supersaturation of hydrogen in the liquid metal consequent on the introduction of moisture into the charge through the medium of the lime additions, which in their turn, had absorbed it from the air. The temperature of casting has, of course, an important influence on the control of this type of behaviour.

Hydrogen from Ferro-alloys

When making high-grade nickel-chrome castings during the war period, it was suspected that substantial additions of hydrogen were coming from the various ferro-alloys used in the melting shop, so an extensive enquiry into their hydrogen content was carried out.[10]

Samples of a ferro-alloy were placed in an evacuated silica tube and heated for one hour to the temperature required, and the gases evolved were pumped off and analysed. The hydrogen evolved at each temperature was plotted and gave the curves shown in Fig. 7. A horizontal line indicated that all the hydrogen had been evolved and that further heating could not extract any more. All the ordinary ferro-alloys, with one exception—ferro-silicon—belong to this type, although they contain varying amounts of gas. Ferro-manganese contains the greatest quantity—about 30 ml. per 100 gm., and ferro-chrome the least, about 1 to 2 ml. per 100 gm. The hydrogen content of ferro-manganese is quite significant, since, making the addition required for a 1½ per cent. Mn steel may add 0.6 ml. per 100 gm. to the steel.

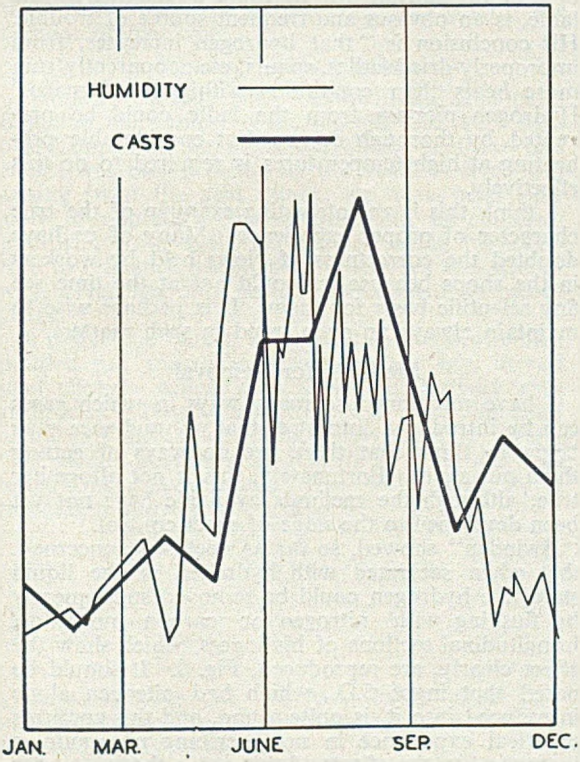


FIG. 6.—RISING OF INGOTS DUE TO ATMOSPHERIC HUMIDITY (POWELL, HAINS AND MORRIS).

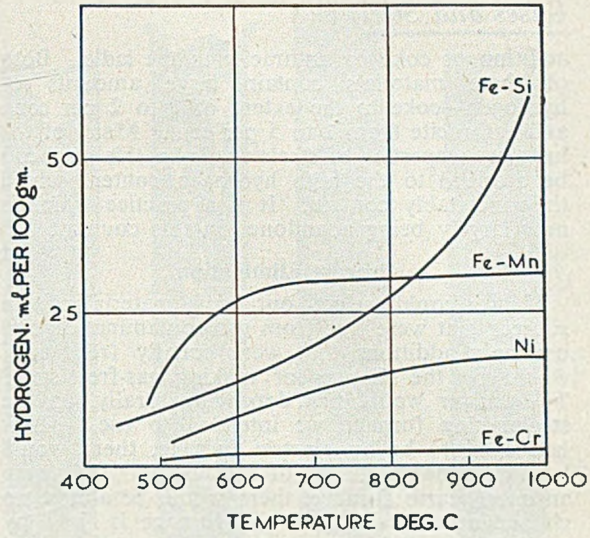


FIG. 7.—HYDROGEN IN FERRO-ALLOYS. (HUNTER AND CAMERON).

The most striking behaviour was shown by ferro-silicon, however, for the quantity of hydrogen extracted kept on increasing as the temperature was raised, and it showed no sign of flattening out at 1,000 deg. C., the highest temperature used. Clearly, there is some chemical bond between silicon and hydrogen, which places this ferro-alloy in a category by itself, a deduction which is confirmed by the course of the curve, which does not follow any standard pattern.

Anyone who has tried to make castings in 4 per cent. Si steel is well aware of the peculiar power of this composition of liquid steel to absorb hydrogen, which it rejects on solidification, so that making sound castings is an exceedingly difficult task. There are still some questions not understood in these relations, since it has been reported[11] that silicon in high percentages decreases the ability of iron to dissolve this gas, and more work on this subject is evidently required. It does not appear, however, that silicon in the amounts normally found in steel casting compositions, *i.e.*, from 0.2 to 0.4 per cent., has any marked effect on hydrogen solubility.

When making high-carbon steels such as for rails, it was formerly a common practice to run the carbon down in the furnace and then to re-carburise to the composition required by the

Gases and Steel

addition of coke or anthracite to the ladle. Both of these materials contain large amounts of hydrogen—coke to the extent of 1 to 2 per cent. and anthracite from 2 to 5 per cent. Many of the inferior properties of steels made in this way can be ascribed to the high hydrogen content which they inevitably contain. It is a practice which is now largely being abandoned in this country.

Process Elimination

If we could select our raw materials from sources that were free from gas contamination and use only additions that were equally free, what would be the chances of making gas-free steel? The answer would first depend, naturally, on the steelmaking furnace we intended to use. If it happened to be an electric furnace, there would be a reasonable chance of succeeding. If it were an open-hearth furnace, there would be almost no chance at all. Whether the furnace is fired by producer gas, coke-oven gas or oil, part of its heat is obtained from the combustion of hydrogen in the fuel used, and, in consequence, the burning gases over the hearth have a fairly high content of water vapour.

Between the furnace atmosphere and the bath of liquid steel there is a layer of slag, composed essentially of silicates—silicates of lime, magnesia, iron and manganese. As students of mineralogy know, there are a very large number of minerals containing the same oxides in combination with silica, which are hydrated—that is, have molecules of water as an intimate part of their molecular structure. When heated in a closed vessel, they give rise to a vapour pressure of steam or, conversely, if the pressure of vapour is raised above the equilibrium value, they will absorb moisture. There is a very definite and clear affinity for water possessed by silicates—a fact which, after all, is not surprising, since they are merely compounds of a feeble acid—silicic acid, $H_2O.SiO_2$.

That affinity must persist in some degree even at high temperatures, so that it can be expected that slags should have relatively a high solubility for water vapour. Few experiments have been been carried out on this subject, but a recent determination[12] gave the following figures, which confirm this point:—

Acid slags, 5 to 40 ml. per 100 gm.
Basic slags, 30 to 175 ml. per 100 gm.

Water vapour from the furnace gases will be absorbed by the slag layer and will reach a balance with the iron and manganese oxides which it contains and the metal bath which it covers, according to the reaction:—

$$(Fe\,.\,Mn)O + H_2 = (Fe\,.\,Mn) + H_2O$$

This hydrogen will be absorbed by the steel until its concentration balances with the slag/metal partition. This, of course, will take time, but the net effect will be that, so long as the furnace gases which arise from the combustion of the fuel contain water vapour, the hydrogen in the steel will keep on increasing until a balance appropriate to all the complex conditions has been reached. This steady rise during the course of the charge has indeed been confirmed experimentally. It may account in part for the fact often observed that charges which take a long time to work in the furnace never produce best-quality steel.

In the slag, the content of FeO will determine the H_2O/H_2 ratio. In the liquid metal, the hydrogen content will be proportional to $\sqrt{P_H}$, so that for a fixed percentage of FeO, it will depend also on the $\sqrt{P_H}$. Relatively small proportions of water vapour in the combustion gases may give rise for this reason to noticeable amounts of hydrogen in the steel.

Contamination from Ladles

It is a widely-held belief amongst steelmakers that charges cast from a newly-lined ladle are more prone to defects and troubles than subsequent charges cast from the same ladle. It has always been a matter for which it was difficult to find any adequate reason, but in spite of this, the belief persisted, and it must be admitted that statistical evidence supported it.

A recent study of the hydrogen absorbed from the ladle would seem now to provide a quantitative explanation. Firebricks absorb moisture which they do not give up readily, and Carter[6] has shown that in new or badly-dried ladles, there is an appreciable increase in the hydrogen content of steels, which have been poured into such ladles. The use of clay or ganister, for patching or making-up the ladle, is an obvious and frequent source of trouble. His conclusion is "that hydrogen increases, from improperly-dried ladles, spouts, etc., apparently ruin more heats than conditions within the furnace." Hydrogen pick-up from the ladle could be prevented by thorough drying, but considerable preheating at high temperatures is required to do this effectively.

I think this is an interesting example of the true character of proper experience. Many of us have doubted the correctness of views held by workers in the shops because we could not at the time see any scientific basis for them. It is perhaps wise to maintain always an open mind in such matters.

Methods for Removal

I have mentioned so many ways in which gases can be introduced into steel that my audience may begin to think that there are no ways of getting them out again. Fortunately, this is not altogether true, although the methods available have not yet been developed to the stage of exact control.

Swinden[13] showed, so far as steel was concerned, that when saturated with hydrogen in the liquid state, the hydrogen could be removed subsequently by flushing with nitrogen or carbon monoxide. Longitudinal sections of his ingots, which show the effect clearly, are reproduced, Fig. 8. It should be noted that ingot 5.D., which had nitrogen alone introduced into it, is quite sound, and this confirms practical experience in not ascribing unsoundness in general to the effects of this gas, although, under special conditions, as we have seen, it can be troublesome. Those results are in keeping with similar observations on aluminium and copper and the underlying principle is of universal application.

If a cavity is created in a liquid by means of an inert gas, any other gas in solution in the liquid will diffuse into the cavity until its partial pressure is in equilibrium with its pressure in solution. Since the latter varies as the square root of the former, the rate of diffusion in the early stages of formation is very rapid with a correspondingly rapid removal of the gas in solution.

During the boiling stage in steelmaking, the appropriate cavities are gas bubbles of carbon monoxide formed from the carbon oxidation and they can effect a substantial reduction in the hydrogen content of the charge, provided the boil is a vigorous and active one. A quiet boil does very little good and these conclusions are in line with the views held by all experienced steelmakers with the added advantage of offering an understandable explanation.

We are now in the position of being able to follow the changes in gas content which occur during the working of a charge. From the results of Scaife,[14] all the effects which have been mentioned can be shown, Fig. 9. There is the increase in hydrogen, which follows an addition of ore, the reduction brought about by a rapid boil, and the great increase that takes place when coal is used for re-carburising.

Steelmakers are also beginning to realise that many of the hitherto mysterious differences in the behaviour and properties of steel may be traceable to the differences in gas content, particularly the content of hydrogen.

Removal After Casting

While it has long been known[15] that, after pickling, the mechanical properties of wire were seriously impaired and that the cause of these bad effects was the occlusion by the metal of hydrogen arising from the acid attack, we have been very slow to appreciate that there might be sufficient hydrogen from ordinary sources during manufacture to influence the physical properties in a similar way. That has only been a development of recent years.

I first came across a peculiar behaviour which puzzled me, more than twenty years ago, in rail steel charges which had been re-carburised with anthracite. Tensile test-pieces cut from the head of the rail and broken immediately gave the results "A," while, if allowed to rest for a week and then tested, they gave results "B," with much better elongation and reduction in area.

	Tons per sq. in.	Elong. on 2 in.	Reduction in area, per cent.
"A"—Tested Immediately	48.4	8.0	26.2
"B"—Tested 7 days later	47.9	14.5	43.6

Longer resting did not have much effect and with mild steel the differences, while noticeable, were not nearly so marked.

We now recognise this as one of the improvements in physical properties that arise from the escape of hydrogen from the surface of the test

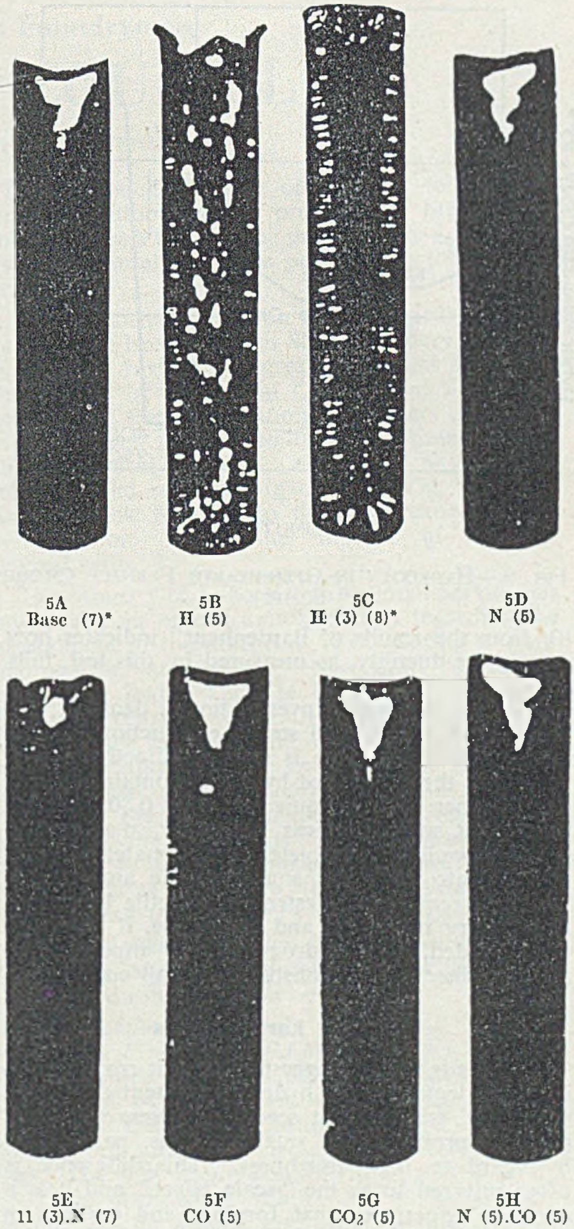


Fig. 8.—Sections of Small Ingots Treated with Various Gases (Swinden).

piece at ordinary temperatures, and it is the practice, in the works, as has already been stated, to catch the carbon on the way down and to avoid the use of re-carburisers with their inevitable contamination.

The improvement in physical properties can be hastened by heating steels to a low temperature 200 to 400 deg. C. for a short time, just as the "blueing" after pickling restores the properties of the metal. That the ductility is seriously affected by hydrogen can be demonstrated by saturating thin wires with the gas and determining the number of standard bends before fracture takes place. Fig.

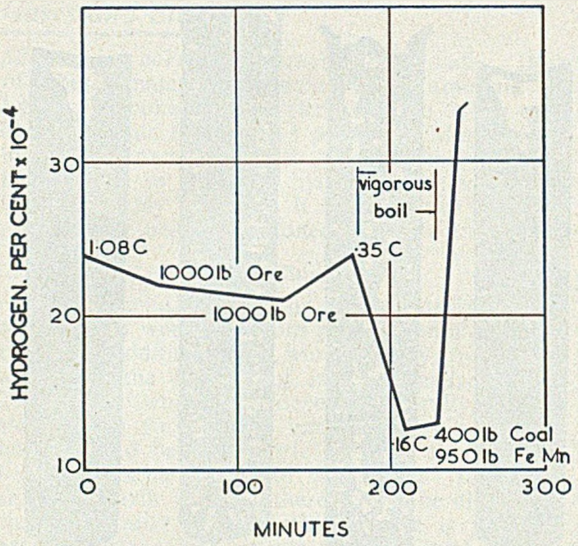


FIG. 9.—HYDROGEN IN OPEN-HEARTH FURNACE CHARGE (SCAIFE).

10, from the results of Bardenheur[16] indicates how rapidly the ductility, as measured by this test, falls off.

A more detailed investigation[17] demonstrates (Fig. 11) that with mild steel the reduction of area in a standard test-piece is reduced directly in pro portion to the amount of hydrogen contained. With 0.00070 per cent., equivalent to 0.80 relative volume, it will disappear altogether, making the steel behave like a completely brittle material. This will indicate how very small are the amounts of hydrogen required to destroy the ductile behaviour of ordinary mild steel and emphasise, if emphasis were needed, that hydrogen is an important, if hitherto disregarded, constituent of all commercial steels.

Effect on Large Masses

This leads to the suggestion that it may be due in some degree to the hydrogen content that large masses of steel do not seem to possess the same physical properties as smaller pieces, particularly in regard to their toughness. This difference is often referred to as the "scale effect," and it is a common experience that forgings and castings of large cross-section seem unable to stand up to stresses which should have been well within their capacity to resist. Whilst hydrogen escapes from the surface rapidly in large masses, it must first diffuse to the surface and at ordinary temperatures its rate of diffusion is slow after the first initial escape. In the centre of large pieces, the hydrogen content may persist for a considerable time and so affect the toughness as to contribute in a very definite degree to the scale effect for which no adequate explanation has as yet been found.

Hair-line Cracks

There is another defect to which hydrogen gives rise, which has received a great deal of attention recently, and indeed, has been one of the main

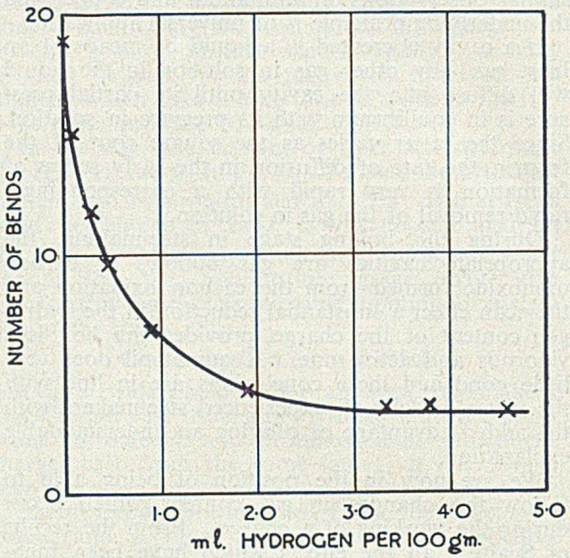


FIG. 10.—DUCTILITY OF HYDROGENATED WIRE.

reasons why the relations between gases and metals have been receiving so much intensive study. I refer, of course, to hair-line cracks or flakes. These are minute cracks which arise during the course of manufacture in certain ranges of alloy-steel compositions which possess self-hardening characteristics on air cooling. Very extensive and important investigations into the cause of hair-line cracks have been carried out by Andrew and his collaborators, and the literature is already so extensive that the subject would require a whole series of lectures to be adequately presented.

Beyond this passing reference, however, I must refrain from attempting to deal with the matter in spite of its importance, but I trust I have already given in this brief, if somewhat sketchy review, an indication of the interest that lies in the study of the complicated interactions between gases and metals, in which many research workers at the present time are slowly but steadily extending our knowledge.

(*References quoted on page* 625)

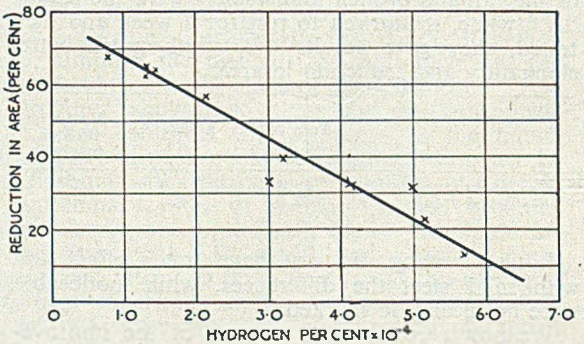


FIG. 11.—EFFECT OF HYDROGEN ON THE REDUCTION IN AREA (MARSHALL, GARVEY AND LLEWELYN).

Institute of British Foundrymen

TECHNICAL COUNCIL

Eighteenth Annual Report

The twelve months ending April 30, 1950, have been a period of undiminished activity on the part of the Technical Council and its sub-committees of the Institute of British Foundrymen. During the year, two sub-committees presented their reports at the Annual Conference in June, 1949, four further sub-committees have since completed their reports (two of which will be presented at the forthcoming Annual Conference), and two new sub-committees have been appointed. Detailed reference is made to these matters later in this report.

The Technical Council wish to record their deep appreciation of the work of the members of the sub-committees, who represent a much broader section of the Institute membership than hitherto, and especially to the chairmen who shoulder duties of an unquestionably onerous character. Upon their energy and devotion hinges the present and future success of the work of the Technical Council and of the valuable contribution to the progress of the industry which is it hoped to maintain.

A share of the renewed grant from the Joint Iron Council, to which reference was made in last year's report, has been made available for the work of the Technical Council, and has enabled several projects to be undertaken which would otherwise have been deferred—most notably, perhaps, publication of the substantial report of Sub-committee T.S.9 in the shape of the revised and greatly enlarged edition of the "Atlas of Defects in Castings," the reception of which has been outstandingly successful.

Mr. A. E. Peace (chairman), Mr. L. W. Bolton, Dr. A. B. Everest and Mr. A. Tipper have again constituted the chairman's advisory panel during the past year. As stated in the previous reports, the *raison d'être* of the panel is to give preliminary but detailed study to proposed new projects, and thus to avoid delay when opportunity to undertake further investigations is presented.

The Technical Council has been very gratified by the markedly growing liaison with the British Cast Iron Research Association which has become increasingly evident during the year, a particular example being the appointment of several representatives of the Association to the Institute's technical sub-committees. Representation on external technical committees, including numerous committees of the British Standards Institution connected with the foundry industry, the Joint I.B.F./B.C.I.R.A. Committee on Gases in Cast Iron and the Joint Sands Committee, has been fully maintained during the past year. The invaluable services of the many members who represent the Institute on these important external committees are warmly acknowledged.

There has been a very considerable increase during the past twelve months in the number of students appointed under the J. W. Gardom Students' Fund Scheme to serve on sub-committees. The instruction and the opportunity to obtain a broader outlook on the problems of the foundry industry which this scheme provides, are appreciated as an immensely valuable privilege by the students concerned.

The authoritative section on steel casting defects contributed by the British Steel Founders' Association to the revised and greatly enlarged edition of the "Atlas of Defects in Castings" is a valuable outcome of the co-operation on matters of mutual interest which has existed for some time between the Technical Council and the Association's technical and research organisation. The Technical Council look forward to the continuance of this collaboration when other matters of common interest arise.

The Ministry of Labour and National Service has now made an official announcement regarding the amendment of the draft S.R. & O. relating to parting powders and sands. New draft regulations have been issued and are known as the draft Foundries (Parting Materials) Special Regulations, 1950. While several of the recommendations made by the Institute's *ad hoc* committee in 1946 have been adopted, certain materials have not been included in the exempt materials specified in the schedule to the regulations. The Technical Council has therefore deemed it necessary to make further representations to secure their inclusion in the schedule and the Ministry's reply is awaited.

The following sub-committees have completed their work, and in the instances noted, have been dissolved during the year:—

T.S.9—Atlas of Defects in Castings. (*Chairman: Mr. F. Hudson, F.I.M.*)—The work of this sub-committee concluded during the year with the publication of the revised and greatly enlarged "Atlas of Defects in Castings," which illustrates some seventy defects in iron and non-ferrous castings. The first impression of 1,500 copies of the book was disposed of within a few weeks of publication, and the second impression is now on sale. The tremendous success of this publication is an adequate testimony of the high value of the sub-committee's work. (Sub-committee dissolved.)

T.S.18—Stripping Temperature. (*Chairman: Mr. M. M. Hallett, M.Sc.*)—This sub-committee's report was presented and discussed at the Cheltenham Conference in June, 1949. (Sub-committee dissolved.)

T.S.21—Solidification Rate of Cast Iron. (*Chairman: Mr. L. W. Bolton, A.M.I.Mech.E., F.I.M.*)—Appointed in March, 1947, to investigate the influence of mould materials on the rate of solidification of cast iron, this sub-committee, after carrying out an extensive series of slush tests at Birmingham University, was compelled to recon-

I.B.F. Technical Council Report

sider its work in the light of a disturbing scatter of the results when thick shells were obtained. This scatter was due to the brittleness or strength of the crystals at the temperature of slushing, the thickness of the shell depending entirely on whether the metal was strong enough to support its own weight. As a consequence, the sub-committee formed the conclusion that the slush method could not be applied to an investigation of the rate of solidification of grey cast iron, but expressed the view that the use of pyrometric indicators might prove a suitable alternative method. A fuller summary of the sub-committee's report was published in the March issue of the Institute's Journal, and a copy of the full report can be supplied on request As a result of the report, a new sub-committee (T.S.33) was appointed with alternative terms of reference as detailed later in the present report.

T.S.23—Reclamation of Iron Castings. (*Chairman*: *Dr. A. B. Everest.*)—This sub-committee has completed its work and its report will be presented for discussion at the forthcoming Annual Conference at Buxton.

T.S.26—Salvaging of Non-Ferrous Castings. (*Chairman*: *Mr. G. Elston.*)—This sub-committee has completed its work and its report will be presented for discussion at the Annual Conference at Buxton.

T.S.27—Cupola Raw Materials. (*Chairman*: *Mr. W. W. Braidwood.*)—This sub-committee's report was presented and discussed at the Cheltenham Conference in June, 1949, and subsequently at three branch meetings.

T.S.28—Standardisation of Moulding-box Equipment. (*Chairman*: *Mr. F. Dunleavy.*)—The final report of this sub-committee, which was exploratory in character, has been considered by the Technical Council, and as a result sub-committee T.S.34 has been appointed with the terms of reference which are noted later in this report. (Sub-committee dissolved.)

Appreciation of the tremendous personal effort represented by the preparation and presentation of the aforementioned reports has already been recorded, and it remains warmly to acknowledge the contribution of the many firms who permitted members of their staffs to attend meetings and who allowed experimental work to be carried out in their laboratories or foundries. It will be widely recognised that, but for these indispensable facilities, the valuable information presented in the reports could not have been placed at the disposal of the Institute's Members.

The work during the year of the remaining active sub-committees is summarised below:—

T.S.20—Soundness of Iron Castings. (*Chairman*: *Mr. A. Tipper, M.Sc., F.I.M.*)—This sub-committee was appointed in March, 1947, to examine and recommend methods of evaluating unsoundness of cast iron with a view to the use of such methods in subsequent investigations into the effect of mould materials on grey and malleable iron castings. The investigations carried out to date can be broadly classified under four headings:—

(*a*) Investigation into limitations of the ultrasonic method of examining metals when applied to cast iron.

(*b*) The correlation of results obtained by non-destructive testing methods with visual and photographic examination by sectioning.

(*c*) The investigation of a number of possible means of detecting unsoundness in cast iron which might give a qualitative or quantitative result by comparison with some selected standard.

(*d*) The preparation of a "comparator" chart for assessing unsoundness revealed by radiography, (i) for grey iron, (ii) for white iron.

This sub-committee is now approaching the end of its investigations and summaries of the work and results are at present being compiled for embodying in the final report.

T.S.24—Ingates. (*Chairman*: *Mr. R. C. Shepherd.*)—This sub-committee was formed in December, 1947, to study the influence of the shape and size of ingate and runner system on the condition of flow of metal into a mould. An analysis of the very large number of experiments which have been carried out has indicated that there are certain geometrical factors which, if not borne in mind, will mask other effects. Only a proportion of the sub-committee's experiments were found to be geometrically valid, and a number of the remainder are being repeated under suitably modified conditions. Mr. W. Barnes found it necessary to relinquish the chairmanship and Mr. R. C. Shepherd has accepted an invitation to serve in his stead.

T.S.29—Flow of Metal. (*Chairman*: *Mr. E. M. Currie.*)—Appointed in March, 1949, to explore and report upon the methods of studying the flow of metal into moulds, this sub-committee has reported that, within the resources likely to be available, the following are practical possibilities:—

(*a*) Ciné-camera colour photography in the horizontal plane, using an open-type sand mould.

(*b*) Ciné-camera photography in the vertical plane, using a perspex mould; the preliminary experiments using a liquid such as glycerine (of various viscosities and wetting agents to reduce surface tension) to be on the effect of turbulence.

This report has been noted by the Technical Council with a view to use being made of these recommendations when an opportunity occurs.

T.S.30—Synthetic Resins. (*Chairman*: *Mr. G. L. Harbach.*)—This sub-committee was also formed in March, 1949, with the following terms of reference:—

To investigate the use of synthetic resins for
(*a*) Core binders;
(*b*) Moulding sand binders;
(*c*) Other foundry applications.

The sub-committee has issued a questionnaire to the foundry industry on the use of synthetic resins, and the information abstracted from the replies is at present being correlated with a report which has been submitted by the British Plastics Federation.

From enquiries which the committee has made on the incidence of dermatitis amongst foundry users of synthetic resins, it would appear that, while details of numbers affected are not readily ascertainable, the dermatitis danger is not excessive and should not be assessed on isolated experience.

T.S.31—Heat Treatment of Grey Cast Iron. (*Chairman*: *Mr. T. R. Twigger.*)—This sub-committee, which was formed in March, 1949, as a result of extended general consideration of the subject of heat treatment of grey cast iron by the chairman's advisory committee, has the following terms of reference:—

> To consider and report upon the subject of the heat treatment of grey cast iron, with particular reference to sectionalising the problems involved and to make recommendations regarding the order in which these problems should be investigated.

The sub-committee has held a number of meetings during the past year, and having reviewed the very wide field of heat-treatment practice, is now subjecting the various points of technique which arise to detailed examination. Its report is expected at an early date.

T.S.32—Internal Stress. (*Chairman*: *Mr. M. M. Hallett, M.Sc.*)—Arising from the report of Sub-committee T.S.18 and from the results of co-operation with Mr. R. A. Dodd of Birmingham University, in connection with the work of that committee, Sub-committee T.S.32 was formed to investigate the problems of internal stress in castings, and to co-operate with Mr. Dodd by the provision of assistance and guidance in his work on this subject. The sub-committee has held several meetings and, from a general review of the whole subject, the conclusion has been drawn that the causes of internal stress can be divided into two main classes: (*a*) Stresses arising due to the resistance of the mould material. (*b*) Stresses arising from temperature difference. Certain work carried out on straight and flanged bars is considered to have provided proof that sand could cause internal stress in a casting before it is stripped and that the stress is removed by stripping.

The following extensive programme of tests by the strain-gauge method has been undertaken and is approaching completion.

(i) Experiments employing a spring-bar design of apparatus using different types of sand and metal. Also experiments on hollow cylinders, using hard sand.

(ii) Experiments with a frame-casting design of test-piece using different types of steel and sand.

(iii) Experiments for a frame-casting test-piece (of the design used for T.S.18's work) using a range of moulding sands of the same fundamental types and with different moisture contents to give a wide range of dry strengths.

(iv) Experiments on the effect of metal temperature on residual internal stresses, using the frame-casting design of test-piece referred to in (iii) above.

T.S.33—Pyrometric Method of Investigating Rate of Solidification. (*Chairman*: *Mr. L. W. Bolton, A.M.I.Mech.E.*)—In view of the report of Sub-committee T.S.21, Sub-committee T.S.33 was appointed in September, 1949, with the following terms of reference:—

> To explore the suitability of the pyrometric and alternative methods for investigating the influence of mould materials on the rate of solidification of cast iron.

To establish the feasibility of the method before embarking on long-term tests, a programme of preliminary experiments was authorised to be carried out at Birmingham University. These preliminary experiments have convinced the sub-committee that the pyrometric method is workable and sufficiently sensitive for the experiments envisaged, and it is anticipated that the Technical Council will authorise a full-scale programme of experiments.

T.S.34—Moulding Boxes. (*Chairman*: *Mr. J. Blakiston.*)—On the recommendation of Sub-committee T.S.28 which was formed to explore the possibility of standardising moulding box equipment, Sub-committee T.S.34 was appointed in December, 1949, with the following terms of reference:—

> To propose a tentative specification or specifications for the standardisation of foundry moulding boxes.

At its first meeting the sub-committee decided to cover a range of boxes of the two-pin type, and at the members' request the terms of reference have been extended to cover the standardisation of pattern plates in all materials, *i.e.*, aluminium, steel, cast iron and wood. With a view to ascertaining the most popular standard box-part sizes a questionnaire has been issued to all sections of the industry.

The Report is signed by Mr. A. E. Peace, chairman.

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(*Continued from page* 622)

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News in Brief

MR. J. EDMUND GAMAGE, A.M.I.E.E., and MR. DONALD L. CAMPBELL, M.C., have been appointed joint sales managers for the Electric Furnace Company, Limited.

EXTENSIONS to the foundry at Scott's Shipbuilding & Engineering Company, Limited, Greenock, are to be made. Plans are being prepared by the firm's own draughtsmen and staff.

A NORWEGIAN STEAMER has brought 5,500 tons of iron ore from Yugoslavia to Tyne Dock. This is thought to be the first ore cargo from Yugoslavia to be brought to the Tyne.

MR. R. H. MINNS, managing director of a Cannock firm of ironfounders, and of a Birmingham company with a factory at Hednesford, has been elected president of the Cannock Chamber of Commerce.

RAPID MAGNETIC MACHINES, LIMITED, have appointed John S. Young & Company, Limited, 257-261, Eglinton Street, Glasgow, C.5, as their agents in Scotland for magnetic separating equipment and lifting magnets.

A RECORD CONSIGNMENT of 28,000 refractory blocks, packed in 467 cases, has been despatched from the Wharncliffe works of General Refractories, Limited, Sheffield, on the first stage of a journey to Takao, Formosa.

ALDER & MACKAY, LIMITED, gas-meter manufacturers and brass founders, of Stewart Terrace, Edinburgh, 11, celebrate their centenary this year. Founded in 1850, the firm now have branches in several English cities as well as in Belfast, Cork, and New Zealand.

J. & H. MCLAREN, LIMITED, agricultural engineers and Diesel-engine builders, of Jack Lane, Leeds 10, have received orders worth several hundred thousands of pounds as a result of the visit to their works of Swedish civil, naval, and military engineering representatives.

THE FIRST ALUMINIUM LIFEBOAT built on Tyneside has just been completed by Gregson & Company, Limited, Chirton, North Shields. The boat weighs 24 cwt. with all the gear on board, is 22 ft. in length, and will carry 35 people. It is the first of a Canadian order for 10.

THE NEW LUTON FACTORY of Vauxhall Motors, Limited, part of a four-year £10 million development plan, will be in three-quarter production by August 5. All engine and gearbox manufacture is being transferred to the new plant. The factory is one-third of a mile long and 480 ft. wide.

THE FIRST United States International Trade Fair will be held at Chicago from August 7 to 20. A rigid limit has been set on the amount of space available to American firms and more than two-thirds of the space will be devoted to merchandise of foreign countries. It is estimated that 40 countries will participate.

THE SUMMER SCHOOL in electron microscopy will be held again this year in the Cavendish Laboratory, Cambridge, from July 18 to 29 inclusive. A detailed syllabus and form of application for admission may be obtained from G. F. Hickson, M.A., Secretary of the Board of Extra-Mural Studies, Stuart House, Cambridge.

THE DIRECTORS of the Wallacetown Engineering Company, Limited, Ayr, recently entertained Mr. John H. McDonald, foundry foreman, on the occasion of his retirement after more than 21 years' service with the firm. Mr. W. M. Ritchie, managing director, presented him with a wallet of notes from the directors, staff and employees.

MR. V. W. OUBRIDGE, managing director of the British Piston Ring Company, Limited, Coventry, told the spring conference of the British Institute of Management, last Friday, that his firm had achieved good results by changing from a piece work to a group incentive system. Groups of workers manufactured a product from beginning to end, thus enjoying co-operative work in competition against each other, he said.

THERE ARE FAIR PROSPECTS of increasing sales for British goods in many countries of the Near and Middle East, according to Mr. C. F. I. Ramsden, oversea director of the Federation of British Industries, who has recently returned from a tour of Jordan, Lebanon, Syria, Iraq, Koweit, Persia (Iran), and Turkey. He told a London Press conference that in six of these countries British exporters should have little difficulty in maintaining or expanding their sales, but the outlook for British exports to Turkey was uncertain.

THE CEREMONIAL "first brick" of the new coke ovens at the Dagenham works of the Ford Motor Company, Limited, was laid by Sir Rowland Smith, chairman of the company, on May 30. Sixteen years ago the company put into operation 45 coke ovens for supplying metallurgical coke for their blast furnace. The new ovens, which are an extension of the old, are underfired and are of modern design by the Coppee Company (Great Britain), Limited. It is hoped that the plant will be in operation by the end of next year.

ASSOCIATED BRITISH OIL ENGINES, INC., of New York, A.B.O.E.'s American sales company, last month held a national convention of dealers and distributors—the first of its kind ever held in the U.S. by a British manufacturer. Messages of greeting were received from Mr. Lewis Douglas, U.S. Ambassador in Britain; Mr. G. R. Strauss, Minister of Supply; Mr. Thomas E. Dewey, Governor of New York State, and Mr. Paul Hoffman, E.C.A. Administrator. Mr. A. C. Geddes, managing director of A.B.O.E. in London, flew to New York to deliver the opening address of the convention.

Shetland Ore Prospecting

Three scientists from the London Geophysical Prospecting Company, who for nearly six weeks have been engaged in investigating the extent and prospects of developing the magnetite ore deposits in the Hill of Clothister, at Sullom, in the Central Shetland mainland, have now completed their work.

Using magnetic and electrical apparatus, they have gone over more than 30 acres of the hill, and their findings have been plotted on large-scale ordnance survey maps. Results are reported to be very encouraging. Scientists are now investigating magnetite and hematite ore deposits at Scousburgh, at the south end of the mainland. Sullom deposits are expected to yield at least 70 per cent. of magnetite. Prospectors' reports will be submitted to the British Iron & Steel Corporation, who will decide whether the deposits will be developed as a commercial undertaking.

Sheffield Steel Output

Weekly production of steel ingots and castings in the Sheffield area during March was 45,000 tons, bringing the average weekly production for the first three months of the year to 44,800 tons. This represents an increase of 900 tons a week over the weekly production in the corresponding period of last year. The weekly average for the whole of 1949 was 41,000 tons.

Sheffield area deliveries of semi-finished steel, excluding alloy steels, in March averaged 16,900 tons a week, bringing the weekly average in the first three months of the year to 16,500 tons, compared with 15,800 tons in the corresponding period of last year.

Company News

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

H. & J. Hill (Willenhall) Limited, ironfounders, etc.:—The company propose to make an issue of ordinary shares to existing holders, who are offered 178,680 ordinary shares of 1s. each at 3s. per share, of which 177,107 shares are offered by way of rights in the proportion of one new for every three held. The balance of the offer and any shares not taken up by way of rights may be applied for by shareholders. The purpose of the issue is to finance the acquisition of ground and buildings adjoining the present works and provision of machinery and plant.

John Summers & Sons, Limited:—Pointing out that in his speech, which accompanied the report and accounts, he referred to the necessity of raising additional money for financing the company's development scheme, the chairman, MR. RICHARD F. SUMMERS, says that, since the accounts were issued, the company have made an application to the Capital Issues Committee and had just received Treasury permission for the issue of a debenture stock. Stockholders will receive in due course a copy of the prospectus.

National Gas & Oil Engine Company, Limited:—Plans to raise additional capital to help finance an expansion scheme costing £510,000 are announced. The rate of interest on the existing £1 cumulative preference shares is to be increased from 5 to 5½ per cent. A call of 10s. per share, the balance due, is to be made on the existing £1 preference shares, 10s. paid. In addition, 200,000 of the new 5½ per cent. preference shares are to be issued at par through Rowe Swann & Company, stockbrokers.

Stewarts and Lloyds, Limited:—MR. A. G. STEWART, chairman, says that despatches of tubes, pipes, and fittings last year again constituted a record in the history of the company and much exceeded those of 1948, itself a record year. Forty-one per cent. of the tonnage despatched in 1949 was exported. Deliveries to the oil companies alone expanded by about 50 per cent. over 1948. Despatches up to the end of April last were almost 10 per cent. higher than in the corresponding months of 1949.

Ransomes, Sims & Jefferies, Limited, engineers and ironfounders, etc., of Ipswich:—In spite of the new capital raised in 1948, the expansion in output coupled with the effects of inflation is such that recourse has again been taken to acceptance credit borrowing of £400,000, says the chairman, MR. J. H. W. PAWLYN, who adds: "If price levels generally continue to increase we may later on again find ourselves short of working capital."

Scottish Industries Exhibition

Holding of the next Scottish Industries exhibition in 1953 was agreed to by the Central Committee of Scottish Chambers of Commerce at their annual meeting at Prestwick on May 24. Mr. W. V. Stevens, secretary of the Edinburgh Chamber, said that after the success of last year's exhibition the Central Committee inclined to the view that the exhibition might become an annual event. On receiving a report from the Scottish Council on the investigations they made among exhibitors, however, the Central Committee now agreed that the proper course was for the next exhibition to take place in 1953, *i.e.*, after an interval of 4 years.

House Organs

Steel Horizons, Vol. 12, No. 2. Published by the Allegheny-Ludlum Steel Corporation, Pittsburgh, Pa., U.S.A.

This is the most beautiful house organ regularly to be received in this office. It has for its object increasing the sales of stainless steel. This issue takes the reader to the circus and indicates in the most charming manner how stainless steel enters into the make-up and running of the big show. The cover, in glorious colour, shows a well-known clown. The back cover will interest fishermen, for on a yellow background there are illustrated with geometrical precision no fewer than 43 types of flies. Other features are equally colourful and interesting.

Alloy Metals Review, Vol. 4, No. 55. Published by High Speed Steel Alloys, Limited, Widnes, Lancashire.

This issue contains a long abstract of a Paper given by W. E. Bardgett and L. Reeve before the Iron and Steel Institute on the Mechanical Properties of Low-carbon Molybdenum Boron Steel. It is a noteworthy contribution to the subject and merits the republication in this form.

Ruston Overseas News, Vol. 1, No. 5. Issued by Ruston & Hornsby, Limited, Lincoln.

The "star" article in this issue is, of course, the new Beevor foundry. As this magazine goes to the various overseas agents and the like, it should act as a stimulus in their search for orders. There is the usual news of recent installations of Ruston machinery abroad—all of which is helping to create a bond between these overseas readers.

The Aluminium Courier, No. 11. Published by the Aluminium Development Association, 33, Grosvenor Street, London, W.1.

This issue is largely devoted to the use of aluminium in the coal-mining industry. Its use in mine cages, coal skips, and tubs are interestingly dealt with. This development, being in its infancy, is well suited for propaganda in the Aluminium Courier.

Indian Standard for Malleable

Nearly all malleable castings manufactured at present in India are of the "blackheart" type. In order to standardise the manufacture of these castings, the Engineering Division Council of the Indian Standards Institution has drawn up a draft Indian standard specification for "blackheart" malleable-iron castings. It covers the requirements of three grades of this type of castings. Requirements with regard to the process of manufacture, chemical composition, moulding, freedom from defects, details of mechanical tests of the materials are laid down in the standard. This draft has been circulated for comment to members of the Institution interested in this field and to large consumers, manufacturers and technologists.

Nickel Prices Increased

Immediate increases in their prices for refined nickel have been announced by the International Nickel Company of Canada and their associated companies, the International Nickel Company, Inc., of the United States, and the Mond Nickel Company, Limited, London. The Mond Nickel Company are raising their price in the United Kingdom to £386 per ton, delivered works, with appropriate increases for other countries.


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Pig-iron and Steel Production in Great Britain

Summary of March Statistics

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

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

District.	Furnaces in blast 1.4.50.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants, and Essex	26	1.4	17.7	23.4	1.1	—	43.7
Lancs. (excl. N.W. Coast) Denbigh, Flints. and Cheshire .. Yorkshire (incl. Sheffield, excl. N.E. Coast) ..	6	—	7.6	—	—	1.5	9.1
Lincolnshire ..	13	—	22.4	0.6	—	—	23.0
North-East Coast	23	7.5	38.0	0.2	—	1.4	47.1
Scotland	8	0.9	9.8	2.3	—	—	13.0
Staffs., Shrops., Worcs., and Warwick. ..	9	—	9.4	1.5	0.1	—	11.0
S. Wales and Monmouthshire	8	4.4	19.1	—	—	—	23.5
North-West Coast	7	15.9	—	0.2	—	—	16.1
Total ..	100	30.1	124.0	28.2	1.2	2.9	186.5*†
February, 1950 ..	100	29.2	122.8	28.3	1.4	2.7	184.4
March, 1949* ..	99	27.7	116.2	29.8	2.2	2.9	178.8

* Five weeks. † Incl. 100 tons of direct castings.

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

Product.	1948.	1949.	1949. Mar.*	1950. Feb.	1950. Mar.*
Non-alloy Steel :—					
Heavy rails and sleepers	8.9	9.8	10.1	12.7	13.3
Heavy and medium plates	36.1	39.2	42.5	42.4	42.6
Other heavy prod...	34.7	36.1	37.2	40.0r	40.3
Light rolled prod.§..	59.7 (Light rolled prod. and Hot-rolled strip)	46.4	49.2	48.5	49.2
Hot-rolled strip ..		17.1	18.1	19.2	19.3
Cold-rolled strip ..	4.8	4.9	5.1	5.1	5.7
Bright steel bars ..	6.1	5.8	6.3	6.0	6.3
Sheets, coated and uncoated	26.3	27.6	29.1	30.1	32.4
Tin, terne and black-plate	13.5	13.7	14.7	13.9	16.4
Tubes, pipes and fittings	15.1	18.5	19.9	20.2	21.2
Wire	12.8	15.0	15.5	15.3	16.5
Tyres, wheels and axles	3.9	4.1	4.3	3.6	3.5
Forgings	6.0	6.3	6.8	7.0	7.1
Castings	3.5	3.6	3.9	3.8r	3.7
Total	231.4	248.1	262.7	267.8	277.5
Alloy Steel† :—					
Tubes and pipes ..	0.4	0.6	0.7	0.9	0.9
Bars, plates, sheets, strip and wire ..	4.7	4.7	5.4	4.6	5.0
Forgings	2.5	2.7	3.0	3.3	3.4
Castings	0.7	0.7	0.7	0.8	0.9
Total	8.3	8.7	9.8	9.6	10.2
Total deliveries from U.K. prod.‡ ..	239.7	256.8	272.5	277.4	287.5
Add from other U.K. sources	5.7	5.8r	5.6	4.1r	3.9
Imported finished steel	3.4	7.7	6.2	4.0	5.2
	248.8	270.3r	284.3	285.5r	296.8
Less intra-industry conversion ..	35.0	39.1	42.4	42.0r	44.5
Total deliveries of finished steel ..	213.8	231.2r	241.9	243.5r	252.3

† Excludes high-speed steel. ‡ Includes finished steel produced in the U.K. from imported ingots and semi-finished steel. *r* Revised
§ Excl. wire rods and alloy-steel bars, but incl. ferro-concrete bars.

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

District.	Open-hearth. Acid.	Open-hearth. Basic.	Bessemer.	Electric.	All other.	Total. Ingots.	Total. Castings.	Total ingots and castings.
Derby., Leics., Notts., Northants and Essex ..	—	1.9	11.1(basic)	1.3	0.2	13.9	0.6	14.5
Lancs. (excl. N.W. Coast), Denbigh, Flints., and Cheshire .. .. Yorkshire (excl. N.E. Coast and Sheffield) ..	1.0	23.8	—	1.2	0.4	25.4	1.0	26.4
Lincolnshire	—	30.9	—	—	0.1	30·9	0.1	31.0
North-East Coast	1.4	65.7	—	0.9	0.5	66.9	1.6	68.5
Scotland	4.3	43.1	—	1.7	0.7	48.0	1.8	49.8
Staffs., Shrops., Worcs. and Warwick	—	15.7	—	0.8	0.7	15.9	1.3	17.2
S. Wales and Monmouthshire	9.1	52.0	5.6 (basic)	0.9	0.1	67.3	0.4	67.7
Sheffield (incl. small quantity in Manchester) ..	8.2	28.0	—	8.2	0.6	43.0	2.0	45.0
North-West Coast	0.6	3.7	5.3 (acid)	—	0.1	9.5	0.2	9.7
Total	24.6	264.8	22.0	15.0	3.4	320.8	9.0	329.8*
February, 1950	28.7	257.1	21.4	14.3	3.5	316.2	8.8	325.0
March, 1949*	29.1	244.4	20.3	15.5	3.6	304.1	8.8	312.9

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

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy). Imports.†	Steel (incl. alloy). Output of ingots and castings.	Steel (incl. alloy). Deliveries of finished steel.	Steel (incl. alloy). Stocks.‡
1938	228	89	—	130	118	16	200	—	—
1948	252	172	200	178	174	8	286	214	1,028
1949	258	169	199	183	188	17	299	231	1,275
1949—October	237	178	196	184	194	12	307	242	1,296
November* ..	249	180	199	187	200	8	315	245	1,246
December	249	170	197	186	181	12	291	231	1,275
1950—January	260	175	198	187	189	11	305	234	1,263
February	250	170	194	184	206	8	325	244r	1,257
March*	255	174	197	186	212	12	330	252	1,279

* Five weeks. † Weekly average of calendar month. ‡ Stocks at end of years and months shown. *r* Revised

Raw Material Markets

Iron and Steel

Pig-iron production in the aggregate scarcely keeps abreast of industrial requirements. Northamptonshire high-phosphorus iron is more plentiful than the Derbyshire grade; hematite and refined irons are more readily obtainable than low- and medium-phosphorus iron, and because of these deficiencies consumers will have to reconcile themselves to the continuance of controlled distribution. Prices, too, have risen, owing to higher fuel and transport costs, but demand is still active and current outputs are passing promptly into consumption.

The substantial curtailment of the volume of imports of semi-finished steel assures regular outlets for the disposal of the maximum tonnages which British steelmakers are able to supply. Re-rollers' chief concern nowadays is to find markets for their finished products. Recent bookings for light sections and bars have been on a disappointing scale and most of the mills would welcome more export business than is at present available. In the sheet trade there is still a wide gap between supply and demand and not until 1952 is this gap likely to be bridged, though it may be considerably reduced next year.

The volume of orders in hand assures full-scale activity for the rollers of steel plates, heavy sections, joists, and rails. Moreover, the restoration of freedom from the irksome restrictions of the rationing system promises to give a new impetus to business in the home market which should manifest itself during the summer months.

Non-ferrous Metals

The price of copper to United Kingdom consumers was raised on Tuesday to a new post-war peak of £186 per ton, an increase of £16. The Ministry of Supply's action followed an upward trend on the other side of the Atlantic. Discounts, premiums, and charges for delivery of copper remain unchanged, but the Ministry's buying price of rough copper was advanced by £12 a ton to £144.

Users of nickel had something of a surprise last week when the price of this metal was advanced without warning from £321 10s. to £386 per ton. The revised price, which became effective on June 1, will presumably apply to all metal outstanding on contract. Another increase was made in the zinc quotation, which was lifted by a further £4 to £111 10s. per ton. This change followed an advance in the United States of 50 points to 13 cents East St. Louis. At the end of last week the futures price was 14.30 cents per lb., and on Monday it was announced that the U.K. prices had been increased by £12 per ton to £123 10s. Consumers here seem rather frightened of the present level and are showing an inclination to cover on a hand-to-mouth basis. Moreover, the April statistics published by the Bureau of Non-ferrous Metal Statistics show that consumption of zinc declined by more than 6,000 tons to 23,802 tons. Stocks increased slightly to 46,594 tons. The price of lead is steady and unchanged and here, too, April brought a fall in consumption of about 5,000 tons to 23,202 tons. Stocks, rather surprisingly, were lower at April 30 by some 3,000 tons at 61,477 tons.

The Easter holidays certainly seem to have upset U.K. consumption in copper, for usage was down from 46,446 tons in March to no more than 36,448 tons in April; 22,804 tons were virgin metal and the balance secondary. Stocks of copper in the U.K. rose from 115,882 tons on March 31 to 127,902 tons at the end of April. This increase occurred almost entirely in blister copper reserves held by the Ministry of Supply.

Tin has been a steady market, but there was a sharp price increase yesterday (Wednesday). The scrap market, too, was firm and some appreciation in the values of most of the grades was seen. Current business in non-ferrous semis appears to be fairly brisk.

Metal Exchange tin quotations were as follow:—

Cash—Thursday, £602 to £602 10s.; Friday, £602 5s. to £602 15s.; Monday, £602 to £602 10s.; Tuesday, £603 5s. to £603 15s.; Wednesday, £606 15s. to £607.

Three Months—Thursday, £603 5s. to £603 10s.; Friday, £603 5s. to £603 10s.; Monday, £603 to £603 5s.; Tuesday, £604 to £604 10s.; Wednesday, £607 15s. to £608.

Company Results

(Figures for previous year in brackets.)

BROOM & WADE—Interim dividend of 7½% (same).

GLACIER METAL COMPANY—Dividend of 7½% (same).

PARK GATE IRON & STEEL COMPANY—Dividend of 10% (same).

SANDERSON BROS. & NEWBOULD—Final dividend of 7½% (5%), making 12½% (10%).

CLIMAX ROCK DRILL & ENGINEERING WORKS—Final dividend of 5%, making 10% (same).

HARLAND ENGINEERING COMPANY—Dividend of 7% (same) on the old shares and of 1 % on the new shares.

WOODALL-DUCKHAM VERTICAL RETORT & OVEN CONSTRUCTION COMPANY (1920)—Dividend of 15% (same).

JOHN HARPER & COMPANY—Second interim dividend of 20%, making 30% (same). There will be no further dividend for the year.

G. N. HADEN & SONS—Trading profit of group for 1949, £141,278 (£134,457); dividend of 12½% on doubled capital (25%); forward, £193,317 (£175,527).

WILLIAM BEARDMORE & COMPANY—Trading balance for 1949, £577,634 (£587,016); net profit, £206,190 (£154,572); final dividend of 8½% and bonus of 5%, making 17½% (same); forward, £527,294 (£441,279).

JURY HOLLOWARE (STEVENS)—Net profit for the year ended March 31, £33,212 (£18,379); dividend of 10% (same); to reserve for replacement, nil (£10,000); general reserve, £20,000 (nil); forward, £26,335 (£25,773).

ENGINEERS & IRONFOUNDERS—Net profit for 1949, £6,286 (£5,768); to pensions, £3,000 (£5,000); reserve, £11,000 (£21,000); final dividend of 15% and bonus of 12½%, making 32½% (same); forward subsidiary companies £17,550 (£10,728), parent company £10,808 (£10,124).

PRIOR STOKERS—Trading profit for 1949, £27,433 (£37,273); to depreciation, £2,594 (£3,287); directors' emoluments, £5,851 (£5,649); profits tax, £2,217 (£3,825); income tax, £7,408 (£11,830); general reserve, £7,500 (£10,000); dividend of 10% (same); forward, £5,143 (£5,486).

CONSOLIDATED ZINC CORPORATION—Final dividend in respect of the period February 2 to December 31, 1949, of 9⅜%, making 12½%, which is equivalent to the distribution of 10s. per share or per unit of stock by the Zinc Corporation in respect of 1948. The company was registered last February.

ASSOCIATED MANGANESE MINES OF SOUTH AFRICA—Mining profit, etc., for 1949, £685,040 (£182,843); net revenue, £602,893 (£140,115); to taxation, £122,500; preference dividends, £1,115; ordinary dividends Nos. 22 and 23 aggregating 75% (25%); to general reserve, £75,000; forward, £93,165 (£33,186).

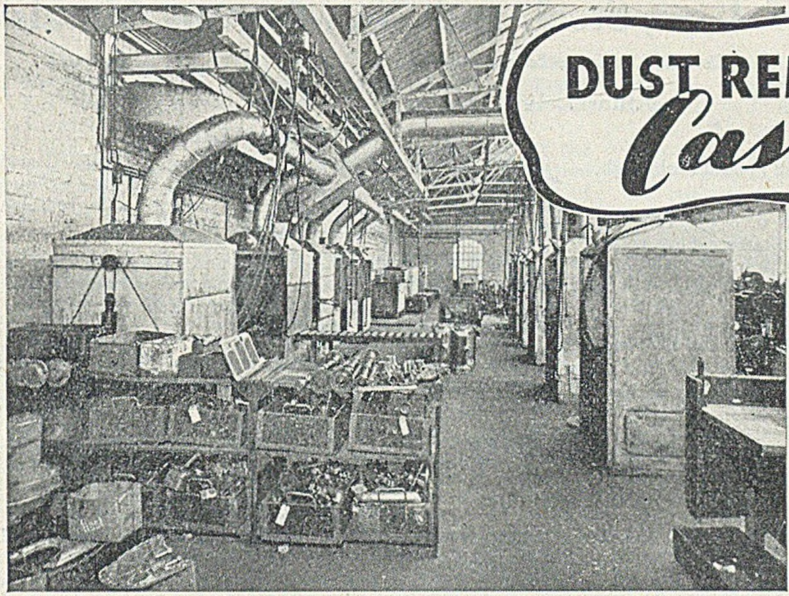
SPARK ALLOYS—Consolidated trading profit to January 31, £40,199 (£81,804); group net profit, £14,069 (£32,365); subsidiary's tax over-provision, £23,214 (nil); retained in accounts of subsidiary, £15,283 (£8,990); net profit of Spark Alloys,

HARRISON (BIRMINGHAM)—Trading profit for 1949, £325,784 (£275,552); net profit, £135,148 (£115,355); casual profits, £718 (£143); to development reserve, £83,000 (£35,000); metal stock reserve, nil (£13,350); pensions, £10,000 (£5,917); dividend of 25%, tax free (same); forward, £156,563 (£160,722 after tax adjustment).

LANCASHIRE DYNAMO & CRYPTO COMPANY—Consolidated trading profit for 1949, £384,639 (£369,164); net profit, £150,994 (£138,106); second interim dividend and bonus of 17½% on increased capital (same); to staff pensions, £20,000 (£45,000); profit attributable to outside interests, £954 (nil); forward, £308,702 (£240,860).

MELLOR, BROMLEY & COMPANY—Profit on trading from all sources of the company and its subsidiary undertakings for the year ended February 28, £465,554 (£366,306); consolidated net profit, £186,174 (£134,915); to general reserve, £40,000 (£30,000); final dividend of 36½%, making 54% (same); forward, by parent company, £153,174.

RICHARD JOHNSON & NEPHEW—Group trading profit for the year ended March 31, £749,883 (£800,936); to depreciation, £118,648 (£104,440); obsolescence, £15,307 (nil); taxation, £295,227 (£361,986); final dividend of 10%, making 15% (same); general reserve, £280(000 (£180,000); plant obsolescence reserve, nil (£100,000); forward, £71,311 (£66,910).



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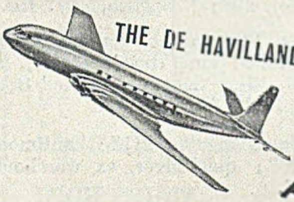

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered, unless otherwise stated)

June 7, 1950

PIG-IRON

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

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

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

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

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

Cold Blast.—South Staffs, £16 3s. 3d.

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

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

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

FERRO-ALLOYS

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

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

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

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

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

Ferro-tungsten.—80/85 per cent., 7s. 3d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 8s. 3d. per lb. of W.

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

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

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

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

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

SEMI-FINISHED STEEL

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

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

Sheet and Tinplate Bars.—£16 16s. 6d.

FINISHED STEEL

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

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

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

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

NON-FERROUS METALS

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

Tin.—Cash, £606 15s. to £607; three months, £607 15s. to £608 ; settlement, £607.

Zinc.—G.O.B. (foreign) (duty paid), £123 10s.; ditto (domestic), £123 10s.; "Prime Western," £123 10s.; electrolytic, £124 5s.; not less than 99.99 per cent., £125 15s.

Lead.—Good soft pig-lead (foreign) (duty paid), £96; ditto (Empire and domestic), £96; "English," £97 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, all English destinations, £139 15s.; rolled zinc (boiler plates), all English destinations, £137 15s.; zinc oxide (Red Seal), d/d buyers' premises, £115 10s.

Other Metals.—Aluminium, ingots, £112; antimony, English, 99 per cent., £160; quicksilver, ex warehouse, £17 to £17 5s.; nickel, £386.

Brass.—Solid-drawn tubes, 17⅞d. per lb.; rods, drawn, 23¾d.; sheets to 10 w.g., 22½d.; wire, 22⅝d.; rolled metal, 20⅞d.

Copper Tubes, etc.—Solid-drawn tubes, 17¾d. per lb.; wire, 191s. 3d. per cwt. basis; 20 s.w.g., 217s. 9d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £115 to £127; BS. 1400—L.G.3—1 (86/7/5/2), £125 to £138; BS. 1400—G1—1 (88/10/2), £176 to £201; Admiralty GM (88/10/2), virgin quality, £185 to £225, per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £208-£230; L.P.Bl, £128-£148 per ton.

Phosphor Bronze.—Strip, 29½d. per lb.; sheets to 10 w.g., 31⅝d.; wire, 31½d.; rods, 29d.; tubes, 32½d.; chill cast bars: solids, 29½d., cored, 30½d. (C. Clifford & Son, Limited.)

Nickel Silver, etc.—Ingots for raising, 2s. 1¾d. per lb. (7%) to 3s. 1½d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 2s. 7¾d. (7%) to 3s. 7½d. (30%); to 12 in. wide, × .056, 2s. 8d. to 3s. 7½d.; to 25 in. wide × .056, 2s. 10d. to 3s. 9½d. Spoon and fork metal, unsheared, 2s. 6½d. to 3s. 5¾d. Wire, 10g., in coils, 3s. 1½d. (10%) to 4s. 0¾d.; (30%). Special quality turning rod, 10% 3s. 0½d.; 15%, 3s. 5d.; 18%, 3s. 9½d.

Personal

MR. JAMES H. LITTLE, formerly a chief accountant in the professional accountants' branch of the Admiralty, has been appointed secretary of Hadfields, Limited, Sheffield.

MR. P. H. WILSON, deputy managing director of the Stanton Ironworks Company, Limited, has been admitted to the Venerable Order of the Hospital of St. John of Jerusalem as a Serving Brother.

COL. E. S. DANE, a director of Peters Stubs, Limited, steel and file manufacturers, etc., of Warrington (Lancs), has been elected president of the Federation of British Hand Tool Manufacturers.

MR. P. HOPKINSON, managing director of British Furnaces, Limited, Chesterfield, who are associated with the Surface Combustion Corporation, Toledo, Ohio, has returned home after a six-weeks' business trip to America.

THE GENERAL ELECTRIC COMPANY, LIMITED, announce the appointment of Mr. M. R. Neville, M.C., M.A., A.M.I.E.E., as manager of their publicity organisation to succeed Mr. C. Pinkham, who is retiring on June 30 after 37 years' service.

MR. E. T. JUDGE, a director of Dorman, Long & Company, Limited, has retired from the chairmanship of the Plant Engineering Panel of the British Iron and Steel Research Association. He is succeeded by MR. J. F. R. JONES, chief constructional engineer with John Summers & Sons, Limited.

MR. G. NEVILLE SPERRYN, of Sperryn & Company, brassfounders and finishers, of Moorsom Street, Birmingham, 6, left for a business visit to Canada and the United States on Tuesday. He was accompanied by his son, MR. GEORGE SPERRYN. Mr. G. N. Sperryn is planning to visit Australia and New Zealand later this year.

Obituary

MR. JOHN S. WATERS, who died in hospital on May 31, was managing director of the Johnson Metal Company, Limited, Salford (Lancs). He was 67.

MR. ALEXANDER WILSON, managing director of Alexander Wilson (Aberdeen), Limited, air-compressor manufacturers, has died at the age of 80. He founded the business nearly 50 years ago.

MR. W. A. R. RICHARDSON, a district manager of Stewarts and Lloyds, Limited, died on May 22. A memorial service was held at St. Stephen's Church, Mountstuart Square, Cardiff Docks, last Friday, coinciding with the time of the funeral at Boscombe.

MR. W. TYRER, who died on May 23, was formerly works superintendent of Walker Bros. (Wigan), Limited, engineers and ironfounders. He joined the firm as an apprentice fitter in 1891, retiring after 57 years of service in July, 1948, largely on account of ill-health. Mr. Tyrer supervised the erection of plant at many collieries both at home and oversea. He was 72.

Weights and Measures Test

The report on the comparisons of the Imperial Standard Yard and the Imperial Pound and the Parlimentary Copies by the National Physical Laboratory is now available from H.M. Stationery Office, price 1s. These comparisons have to take place every ten years and should have been held during the war years. Among the conclusions reached by the National Physical Laboratory in their report is that the Imperial Standard Yard has been shortening at a fairly uniform rate throughout the last 52 years. It is recommended that new arrangements for defining the Yard and Pound more scientifically are much overdue.

CLASSIFIED ADVERTISEMENTS

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

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

SITUATIONS WANTED

FOUNDRY MANAGER (age 35) desires change; 12 years' experience of repetition castings, including motor car cylinders, heads, etc., and general engineering castings in high duty and grey iron; capable of full sand and metal control, and training of unskilled labour.—Box 520, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER (age 35) desires join established concern. Thorough practical, technical knowledge moulding, metallurgy; mechanised, jobbing (green, dry loam up to 15 tons); iron, steel; sound organising ability. Preference for being responsible to managing director.—Box 586, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER / SUPERINTENDENT (36), 12 years' executive experience, seeks change, where experience of modern methods of production, mechanised, jobbing, cupola, sand control can be utilised. Used to high-class engineering castings.—Box 584, FOUNDRY TRADE JOURNAL.

FOUNDRY SUPERINTENDENT desires join reputable firm Foundry Suppliers; preferably south-west England and Wales. Expert knowledge founding in steel, iron, non-ferrous metals for all branches engineering. Age 35.—Box 588, FOUNDRY TRADE JOURNAL.

QUALIFIED METALLURGIST, Chemist (34), seeks change; ferrous, non-ferrous analysis, metallography, etc. Laboratory and foundry control. Electroplating.—Box 566, FOUNDRY TRADE JOURNAL.

VITREOUS ENAMELLER desires Executive position; age 40; 20 years' experience, 10 years management, modern plants. Sheet and cast iron, signs, frit melting. Own formulæ.—Box 576, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

CHIEF ESTIMATOR for Foundry Section of large Engineering Concern (Manchester-Salford area). Applicants must have experience of Steel Foundry and Pattern Shops, and be of Higher National Education standard. Excellent opportunity for suitable candidate.—Reply, giving full particulars, to Box 564, FOUNDRY TRADE JOURNAL.

CYLINDER PATTERNMAKER. — A first-class man, fully experienced in cylinder patternmaking, is required for a new foundry in Wellingborough.—Apply in writing, giving age, details of experience, wages required, etc., to MORRIS MOTORS, LTD., Wellingborough, Northants.

ENGINEER (age 20-26), good education, willing to undergo training, some foundry experience advantageous but not essential, required by large firm.—State full particulars of education and experience to Box 578, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

FOUNDRY METALLURGIST required for Works situated 20 miles west of London. Good practical knowledge of Non-ferrous Melting and Foundry Work essential, and some experience of Steel Foundry Work an advantage. State standard of education, experience, and salary required. All applications will be acknowledged. — Write Box A.770, WILLINGS 362, Grays Inn Road, W.C.1.

FOREMAN wanted, to take charge of semi-mechanised production of iron castings. A suitable man would in due course be given opportunities to prove his value in other ways. Assistance with house can be arranged. Full particulars in confidence.—Box 554, FOUNDRY TRADE JOURNAL.

FOREMAN required for Iron and Non-ferrous Foundry in South-West London area; must be fully experienced with all types of castings up to 2 tons; only men with drive and initiative need apply; good remuneration.—Box 580, FOUNDRY TRADE JOURNAL.

FOREMAN PATTERNMAKER for small shop in Midlands making wood and metal patterns, attached to Jobbing and Mechanised Foundries. State full particulars of experience, age, and salary required.—Box 558, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN required for Grey Iron Foundry, West of England; general engineering castings, 20-25 tons per week; high class jobbing work, with small machine moulding section; knowledge of cupola control and machine practice necessary; good prospects for the right man; house provided.—Applicants, who should be between 35 and 45, should state qualifications, experience, and salary required, Box 494, FOUNDRY TRADE JOURNAL.

MODERN Factory requires SUPERINTENDENT, who must have thorough technical and practical knowledge of vitreous enamelling, spray painting, and electroplating, and must have wide experience in control of male and female labour. Assistance with housing accommodation if necessary.—Applications should state age, experience, and salary required, to Box 562, FOUNDRY TRADE JOURNAL.

SALES ENGINEER required, with comprehensive knowledge of modern furnace, boiler and incinerator construction and application, to handle the sale of refractories, mainly in Central and East Africa and the Middle East. The successful applicant must possess sound technical qualifications, including at least Associate Membership of appropriate technical Associations. The job entails considerable travelling, from the Headquarters in East Africa. A four figure salary will apply, together with the usual privileges of overseas employment. Interviews in London. Applications will be treated in confidence and should be as complete as possible.—Write Box L.L.A., c/o 95, Bishopsgate, London, E.C.2.

SITUATIONS VACANT—*Contd*

MOULDERS required, first-class men only. Vacancies occur in iron and non-ferrous departments for floor and bench moulders. Piece work with time rates guaranteed.—MOYLE, Kingston-on-Thames.

PATTERNMAKERS required for Wood and Metal patterns by highly mechanised Foundry in Doncaster area, producing castings for agriculture, textile, and mining machinery. Top rates of pay. Good prospects for young and ambitious men.—JOHN FOWLER & CO. (LEEDS), LTD., Sprotborough Works, Doncaster.

PATTERN SHOP FOREMAN wanted for West London district. Familiar with design and manufacture of large matched metal patterns. Experience in manufacture of large metal dies would be an advantage, but not essential. Must be capable of controlling personnel and organising pattern maintenance system.—Box 568, FOUNDRY TRADE JOURNAL.

RATEFIXER required for general Foundry in Lancashire. Must be competent to estimate and negotiate suitable time standards with operators on moulding and coremaking for mixed castings up to 25 tons individual weights. A man of adequate education and suitable personality with practical experience needed.—Reply, giving full particulars, to Box 548, FOUNDRY TRADE JOURNAL.

WANTED, by well-known Ironfoundry in North Wales, METHODS ENGINEER AND ESTIMATOR. Applicant must have had sound experience in patternmaking, moulding, and layout of pattern equipment for high speed machine moulding and core blowing. The position offers scope for push and initiative. Opportunity will be given to join the Company's Superannuation Scheme, and a house will be provided. Please state in confidence age, experience, and salary required.—Box 582, FOUNDRY TRADE JOURNAL.

BUSINESS OPPORTUNITIES

SMALL Non-Ferrous Sand and Die-Casting Foundry in Berkshire seeks PARTNER. Engineering connections an advantage. Moderate capital investment required. This is an outstanding opportunity for the right person.—Box 574, FOUNDRY TRADE JOURNAL.

PARTNERSHIP available in well-established Iron and Non-ferrous Foundry situated 50 miles south London. Full order book, with scope for expansion. Modern Building, on long lease. Commercial Partner preferred. Capital required £1,500-£2,000.—Box 590, FOUNDRY TRADE JOURNAL.

INDUSTRIAL Engineering Syndicate, with substantial financial resources, desire to acquire whole or part interest in an engineering concern or allied industry. A transaction involving from £50/£200,000 is envisaged.—Write PRINCIPAL, Box 514, FOUNDRY TRADE JOURNAL.