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Taking Care of Ninepence

The addition of ninepence per gallon on petrol and other oils seems superficially fairly innocuous, but for the whole of industry it is a very serious matter because it is cumulative. Obviously, where, as is so often the case, delivery is made by lorry, then there is a known direct increase. Not so obvious are the increased charges which will gradually show themselves in all incoming goods. In the case of many of the smaller concerns which are not serviced by the railway, it means that the whole of their raw materials will have to carry this extra tax. It is a fundamental duty of all businessmen to keep solvent and to do this, they, in their bookkeeping methods, absorb all their costs and then add an amount to provide profit. This paper figure has to do many things other than the paying of dividends. It has to act as a reservoir for meeting any future losses that might be incurred, for providing new capital and for extensions or replacements of machinery. To maintain earlier levels, the direct costs and the indirect costs (which may take a year to develop fully) must be absorbed by passing on to the customer.

A very superficial examination seems to indicate that a foundry employing about forty men and using one lorry will have to pay about £130 extra per year as a direct result of the increase in the price of petrol and oil and, as suppliers' lorries bring in a corresponding quantity of material or perhaps more, then in the course of time they too will want about £130, or rather more, to cover themselves. If the weekly wages bill is of the order of £280 a week, the petrol tax by the end of the year will be approaching that figure. We have used the vague expression "rather more" because the suppliers too are in much the same position as the foundries, and they too have their own direct and indirect increases, and so the system snowballs.

In the ordinary way, the smaller founder waits for his auditor to tell him at the end of the financial year the total of his overheads and, if there is a marked increase, gives a recommendation as to a percentage addition to selling prices. That is not good psychologically, for to tell customers that an increase in selling prices is due to an event which took place some time ago may seem somewhat insincere. It thus would appear preferable to make up one's mind quickly as to whether and to what extent the petrol tax warrants increased selling prices. If concerns find they can absorb it, so much the better, but they had better be sure than sorry. No founder in his own interest desires to see the general cost of living being increased as this only leads to inflation. We doubt if this is properly understood by the man in the street, but as there are still enormous quantities of German inflation postage stamps available, running up to 1,000,000,000 marks, they might be used to show the end of the spiral, for it then required a "war loan" to frank a letter. Thus the manufacturer is faced with the problem of ensuring a stable business with full employment or endangering the level of the cost of living by increasing his selling prices. That it should have arisen at all is due, in our mind, to a particularly bad exercise of statesmanship.

Contents

Constitution of Alloys Study Group

For some time it has appeared desirable that some organisation should undertake the co-ordination of phase-diagram work being carried out in connection with metallurgical subjects, especially the transitional elements and high-temperature alloys. The Metal Physics Committee of the British Iron and Steel Research Association, which is charged to take an active interest in the co-ordination of the progress of metal physics in Great Britain, has now appointed a Constitution of Alloys Group to consider this specific aspect of its work.

The chairman of the Group is Professor G. V. Raynor (Birmingham University) and its members are:—

Mr. R. L. Bickerdike ...	Royal Aircraft Establishment.
Dr. A. J. Bradley, F.R.S.	B.S.A. Group Research Centre.
Dr. A. M. B. Douglas ...	Cavendish Laboratory, Cambridge.
Dr. G. A. Geach ...	A.E.I., Limited, Research Laboratory.
Mr. H. J. Goldschmidt ...	B.S.A. Group Research Centre.
Dr. J. L. Haughton ...	Essex Aero, Limited.
Dr. W. Hume-Rothery, F.R.S.	Oxford University.
Mr. H. W. L. Phillips ...	British Aluminium Company, Limited.
Dr. A. G. Quarrell ...	British Non-ferrous Metals Research Association.
Dr. T. Raine	Metropolitan Vickers Electrical Company, Limited.
Mr. W. P. Rees	National Physical Laboratory.
Dr. A. H. Sully	Fulmer Research Institute.
Dr. H. Sutton	Ministry of Supply.

The terms of reference are to be—

> To co-ordinate constitutional studies of interest to metallurgists, to encourage further work which the Group consider necessary and to recommend to the Metal Physics Committee the provision of support in suitable cases.

It is obvious that it is impossible to include in the membership of the Group a representative from each centre engaged in work of interest to the Group, but from time to time non-members will be invited to contribute to discussions on particular topics. Already many centres have given the Group details of work carried out and proposed in their laboratories. The Group will try to keep in touch with all centres concerned with the constitutional studies included in its terms of reference. It will welcome enquiries and information from research workers and laboratories not represented by the membership of the Group, and in particular, it will be glad to receive suggestions of aspects of constitutional studies which ought to receive attention.

AT THE MEETING of the Chemical Engineering Group to be held on May 9 at Burlington House, Piccadilly, London, W.1, at 5.30 p.m., a Paper on "Silicones" will be presented by Dr. J. W. Barrett.

A PAPER "X-ray of Castings" will be given by Mr. J. D. Hislop at the May 9 meeting of the Wolverhampton Graduate Section of the Institution of Production Engineers, at the Wolverhampton and Staffordshire Technical College, Wolverhampton, at 7.15 p.m.

British Standards Institution

The Monthly Information Sheet for March, of the British Standards Institution, lists under "*New Standards Issued*":—1641:1950: Cast-iron pipe fittings for sprinklers and other fire protection installations. (2s. 6d.)

One of a series of British Standards for pipe fittings, it deals with all types of cast-iron fittings commonly used for automatic sprinklers, which have taper threads conforming to the appropriate requirements of Part 1 of B.S.21—"Pipe Threads," except for the minimum length. Standard dimensions are given for all customary types of fittings, with nominal pipe dimensions from ¼ in. to 6 in. inclusive, comprising equal and reducing sockets, elbows, tees, and crosses. The fittings are, in general, suitable for working water pressures up to 200 lb. per sq. in., and tests for porosity are prescribed.

Another new Standard is 1648:1950: Heat-resisting alloy-steel castings. (2s.)

The requirements are laid down for a range of heat-resisting steel castings: nine grades are specified. Three are of the straight chromium type and the remainder of the chromium-nickel type with alloy content up to 60 per cent. nickel/15 per cent. chromium. Details are included of the process of manufacture, fettling and dressing, freedom from defects, provisions for testing, marking and repairs to castings.

Forty Years Ago

The FOUNDRY TRADE JOURNAL for May, 1910, devotes its leading article to bell founding, as a speaker at the Royal Institution criticised the tone of Big Ben. It seems that to stop the extension of a crack, holes had been drilled and deterioration of tone had been noted. There is an illustrated description of a steel foundry, which is no ornament. Another steel foundry, Samuel Osborn & Company, Limited, is in the news as having designed, patented and installed a spark arrester on, presumably, the cupolas in the foundry of Blakey's Boot Protectors. David Brown & Sons (Huddersfield), Limited, were reported as transferring their East Parade Patternworks to Lockwood, W. & T. Avery, Limited, as exhibiting in Buenos Aires, and Crossley Brothers, Limited, as erecting a new shop "which adjoins the workmen's dining hall . . . and a large pattern shop and stores."

Latest Foundry Statistics

According to the March bulletin of the British Iron and Steel Federation, employment in ironfoundries showed some improvement, with a gain of 430, making a total of 146,220 as at February 4. This gain was fairly evenly distributed between male and female workers, the former numbering 227 and the latter 203. In the steelfoundry there was a slight loss of manpower, as compared with a month earlier. At 19,283, there was a net loss of 32, made up of a loss of 48 males and a gain of 16 females. The weekly average production of liquid steel for steel castings was, during February, 8,800 tons, exactly the same as in February, 1949, but 200 tons better than January this year. The production of alloyed steel castings is tending to rise. The average weekly despatch of steel castings was of the order of 4,900 tons.

THE BRITISH INDUSTRIES FAIR will open at Birmingham (Castle Bromwich) and London (Olympia and Earls Court) on May 8 and will close on May 19.

The Holman Foundry

The story of a jobbing foundry for iron, steel and non-ferrous castings, established in the extreme South Western peninsula of England over a century ago. Initially, it served the local tin-mining industry and now is a "tied" foundry supplying a large mining, metallurgical, and pneumatic engineering works, the products of which are known the world over. Despite the remote location, foundry practice is well abreast of the times, and the emphasis on metallurgical control and stringent inspection of the finished product compares well with some foundries having less historic backgrounds.

OVER one hundred years ago, actually in 1840, the Holman foundry manufactured castings primarily for the Cornish tin mines. These castings were mainly large components for pumping engines and other heavy equipment. Another demand was for large balance bobs weighing anything up to thirty tons. Time has wrought many changes in the products leaving the foundry and to-day air compressors, rock-drill sharpening machines, small pneumatic hoists, scraper haulages and such like machines are the chief items.

As long ago as fifty-five years, when the present building was erected, the main bay (Fig. 1) occupied a floor space of 8,000 sq. ft. Since then many extensions have been made which now accommodate the core shop, non-ferrous metal department and a small steel-founding section. Extensions are still being planned for this very active section of the Holman organisation.

It is interesting to record that the foundry was built by the firm's own employees who used Cornish granite and Elvan obtained from the obsolete pumping-engine-house at Seaton Mine. The main bay has a gabled roof using "Robinsons" protected metal on wood principals and purlins, strengthened with wrought-iron main braces. Roof lights, which form thirty per cent. of the total area, provide much natural lighting which is supplemented by modern mercury-vapour and sodium lamps. Good ventilation is provided by five large electric fans situated at the apex of the roof.

FIG. 1.—CASTING IN PROGRESS AT THE HOLMAN FOUNDRY.

The continually increasing demand for the firm's products has resulted in the growth of many satellite departments which now surround the foundry. These departments have been developed and extended with the growth of the foundry through the years. As a result of this growth, large moulding boxes and raw materials have to be stored some distance from the foundry. The transport of moulding boxes is effected by the use of a "Stacatruck" fitted with a jib which converts it into a miniature portable crane. This has a capacity of two tons. Raw materials are handled by "Lister" autotrucks with tipping stillages. By means of these modern transport devices little inconvenience is felt as a result of the removal of the stores from the working site.

Moulding Equipment

The foundry is called upon to make castings which range in weight from a few pounds to two tons, with occasional demands for some up to four tons. The bulk of the castings are made in dry sand by the floor moulders and vary widely in complexity and design. Practically every new type of casting brings its problems which only experience and expert craftsmanship can solve.

The equipment installed includes two Foundry Equipment Company's 14 by 18 in. plate jolt-squeeze machines, one "Molineaux" jolt-squeeze machine of similar size and one "Coleman" rollover-jolt-squeeze machine. These machines, situated at one end of the shop, produce moulds for light castings from pattern plates, and work in "green" sand.

Compressor-cylinder castings must be of fine grain and pressure tight, while forging machines and hoist parts must be in the strongest possible metal if they are to satisfy the requirements of mining and public works. The foundry demands, and gets, 100 per cent. clean, sound castings of high strength in all the work it produces, and these castings are mainly of a complicated design and are heavily cored.

Not the least important items in the foundry equipment are the two "Vaughan" overhead travelling cranes of eight and four tons respectively which serve the floor moulders. Mould drying is done by two "Acme" stoves. The larger moulds are rammed with "Holman" pneumatic rammers; these take hard work from the hands of the workers and greatly increase production in the shop.

Core Department

The core-making shop (Fig. 2) is in an annex to the main moulding bay and occupies floor space of about 1,800 sq. ft. Leading to an "Acme"

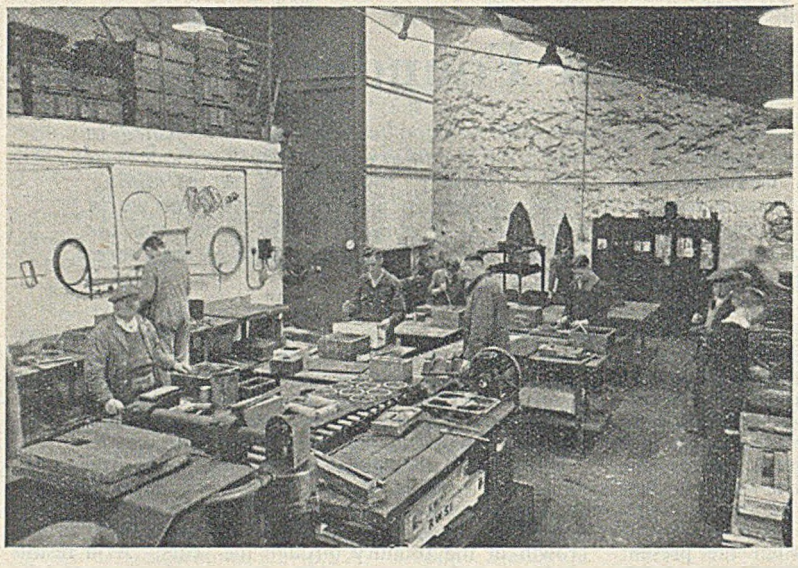

FIG. 2.—VIEW OF THE CORE SHOP; THE CORE-BLOWING MACHINE IS SHOWN IN THE FOREGROUND.

continuous-type core-drying stove, a roller conveyor extends the entire length of the shop. The core makers work on each side of this conveyor, at the far end of which, beyond the stove, assembly and inspection is done. The cores are then released to the moulders.

It will be appreciated that cores made in this department cover a wide range extending from small compressor components to large hoist parts. In the main, they are of intricate pattern and variety. The equipment here comprises a "Coleman" core blower, a "Rotoil" machine for making round cores of various diameters, and a thermostatically-controlled drying oven for blackened core assemblies.

Melting Department

Under licence from the International Meehanite Metal Company, Limited, the foundry produces high-duty cast irons. Cast steel is melted in an oil-fired rotary furnace manufactured by Stein and Atkinson, Limited. The non-ferrous metals handled are phosphor bronze, aluminium bronze, aluminium-silicon alloy and "Y" alloy in addition to the normal gunmetals and brasses. Non-ferrous melting is carried out in two "Morgan" oil-fired crucible furnaces and one coke-fired furnace.

The two cupolas for the iron shop have been modified to the Meehanite designs and they produce exceptionally hot, well-melted metal at a speed of two to three tons an hour. The very interesting process of steel melting in a rotary furnace was fully described in an article which appeared in the "Foundry Trade Journal" of November, 1947.

"Meehanite Metal" is made under strict metallurgical control for chemical analysis, physical results and constitutional properties. The metal is tested for constitutional property before any casting is poured. Thus, high physical properties and ease of machinability are ensured in the resulting castings. The general-engineering grades of this metal are particularly suitable for the manufacture of Holman products.

As they enter the cupola, all metal charges are weighed on an "Avery" direct-reading weighbridge,

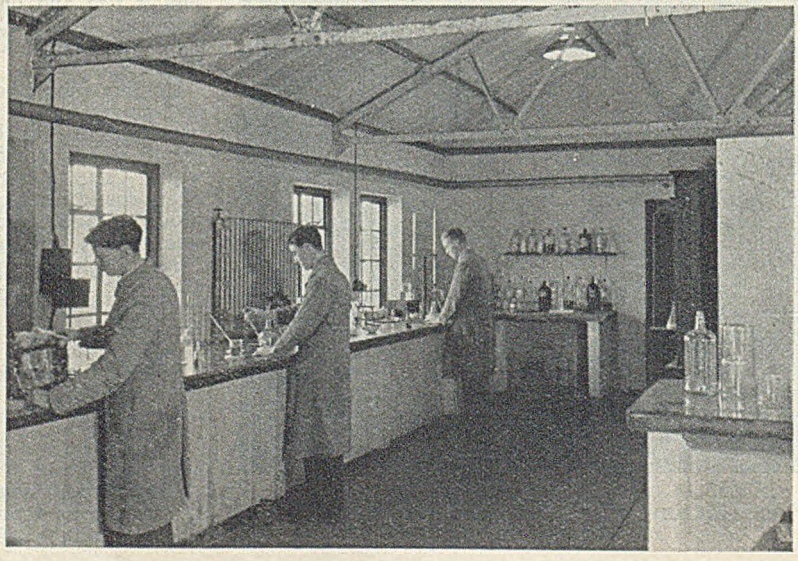

FIG. 3.—A SECTION OF THE CHEMICAL RESEARCH LABORATORY

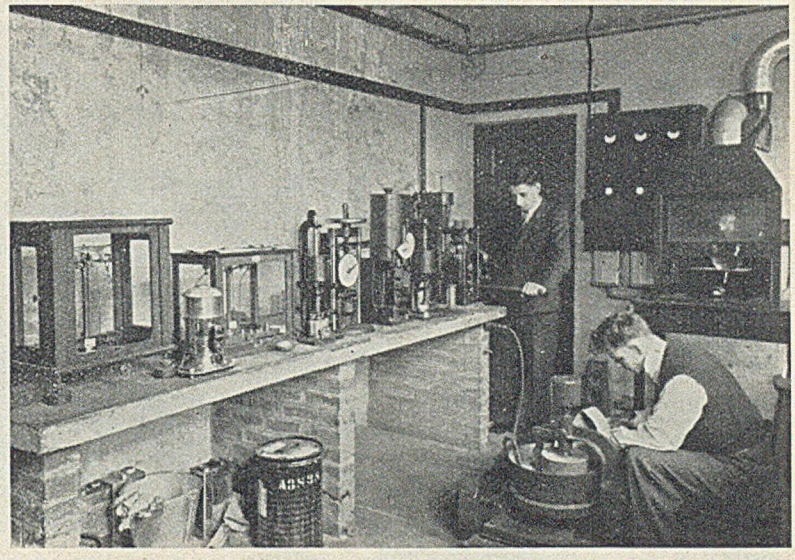

FIG. 4.—FOUNDRY LABORATORY FOR ROUTINE SAND TESTING AND RESEARCH.

while molten metal is weighed on scales supplied by the same company. The scale in the latter case is situated between the crane hook and the ladle.

The exclusion of slag from the castings is a vital matter, and every precaution is taken. "Teapot"-type ladles, skimming before pouring, the provision of slag traps in all the moulds and the incorporation of dam and filter cores in the pouring basins all play their part in the process of slag exclusion. Pouring basins are made as oil-sand cores.

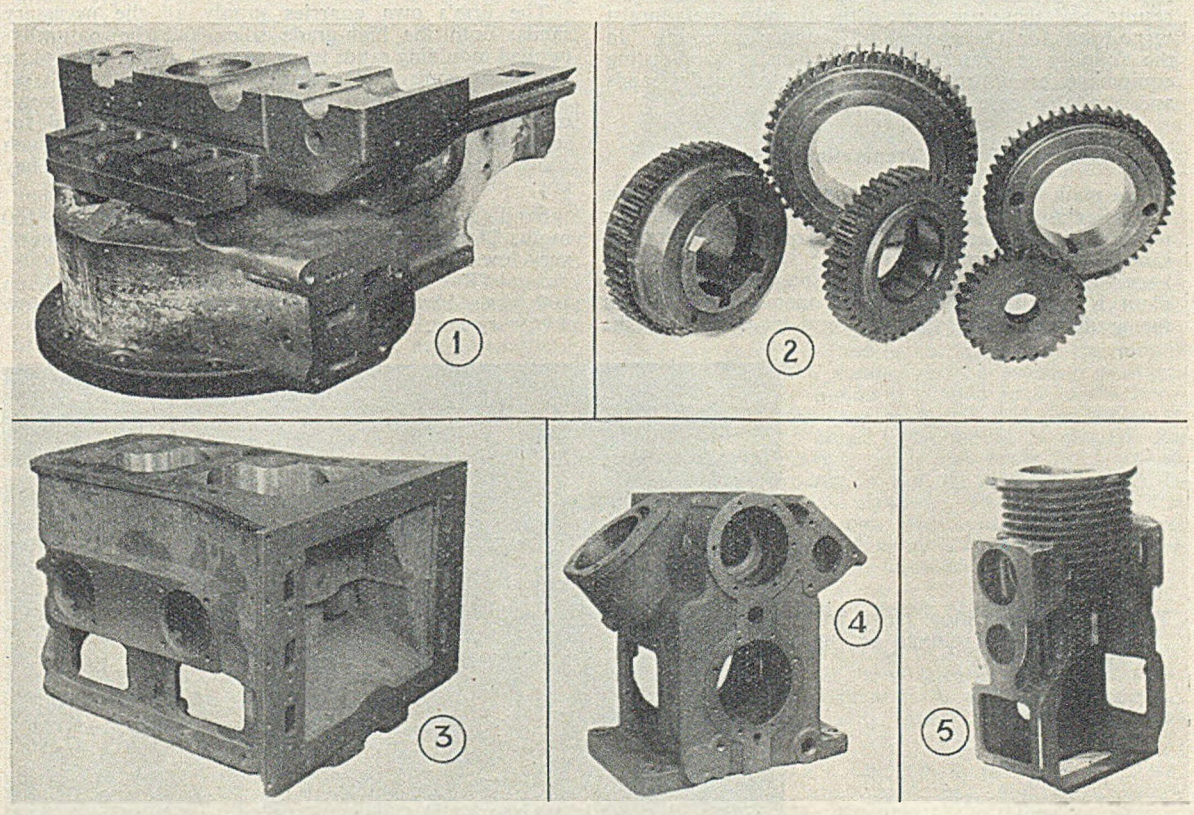

FIG. 5.—GROUP OF FINISHED CASTINGS MADE BY HOLMAN BROS., LIMITED.

(1) Mechanite Gripping Cylinder for Rock-drill Sharpening Machine—28 tons tensile, weight 7 cwt. 2 qrs. (2) Gear Wheels, from 4-in. to 9-in. dia., for a Holman Vee Engine. (3) Cylinder Block for a 600 cub. ft. Water-cooled Air Compressor. (4) Cylinder Block, weight 4 cwt. 2 qrs., for a Holman Vee Engine. (5) Cylinder Block for Air-cooled Air Compressor, weight 3 cwt.

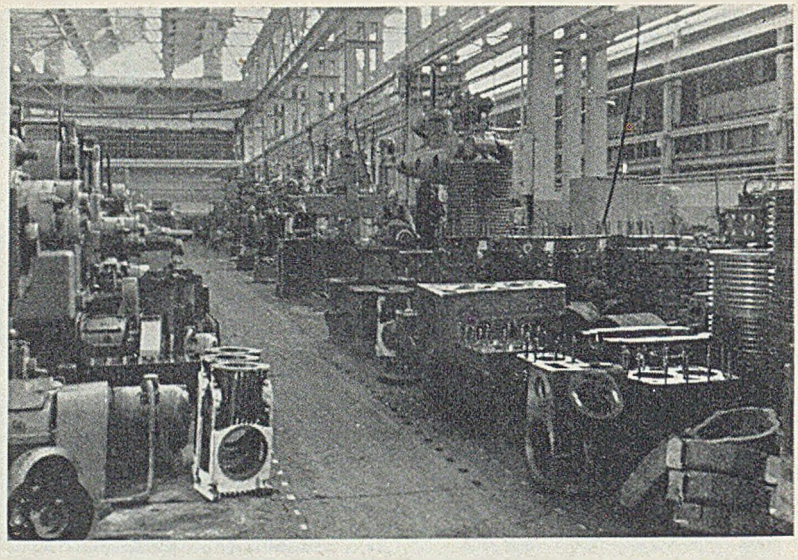

FIG. 6.—PART OF THE MACHINE SHOP SHOWING A GROUP OF TYPICAL FINISHED-MACHINED CASTINGS.

Metallurgical and Foundry Control

All metal and sand properties are controlled by the laboratory (Fig. 3) which is an extension of the foundry. To this laboratory the melting-shop and sand section personnel are directly responsible. From the central research laboratory come daily chemical-analysis results, and these are sent to the foundry metallurgist responsible for the control of foundry processes. In the foundry laboratory is comprehensive sand-testing equipment for control and research into foundry sands and available core binders.

Methods of Sand Preparation and Control

The main ironfoundry uses "dry" sand moulds, with a smaller amount of "green" sand for the moulding machines and other light work. For this foundry, all sand is prepared from a "system" sand at the central knock-out where an "August's" intensive preparation plant is installed. The control operates to maintain the grading of this "system" sand by controlling the addition of new sand and "Fulbond" to the prepared mixes. Before being released to the moulders, all sands are tested (Fig. 4) for permeability, compression strength and moisture content. The individual results are booked against the moulder's name and the day's results are recorded on a quality-control chart.

The firm's own quarries supply all the necessary sands; both the high-grade silica and the naturally-bonded moulding sands being of local origin. The same degree of control is exercised when dealing with oil sands for the core department, steel moulding sands or any special mixes. These latter are catered for separately, and are graded under three headings which show their clay content and screening mesh. They are:—

Sand (A)—5.4 per cent. clay, 84.2 per cent. on 100 mesh, 5.6 per cent. on 150 mesh, and below 150 mesh, very low.

Sand (B)—26.5 per cent. clay, 50 to 75 per cent. on 100 mesh, 10 to 25 per cent. of 150 mesh, and below 150, very low.

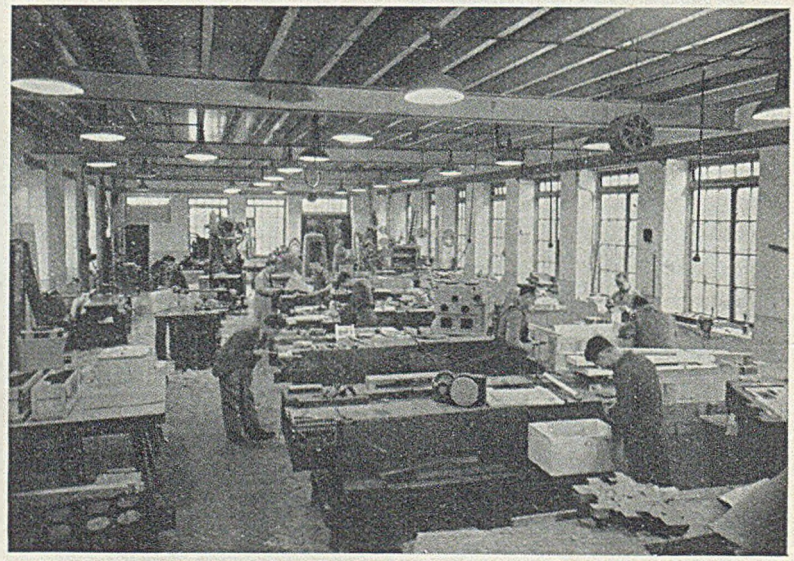

FIG. 7.—PATTERN SHOP. NOTE THE GROUPING OF MACHINES AT THE ONE END.

Sand (C)—2.8 per cent. clay, 22.6 per cent. on 44 mesh, 31.8 per cent. on 60 mesh, and 29.4 per cent. on 100 mesh.

"Steel" sand is a synthetic mixture from Sand (A) with low clay content. For green-sand moulds, the sand is controlled at green permeability—60; green compression strength—10 lb. per sq. in. and moisture content—6.5 per cent. For dry-sand moulds the properties are dry permeability—75; green compression strength—9 lb. per sq. in.; dry compression strength—150 to 180 lb. per sq. in., and moisture—8.5 per cent, at moulding.

Fettling Department

The modern equipment for the fettling and dressing of castings includes a "Tilghman" cabinet-type shot-blast plant, pedestal and swing grinders and tumbling barrels. It goes without saying that the firm's own pneumatic chipping hammers and hand grinders are extensively used for dressing light castings.

Final Inspection

In addition to the systematic control and inspection of castings at every stage of production, a rigorous inspection for flaws is undergone before any casting is released. The standard set is very high, yet foundry defectives, even with this standard, are found to be well below ten per cent. The maximum machine-shop figure due to faulty castings is 1½ per cent.

No satisfactory comparison of the work of different foundries could be made unless the actual standard produced is seen and examined with work of an exactly similar type. All that can be said by the firm is that standards are set and controlled at an exceptionally high level. The percentages given are based on the weight of castings poured and the quantity passing the final inspection as being flawless. A full description of the rigorous inspection methods practised at the Holman works has been read before the Institute of British Foundrymen and published in the FOUNDRY TRADE JOURNAL recently. Typical finished castings are shown in Fig. 5 and 6.

A modern department that plays no small part in the maintaining of high standards is the pattern shop (Fig. 7) which has bench space for fourteen men. Here, modern equipment includes a "Wadkin" pattern miller, lathes, bobbin and disc sanders, circular and band saws, planing machines and other plant. Metal patterns are made by utilising all the necessary machine-tool equipment. Here, again, "Holman" pneumatic tools are much in use, each man having a suitably-placed air supply point available for his use.

Personnel

The total of personnel in all foundry departments is one hundred. It will be realised that there is little mechanisation in this foundry and that the tonnage is not very high. Nevertheless, it has been found by experience that the methods used are the best possible for obtaining high-quality castings, as and when required, for the firm's own use. These methods have proved economical.

The motto of the foundry personnel is "we can all learn from others." They therefore welcome visitors who are foundry enthusiasts. So, when in Cornwall on holiday or for business reasons, call on them and have a talk. Readers will be cordially received.

THE NATIONAL INSTITUTE OF INDUSTRIAL PSYCHOLOGY is organising throughout the summer months in a number of centres a series of lecture courses lasting several days. Interested readers can have details by writing to the secretary at 14, Welbeck Street, London, W.1.

Novel Permanent-mould Casting Machine

At our request, the Centrifugal Casting Machine Company, of Tulsa, Oklahoma, U.S.A., have sent us some details of a die-casting machine of a novel character, which we illustrate in Fig. 1. It is claimed that the machine can be used for all the normal foundry alloys ranging from magnesium to steel. A novel feature of this machine is the facility it gives for the operator to place the core in the drag half

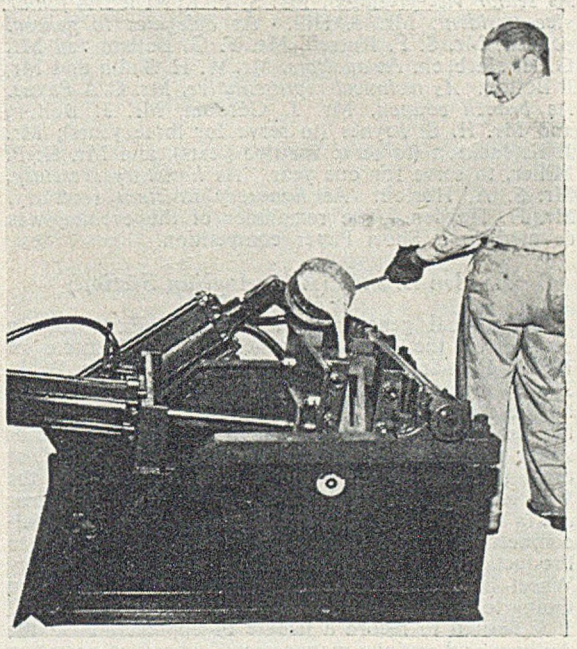

FIG. 1.—PERMANENT-MOULD CASTING MACHINE SUPPLIED AS A COMPLETE UNIT.

of the die while the parting line is in a horizontal plane. Either dry- or green-sand cores may be used, but in the latter case it is advisable to use an arbour. After the core is placed in the drag half, the mould is closed and then rotated to the pouring position. After pouring, the mould is rotated back to the horizontal position, the cope is raised, and the casting is lifted out of the drags. The mould is cleared out by blowing, is sprayed, and is then ready for a second operation. A production ranging between 20 and 40 castings per hour is claimed. The makers of the machine supply the dies, the core boxes, arbours, spraying equipment and spray wash. Moreover, they test the "set up" before dispatch.

AN INDUSTRIAL X-RAY PLANT of 250,000 volts, capable of examining steels up to 3 in. thickness, and lighter metals and alloys up to any thickness normally used in industry, has been installed at the Government Test House, Calcutta. It will be available to Government departments, public bodies and manufacturers.

F. & M. SUPPLIES, LIMITED, 4, Broad Street Place, London, E.C.2, announce that Vokes (Canada), Limited, Hermant Building, 21, Dundas Square, Toronto, have been appointed as their sales distributors for Canada. F. & M. products are to be exhibited at the Canadian International Trade Fair (May 29 to June 9).

Notes from the Branches

East Midlands Branch

The East Midlands branch of the Institute of British Foundrymen held its annual meeting at the School of Arts and Crafts, Derby, on April 15. Mr. C. A. Payne presided.

The following officers were elected for the 1950/1951 session. As *branch president*, Mr. K. Docksey. As *senior vice-president*, Mr. S. P. Russell. As *junior vice-president*, Mr. J. Hill. As *delegates to general council*, Mr. S. P. Russell, Mr. F. G. Butters and Mr. G. H. Harbach. As *auditors*, Mr. W. H. Smith and Mr. J. Bolton. *As technical representative*, Mr. C. A. Payne. As *branch council*, Mr. J. Gardom, Mr. J. Bolton, and Mr. H. S. Joynes (to serve for three years); Mr. J. K. Jackson (to serve for two years), and Mr. H. P. Miller, to serve for one year. As *honorary secretary*, Mr. S. A. Horton. As *honorary assistant secretary*, Mr. H. Hayden. The remainder of the evening was devoted to a Short Paper competition.

London Branch (East Anglian Section)

The annual general meeting of the East Anglian section of the London branch of the Institute of British Foundrymen was held on April 20, Mr. W. L. Hardy presiding. The annual report was presented by the secretary, as follows:—During the past session, the section has witnessed a full technical programme of seven monthly meetings. The Papers presented at these meetings were:—"Presidential Address and the Visit to America"; "Radio-active Materials and their use in the Foundry"; "The Manufacture of Internal-combustion Engine Castings"; "Some Simple Aids to Production"; "The Manufacture of a Large Pulley Wheel in Aluminium Alloy"; "Where is Cast Iron Going to?" and "Chill and Grain Roll Manufacture." It is desired to record a tribute of appreciation to the Authors and various managements whose co-operation made this satisfactory programme possible. During this session, the section suffered the loss of one of its most active members and past-president—Mr. A. F. Hammond—who left the district to take up an appointment in the Midlands.

Membership has increased only very slightly during the past year, two new members being elected, and one leaving, making a total of 97 members and one member firm. Generally, the technical sessions have not been well attended. This shows there is a tendency for less interest to be taken in the technical sessions, and if the downward trend continues, a condition will be reached whereby it will be almost impossible to obtain lecturers from outside the area. It is to be hoped that in the coming session more enthusiasm will be shown by the members in the locality when we can once again look forward to at least 35 per cent. of the total membership.

Mr. A. H. Horton, who was the president designate, has been obliged to relinquish this position for personal reasons. Mr. W. L. Hardy, who has acted as president for the 1949-50 session, was unanimously elected president for another year. Mr. V. W. Child was elected senior vice-president and Mr. R. J. Hart junior vice-president. Mr. Bolton and Mr. Dobie were elected as members of council for a period of three years.

Following the business meeting, a lecture was given by Mr. L. H. Grainger, A.I.M., of E. R. & F. Turner, Limited, on "Chill and Grain Roll Manufacture," illustrated by slides of various processes. The lecture outlined some of the problems associated with this type of casting, which to the ordinary foundryman was of considerable interest. A lengthy discussion followed, and several questions were addressed to Mr. Grainger on various matters arising from his lecture. At the conclusion, a vote of thanks was proposed by Mr. Coates; this was seconded by Mr. Carrick, and carried with acclamation.

Newcastle-upon-Tyne Branch

The annual general meeting of the Newcastle branch of the Institute of British Foundrymen was held on April 15, when Mr. H. Smith, branch president, was in the chair. About fifty members and visitors were present.

The secretarial report made favourable comment on the increase in membership of the branch and the steady progress which had been maintained. Attendance at meetings during the session had been high, and the Papers, most of which were given by members of the branch, had proved of great instructive value. Mr. H. Smith, in his presidential address, had expressed gratification on the election of Mr. Colin Gresty to the office of junior vice-president of the Institute.

On October 8 of last year the branch had the privilege of viewing the newly erected modern foundry of C. A. Parsons & Company, Limited. Mr. G. L. Harbach, a member of the East Midlands branch, presented a Paper on "Foundry Sand Control" at the November meeting, and the debate which followed left no doubt that the value of this Paper was appreciated by the large number of members present. December brought a Paper by Mr. N. Charlton, senior vice-president of the branch, on "Defective Castings." With the aid of slides, various defects were illustrated; suggestions made on the causes and how these may have been overcome, were discussed. The branch had the pleasure of welcoming the president of the Institute, Mr. N. P. Newman, J.P., accompanied by Mr. T. Makemson, M.B.E., secretary of the Institute, at the January meeting. Mr. H. Smith, branch president, gave a Paper on "Pattern-making as Applied in the Foundry." On February 11 a party of over seventy members viewed the brass foundry, rolling mill, extruding shop, steel foundry, and printing machine shop of Vickers Armstrongs, Limited.

The March meeting took the form of a mock trial, and although this was a departure from the normal monthly technical meeting, over a hundred members and visitors enjoyed the display of a combination of casting "know-how," judicial experience, and humour by all the characters in "court." The dance held proved a most enjoyable evening, and it was agreed to hold a similar function in December next.

After the financial report had been adopted on a proposal by Mr. N. Charlton, seconded by Mr. C. R. Tottle, the following members were elected to office for the session 1950-51:—President, Mr. N. Charlton; senior vice-president, Mr. C. Lashly; junior vice-president, Mr. F. J. Pittaway; members of branch council:—Mr. R. F. Hudson (re-elected); Prof. A. Preece, M.Sc., F.I.M.; Mr. M. M. Hodgson, and Mr. J. Walton. Mr. C. Lashly agreed to act as representative to the general council, and Mr. G. Elston and Mr. R. F. Hudson as joint representatives to the technical committee. Two films on foundry chills and chaplets made by Canadian Fanner, Limited, were then shown.

THE 1950 ANNUAL MAY LECTURE to the Institute of Metals will be delivered at the Royal Institution, Albemarle Street, London, W.1, on Wednesday, May 10, at 6 p.m. This year's lecturer is Dr. H. Roxbee Cox, chief scientist, Ministry of Fuel and Power, whose subject will be "Industrial Gas Turbines."

Future of the Founding Industry*

By F. W. Rowe, B.Sc.

The Author of this Paper, who is managing director of K. & L. Steelfounders & Engineers, Limited, Letchworth, and president of the British Steel Founders' Association, makes a personal forecast of the probable developments which will concern foundrymen in the future. A brief but realistic survey is presented of the industry as it is to-day, with emphasis on the changes that are taking place and suggestions of others that may be desirable. Progress within the foundry industry is always gradual rather than revolutionary, and it is pointed out that careful and systematic study of any new scheme from every angle is of far greater benefit than rushing into practice with "bright" ideas.

AS one who has been in the founding industry now for more than 30 years, it is probably safe to assume—rightly or wrongly—that some lessons have been learned from past progress which may be some guide as to the likely trends in the future. The outstanding impressions which persist, looking back over the intervening years, are the change in working conditions, the rise in the use of mechanical aids, and the great progress in sand practice. These—and other changes—are on the credit side. On the debit side there has—in common with other industries—been a great decline in the standards of manual craftsmanship in moulding and coremaking, which is understandable and inevitable. Naturally, the greatest changes which have taken place are in the methods of production of light and medium-size castings, methods for the production of heavier castings having altered more slowly.

This address, however, is concerned not with reminiscences of the past, but to try, so far as possible, to give a personal forecast of the trends for the future. The major outstanding progress which is being made at the present time, and will continue for many years to come, is the improvement in conditions for the foundry worker. Foundry work is not, and never can be by the very nature of things, a clean occupation, but there is little doubt that, up to the outbreak of the last war, far too little attention had been given to securing working conditions which would attract and hold the right type of workers to the industry. Too many foundries were merely barn-like structures with sand floors and insufficient natural lighting—and that often partially obscured by months of un-removed metal fume, and dust inside and furnace dust outside. There has been, since the war, a much better appreciation of the need for working conditions as good as they can be made, but, due to the shortage of glass and building materials in general, coupled with the need for and difficulty in obtaining licences, progress has not been as great and as rapid as most people would have liked. Many foundries, too, are not structurally suited to accommodate the improvements which are desirable. Some can never be altered— at a practicable cost—to meet those standards which are being set in foundries which are now being built from the ground upwards.

Amenities

Sufficient attention has now focused on the problem by the "Garrett" Report, and by many other valuable surveys, to prophesy with certainty that far greater care will be taken in designing new foundries to ensure that conditions will be much better than those to which most foundrymen have been accustomed from their youth upwards.

The considerations which must be given the greatest thought in the future are: ventilation, lighting, heating, and washing accommodation:

Ventilation.—For good ventilation not only must air flow and natural general ventilation be studied to give a cleaner and more dust-free atmosphere, but the layout of certain plant and processes must be fixed not merely with regard to the best location to suit production needs, but with an eye to what is most desirable from the dust-removing standpoint. Plant, equipment, and processes which are likely atmosphere polluters—typical of which are melting furnaces, sand mills, and box knock-outs—will be located and housed in such positions as will prevent the inevitable fume from polluting the atmosphere, or in the best position for attaching covers, hoods, or suction plant to remove effectively the dust from the foundry. There is still a great deal yet to be learned about foundry ventilation, both in general principles and detailed application, and there has been nothing like the careful study given to it that the subject merits.

Lighting.—Many foundries are deficient in both natural and artificial lighting, and the future must see a distinct improvement in both these. For natural lighting at least one-third of the roof should be glass provided 10 to 20 per cent. of the side walls are glass. If side walls have no natural lighting, then 50 per cent of the roof should be glass. Buildings should—and will—be constructed so that cleaning of glass, both inside and out, is provided for without this being a major and dangerous operation. Walkways, both inside and out, will be built in the original structure so that all glass can be easily cleaned twice or three times a year.

It is difficult to be dogmatic about the type and location of artificial lighting in the foundries of the future; as a personal opinion, the ideal type of lighting has yet to be evolved, and present fittings of any type—either in cost or design—leave much to be desired. Suffice to say that general lighting of from 8 to 10 candlepower in any location, with special or local lighting of from 12 to 16 for intricate processes, will be the standard of the future. The natural or artificial lighting will be helped by white- or cream-painted smooth walls and by the inside of the roofs being painted and cleaned regularly, and by cheery-coloured girders, cranes, and equipment provided with some reflective surface.

Heating.—The foundry of the future will undoubtedly have minimum temperature variations throughout the working day and throughout the working year. This will become an important feature of

* An address given to the London Branch of the Institute of British Foundrymen, Mr. F. Arnold Wilson presiding.

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the architects' or plant engineers' initial designs, and will be taken most strictly into account in selecting wall and roofing material, designing doorways, putting in ventilating plant, and general building proportions. Up to recently, the necessity for—or even the desirability of—maintenance of a reasonable temperature at all times in a foundry was hardly considered in designing foundry buildings. Foundries were often freezing and draughty in winter and overheated in the summer or at casting time, and these features contributed not a little to the arduousness of working in foundries.

Washing accommodation.—Few firms to-day—and still fewer in the future—would consider building a new foundry without careful consideration of proper washing and clothes accommodation. Given these, few people will refuse foundry work because it involves working with materials which leave dirt on the face, hands, and clothes. Few people refuse to play Rugby football because it involves getting muddy, but players would object if they had to travel several miles home in the same state as they left the field.

There are many fascinations in foundry work, and some in every phase of it, but the trade will never appeal to the young and intelligent section of the population till provision is made for the boy to go to work and come home from work in the same clothes and in the same condition as he would take his best girl to the pictures. The locker, washing, and shower-bath arrangements should be as attractive at least as those at a public baths—warm, clean, and shiny, and loads of hot water, soap, and towels. Please do not be put off with the story that the men will not or would not use them. Some may not; new habits are hard to introduce to the older generation. But the younger generation will, and the still younger generation whom it is hoped to attract to the foundry industry in the years to come will not even join it unless these facilities are provided and provided of such a standard that every member of the staff would be prepared to use them themselves.

Mechanical aids.—The foundry industry of the future will have more and more mechanical aids as time goes on. Managements will find themselves unable to pay high wages, and still compete, unless their manhours per ton are reduced considerably. Now, when people talk about reducing manhours per ton, the operations they usually think about are the direct labour operations—moulding, coremaking, and dressing, with, perhaps, an occasional thought about sandmixing and metal melting. These operations are important, but no more so than many others. The drive for greater efficiency may rightly start on the moulding machine or in the coreshop, but it should not finish there. There are dozens of ancillary operations necessary to the successful running of a foundry enterprise which will amply repay thought and provision of mechanical aids. It is all right starting with a timestudy on the moulding floor, but occasionally it is thought the process should be reversed and have a timestudy taken in the managing director's office. Direct labour operations are becoming an increasingly lower proportion in the foundry cost due to mechanisation, but overheads—not only as a percentage of direct labour but as a percentage of the whole cost—seem to go on increasing year after year.

Overhead Costs

It is obvious that one cannot mechanise, that one cannot control modern methods of founding, that one cannot fix fair methods of payments by results, that one cannot obtain the quick and accurate costs and financial results without increase in overheads, but the total overhead costs in any industry today do certainly give food for thought and cause for alarm and would surely repay further study. They present as fruitful a field of mechanisation and improved efficiency as direct operations on the foundry floor.

Coupled with this thought about overheads is the greater efficiency of ancillary operations. Box handling, box storage, patternmaking, pattern storage, coke, coal, sand, and pig-iron handling outside the foundry—are all these done in members' foundries with the fullest use of mechanical aids and the lowest manhours per ton of castings produced?

Many foundries still go on as though the grab, the magnet, the rail crane, or the mobile crane had never been invented. The Author was in a highly mechanised foundry the other month, and a quick calculation showed that it was costing twice as much in labour to handle the coke, limestone, scrap, and pig iron from the works gate to the cupola stage than it was to melt and take it round and cast it all over the foundry. Those sort of things should not be, and progress will be made in the future in these matters.

The industry has progressed a long way inside the foundry in material handling, but not by any means has it reached perfection. Just as in civil engineering the bulldozer, the scraper, the mobile crane, the excavator, and the trench digger have replaced—or are rapidly replacing that staunch worker of the past—the genuine Irish navvy with his corduroy trousers and the straps below his knees—so, in the foundry industry, the pneumatic rammer, the jolt table, the vibratory shake-out, and the sand slinger are rapidly doing away with the donkey work traditionally associated with the foundry. Progressive foundrymen are looking forward to the day when peg rammers, shovels, and wheelbarrows will be museum pieces in the foundry. It will come—and with benefit to everyone.

In the days of his youth the speaker's first job in the morning was to water and riddle by hand, with the help of his mate, over two tons of sand—his pile and mine. With one pile he was the shoveller and the other pile the riddler. Then being much the younger of the pair, he scrounged a barrow from somewhere (scrounge was the right word) and away off to the old mortar mills for facing sand for both, then a trip to the fettling shop for a supply of gaggers, then away to the yard for some clay wash, and, by 8.30, was expected to have his first 18 by 24 by 12 box down, and, by noon, 6 of them—peg rammed, of course.

Well, most foundries have moved some distance since those days, but not, perhaps, as far they should have done. Everybody is apt to believe themselves to be more modern than they really are, and the foundry industry, has, for many reasons, to be cautious and conservative. Slight changes in method and practice can so very, very, quickly run a foundry into quite heavy losses. Everyone who has been in the foundry industry for any length of time has had experience of these things—often due to changes even that he has not initiated.

A bad lot of coke, a change in the supplier of aluminium ingots, a leak in the roof cooling of an electric steel furnace, a change in the sand mixing by the new sand man—and there is a whole day's, or perhaps several days' castings marked "scrap" in the dressing shops.

So change is naturally somewhat more repugnant to the man who has the responsibility of producing nearly nothing but good castings than it is to the bright young metallurgist or the director who has glanced through

the latest issue of the FOUNDRY TRADE JOURNAL. The Author is allowed to speak feelingly on this because he was once a metallurgist who at any rate thought he was bright (nowadays he is not so sure), and, though no longer young, he has occupied a director's chair for some years.

Ideas are always ten a penny—it is in the successful execution of them where the brains and hard work come in.

Many basically good ideas have been failures, or the application of them delayed for many years, because they were rushed into practice before the methods of application or the repercussions on other phases of foundry practice had not been studied sufficiently beforehand. One idea for progress taken at a time, studied and deeply studied from every possible angle before application, tried experimentally over and over again with most carefully recorded results, introduced slowly into day to day practice with slow and steady extension, will prove more profitable and of more lasting benefit than dabbling in many changes and many new ideas at the same time. In no other phase of engineering is there the need for most careful study before introducing changes.

Nevertheless, cautious though one should be in making changes, a foundry which is doing its work in exactly the same way to-day as it was two years ago is one which is relatively going backwards.

Controls

The word "controls" in the postwar world has almost become a word of hate—the red rag to the bull. Form filling and the production of statistics have—like tea brewing—become one of the major occupations of British industry, and far be it for the Author to suggest a further swelling of the avalanche of forms and paper which surrounds executives at every turn. But figures can be good servants although they make exceedingly bad masters.

The greatest difficulties encountered in the foundry world are those due to variations in day-to-day practice due to non-standardisation of conditions in every one of the multifarious operations which go into the successful making of a casting.

Well-chosen controls and accurately compiled records will help even the most modest foundry to get nearer that never achieved goal of 100 per cent. good castings. They will help not only to keep things right or show you where they have gone wrong, but, properly studied and used, they will point the way for change and progress for the future. It is not suggested that controls and figures are any substitute for eyes and brains. They are not. The man who will make the greatest contribution to foundry techniques is the man who spends a good proportion of his time on the foundry floor using his eyes, together with such brains as he may be blessed with.

Bonding Materials

It is also felt that great progress is likely to be made in bonding materials in the future. Whilst the basic moulding materials are always likely to remain local, indigenous, sands such as used today, there are going to be tremendous alterations in methods of bonding them and coating them to give the physical properties combined with the refractoriness and permeability we want.

Those people who are not keeping abreast of modern developments in bonding materials are, it is felt, missing points which are likely to be of great significance to future practice. Now that the great resources of the organic chemists have been focused on the subject, no doubt great progress will be made. Everybody realised how fine a compromise has to be made at all times between green strength, moisture content, refractoriness permeability, and dry strength and collapsing properties, and how the best one can do to-day is to compromise.

Present types of binders, whether clay, bentonite, oils, cereals, or the newer compounds, do not yet give that combination of final properties and handling properties that are so necessary, and it is reasonably certain, that, if there were a clear understanding of what the foundry industry really would like by the organic chemist and keen interest taken in their work and progress, then it will get far nearer the ideal bonding material than ever is dreamt of today.

The Author entered the foundry trade at a time when the only core binders known to the industry were clay and certain insanitary and odoriferous by-products of the horse and cow. Sands bonded with pure linseed oil were only just coming in, and the astonishing difference between their green and dry strength was a constant source of astonishment to the older hands.

It is reasonably sure that foundrymen will be just as astonished in the future with what can be accomplished with organic compounds if they will encourage and co-operate with the organic chemist. How many of the present difficulties and troubles would be solved if foundrymen could get the maximum green and dry strength, the maximum permeability and collapsibility, and the maximum refractoriness and hot strength all in one sand. It is a subject well worth pursuing to the uttermost.

It is felt that sands are rather a neglected subject despite all the valuable work which has been done in recent years. Possibly, to the metallurgist, they are a rather dull subject. The Author knows that when he was a young metallurgist, exercising his talents under the dubious gaze of his directors and always incurring the wrath of the foundry manager—who was usually, it may be said, ably and cordially supported by the machine-shop superintendents—he was much more interested in new mixes and new heat treatments than he was in sands and binders.

Metallurgical Progress

On purely metallurgical progress the field for advancement is unlimited, and there is little doubt that the next 30 years will see as much improvement in all metals and alloys suitable for casting and in the methods of melting as there has been in the last 30 years. Further progress and extension of high-frequency melting is awaiting cheaper methods involving less-expensive capital equipment, but this is sure to come and the much wider use of this attractive method of melting, particularly for steels and non-ferrous metals, will follow.

For cast-iron melting—and efficient a servant as the present design of cupola is—it is generally realised that its controllability, due to fundamental difficulties inherent in the basis method, is limited. There have been endless attempts—many with definite but limited success—to take advantage of its relative mechanical simplicity and high thermal efficiency and still regulate its operation to give standardised metal with less variation in composition, temperature, and gas content and graphite structure than usually obtains.

It is felt, however, that, for melting cast iron—and particularly the new and improved forms—there will have to be alterations in cupola design and operation which will give something better than the best which can now be achieved and with greater certainty. It does not seem metallurgically necessary to have to resort to duplexing or entirely electric-furnace melting

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without even further attempts to improve the cupola and its operation.

Great as the progress is which has been made in producing cast irons with improved physical properties, it is not thought that finality has been reached. The attractions of cast iron as a casting alloy are many and well known, and it is certain that further work which is constantly going on will eventually be repaid with remarkably improved properties, particularly with irons which only develop their best mechanical properties to the full when subjected to heat treatment after casting.

Everybody in the foundry industry should remember that castings have many inherent, unalterable, advantages over other forms of construction material, and, if foundrymen use their potentialities for development to the full, there is no question but that the field for the use of castings will widen and not shrink. The field for development is wider than that of any other type of constructional material, and it is up to us to take advantage of it.

Recruitment and Training

Lastly, the amount of progress that will be made is entirely regulated by the number and calibre of the men who enter, and are properly trained for, the industry. If progress in the industry has been slower than it ought to be, or less extensively spread, that is entirely due to not having enough of the right type of men in the industry. The wealth of a community, or of an industry, or of a foundry depends not on its physical assets but on the quality of the men in it.

If the industry fails to attract the men or to give opportunities for, or guidance in, training now, then the industry will be poorer in the future. That is why the working-conditions side of the foundry trade has been stressed so forcibly. No amount of expenditure on foundry colleges, research work, plant, or equipment will ensure the progress unless the due proportion of the cream of the youth is willing to come into foundry work. From these will come the craftsmen, the technicians, and the supervisors of tomorrow, and from these will come the initiative and drive to make progress certain. Industry can only attract youth if it makes the working conditions throughout as good as they can be. Much is now being done, but it is felt that even yet there is sufficient emphasis throughout the length and breadth of the country.

If the foundry industry is given the men, and if both the fiscal policy of the country and the attitude of the financial controllers of companies are right—one ensuring that money is available from profits for more and more modern equipment, and the other seeing it is properly spent—then even more rapid progress than in the past will eventuate.

There are many good, enthusiastic, and intelligent men in every grade of the industry, but it is a long way from having too many or even enough. There are ample opportunities now, and there will be more in the future, for men of intelligence and experience and real desire to foster improvements and progress.

The Author realises he may have disappointed many in the way he has placed his emphasis, but feels sure that, taking the long-term view, he is right. Given the emphasis in the right directions, the future can be more prosperous and more certain than the past, and the field for the use of castings of every type and description vastly widened.

[As a result of asking all the men in the audience who were married (or who had been married), and who had or had had sons, to stand up, then asking all those who did not or do not intend to put their sons to work on the foundry floor to sit down, it was ascertained that out of 50 foundrymen with sons only 7 have made or intend to make their sons into foundrymen]. The outcome aroused no surprise to the Author, and proved his contention that the first job to safeguard the progress of the future was to lend weight to the improvement of working conditions so that this ancient, honoured, and well-remunerated craft of foundry practice should secure the right type of youth—and what better type of youth than a foundryman's son could there be?—without whom progress could not be as great as it should be.

Book Reviews

The Story of Steel. By Max Davies. Published by the Burke Publishing Company, Limited, 180, Fleet Street, London, E.C.4. Price 7s. 6d. net.

This book is the latest volume in the Burke Publishing Company's "Commodity Series," a series of books "designed to meet the need for authoritative literature covering all aspects of Britain's industrial achievement," as the publishers' blurb puts it. The Author, like the industry he writes about, reaches his target—to use a term that has been inflicted on industry generally during and since the war—in giving a very readable account of the history of a great industry.

Mr. Max Davies is well qualified to write on steel, and words flow smoothly from his pen. His book will be appreciated especially by those whose knowledge of the steel industry is scant—those who would be bowled out by references to the cementation process and stumped by mention of a Bessemer converter unless accompanied by explanatory material. The author traces his story from ancient times through to the present when politicians are seeking to command an industry flourishing under the wing of private ownership and, therefore, apparently, an industry in need of State supervision.

The book carries no fewer than 78 illustrations—many of them excellent in character—but all too often an illustration is far removed from its reference in the text. Such a criticism, however, should not deter the potential reader from making his modest outlay for Mr. Davies's story.

P. E. C.

Warne's Wages and Overtime Calculator. By H. S. Stillwell. Published by Frederick Warne & Company, Limited, Chandos House, Bedford Court, Bedford Street, London, W.C.2. Price 7s. 6d.

First published in 1942, this calculator has been in great demand by various industries for working out wages and overtime rates. Now, owing to the upward trend in wages, it has been necessary to revise and extend these tables. The wages rates now show from 1/40th to 100 hours at 9d. to 5s. per hr., including sixteenths to 1s. 6d. and eighths to 5s., with an overtime calculator showing the hourly values of overtime rates from time-and-one-tenth to double-time and percentage increases from 10 to 100. This is a simplified system of working out total wages to be paid for time and overtime for the different schedules prevailing in many trades and industries.

The supplementary tables issued in 1947 to bring the wage rates up to 5s. per hr. are still available, but are not so extensive as the latest edition of the calculator. They give wage rates from 1/40th to 100 hours at 3s. 0½d. to 5s. per hr., advancing in halfpennies. The price for the supplementary tables is 1s. 6d. net.

Association of Bronze and Brass Founders

Annual General Meeting in London

At a general meeting held on April 26 at the Connaught Rooms, London, over which Mr. Max Horton presided, Mr. F. W. Burrell, of Hull, was presented with a silver salver, suitably inscribed, as a token of appreciation of his work as president of the Association last year. It was announced that a telegram of good wishes had been received from Mr. Frank Hudson, leader of the brass-foundry productivity team. The message read "Approaching New York. Team in fine form. Hope you have good annual general meeting."

President's Report

After some formal business, the president delivered his report in the course of which he said:—

I am glad to welcome you to-day and to meet again so many whom I have come to know by attending the various area meetings—that has been a duty and a privilege which I value very much. I have been present at eight such meetings during the past year, and was especially pleased to be present at the very successful meeting held in Glasgow in November last.

There are no hidden mysteries in the Association—the Council aims to keep members fully aware of the varied activities of the Association, but to do so as concisely and interestingly as possible because we are all aware of the demands made on our time these days by literature from many sources and of the temptation to relegate it to the waste-paper basket. I hope our efforts have a happier fate; they are the result of much thought, and effort on the part of Council, committees, members and officials of the Association.

Membership

Many of you will be aware of my keenness to increase the membership of the Association and I appreciate the help which members have given me in this effort; it is an uphill task and one which calls for greater effort, one in which I invite you all to join.

Associate Membership

You will note proposals for associate membership appear on the agenda—the Council on the whole consider that provision—subject to safeguards—should be made for this; but this must not obscure the great need to increase the ordinary membership.

Film "Bronze Founding"

The Association has recently acquired the British copyright and two copies of this film which are now available for hire. In this connection since the purchase of the film by the Association on December 17, there has been a little delay in arranging the bookings with members of the Association by reason of the fact that two copies of the film were required for this purpose. As recently advised to members, these copies have now been obtained and up to the present the Association has booked the film to four members, two of whom have already exhibited it.

I would urge those members who desire to show this film to send in applications as soon as possible so that the secretaries can arrange the bookings in proper rotation. I feel that if proper use is made of this film much good will accrue to the Association in addition to the help which it will give in getting youths into the foundry—that, as you are all aware, is a vital problem which must be solved.

Brass-foundry Productivity Team

The question of forming a productivity team was considered just a year ago. Now, a team formed jointly by the National Brassfoundry Association and our own is on the way to America; we have seven representatives in the team, and we were fortunate in being able to persuade Mr. Frank Hudson to lead the team. I look forward to the team doing a fine job of work and bringing back worth-while information which will be available to all.

Standardisation and Productivity

Much is heard on this subject. We hope the report of the productivity team will help. As regards standardisation, founders often say it is not a matter for them but for their customers. That may be so, but it is no reason for doing nothing and our technical committee is alive to the problem. A list of specifications for the motor industry has been published during the year. Other means of attacking the problem are under consideration; we recently made a report to the Ministry of Supply on the question. The ultimate issue is, however, between members and their customers; we can only strengthen members' hands.

Relations with the Ministries

Our relations with the Ministry of Supply continue to be excellent—though their demands on us are not always easy of fulfilment. I have attended six meetings of the Ministry of Supply Advisory Committee (Die-castings) and Technical Panel during the past year and, together with Mr. Neil Robertson, have acted on this Committee which is doing very valuable work since its formation in 1946. Because of the keen interest shown by the Ministry of Supply in the film "Bronze Founding" we have established contact with a number of official bodies and have good relations with the Central Office of Information.

Research

We are conscious not only of the need for and importance of research but also of the considerable sums needed to finance it and of the need to spread the burden over the entire industry. The answer to that has not yet been found, but the British Non-Ferrous Metals Research Association have proposals for a beginning which you are to consider later, and which is subsequent upon the invitation by their director, Mr. G. L. Bailey, to a number of our members to visit the laboratories at Euston.

Training School

I have referred to the importance of youths entering the industry; it is no less important that boys who do enter should stay. There are two things that devolve from this (*a*) we must make their surroundings as pleasant as possible—and most foundries have a long way to go in this respect, and (*b*) we must see that the boys have first-class training. Here I would urge that you should send your boys to the Training Centre estab-

Bronze and Brass Founders

lished at West Bromwich; they, and you, cannot fail to benefit from it, as experienced by those apprentices who have already passed out and are now playing their part in Industry.

At this point I would stress the importance of Members supplying recruits for this Centre, as there are insufficient in training to maintain their normal courses. Further the hostel will shortly be completed and will fill a definite need for recruits who live outside the Birmingham area. There is then the question of indentures. This is at present being studied and I hope you will give most careful consideration to whatever recommendations may in due course be made.

Metal Prices

Devaluation resulted in an immediate rise in metal prices; but tin on subsequently being free from control fell appreciably. Due to the kindness of the Phosphor Bronze Company, Limited, we circulate information on metal costs from time to time and we know that this information is greatly appreciated.

Area Meetings

I know that these meetings are most valuable, but we look for better attendances. If you have not attended I would urge you to make the effort. I believe that you will make every endeavour to attend your own local area meetings and when the occasion warrants attend other area meetings when perhaps your business coincides in time with the area in question.

Technical Committee

This Committee continues with its valuable work of benefit to all members. I would like to congratulate and thank all its members for their splendid efforts.

Our thanks are due also to the Council for their guidance to Mr. Smithson who, as editor of the *Bulletin*, discharges an important function so well, and to our representatives on other bodies and all who serve the Association, among whom particularly Mr. Frank Hudson must be mentioned for the help which he continues to give to the Assocation and individual members.

My personal thanks are due and gladly given to those who have supported me so well during my year of office, especially Mr. Heathcote and Mr. Rogers of the secretariat.

Report of the Technical Committee

Following the president's speech, Mr. P. D. Crowther, chairman of the Technical Committee, presented his report:—

The Technical Committee has held four meetings in the course of the past year. Following the resignation of Mr. F. C. Evans in July last, the necessity for which caused members much regret, the speaker had the honour to be elected chairman of the Committee. During the year the Committee has been strengthened by the addition to its members of Mr. Cross of the Aluminium Bronze Company, Limited, Mr. G. A. Hannaford of the Phosphor Bronze Company, Limited, and Mr. H. T. Rutter, of Sagar Richards, Limited.

The Committee has had a busy year during which some of its ventures have come to fruition. The report "Mechanical Properties of Some Copper-base Alloy Castings" was presented to the annual conference of the Institute of British Foundrymen in June last and was favourably received and was the subject of encouraging comment in the Press. Later the booklet "Bronze & Brass Castings for the Motor Industry" which had been prepared jointly with the Society of Motor Manufacturers and Traders was published.

A display board "Do's and Don'ts for Crucibles"* which is a concise list of hints for furnacemen on prolonging the life of crucibles is now being issued to members. The crucible manufacturers have asserted that short crucible life is due mainly to mishandling of pots and the "Do's and Don'ts" have been prepared from a lengthy memorandum received from them on the subject in an effort to eliminate losses due to this cause.

At the same time the Committee was convinced that the quality of crucibles left room for improvement and the manufacturers have been constantly urged to produce crucibles which would give better service. It is thought this campaign is at last yielding results—one report says that crucible costs have been halved during the past year. The Committee desires that members should keep records of the performance of their crucibles so that it will have reliable data on which to base its case.

A report on the non-crucible-type metal-melting furnaces has been completed; this will be distributed as soon as received from the printers. Ten members have supplied information on the costs and other aspects of operating these furnaces and it is thought members will find much of interest in the report.

The Committee, at the request of the Ministry of Supply and the Council have given considerable thought to the question of standardisation and productivity. Purely from the foundry angle, as distinct from finished products, one great avenue of economy through standardisation is the reduction in the number of alloys, and the opportunity has been taken to impress upon the "Lemon Committee," the Ministry of Supply and the British Standards Institution, the importance of concentrating on the alloys listed in BS.1400. This matter is in abeyance until the productivity team, now on its way to America, has reported, when the matter will be looked at again. Committee members are greatly interested in a proposal to investigate metal losses in the foundry and are collecting preliminary information on this subject.

The chairman felt the Committee was giving the Association and members excellent service and he knew their desire to assist to the extent of their power. Members should not hesitate to ask for help if they have a difficulty with which they feel it can legitimately deal. His personal thanks were due to members of the Committee for the loyal support which they have given to him and Mr. Frank Hudson for continuing to give his valuable services as honorary consultant to the Association.

Election of Officers

After luncheon the annual general meeting was held. Mr. G. F. Mundell, of the Knowsley Cast Metals Company, Limited, Manchester, was elected president and Mr. W. R. Marsland, of Newman Hender & Company, Limited, of Woodchester, Glos., was elected vice-president. It was announced following a postal ballot that Mr. J. C. Colquohoun; Mr. P. T. Holligan; Mr. J. C. M. Sheckell and Mr. G. Skript were elected members of Council. The membership of the Technical Committee was unchanged, as were the representatives on ministerial, standardisation and educational bodies. The auditors (Kemp, Charteris & Company) and secretaries (Heathcote and Coleman) were re-elected.

* This is available to our readers, at a small charge, on application to the secretaries, Heathcote and Coleman, 25, Bennetts Hill, Birmingham, 21.

B.S.F.A. Productivity "Progress Report"

The Second Productivity Convention of the British Steel Founders' Association, held at Ashorne Hill from April 27 to 29, was in the nature of a series of progress reports from various members following upon the application of the principles discussed at the earlier convention held last November. This, in turn, arose out of the report of the steelfounders productivity team, the first of such teams to visit America. Following an introduction to the convention by Mr. F. W. Rowe, B.Sc., F.I.I.A. (chairman, B.S.F.A.), the proceedings were divided into five main sessions:—

Session I—Introductory and Steel-making Methods

Under the chairmanship of Mr. J. F. B. Jackson, B.Sc., A.R.I.C., F.I.M. (director of research, B.S.F.A.), the first session concerned (A) general Papers on productivity, including "The Productivity Report as a Spur to Improved Relations and Higher Productivity," by Mr. D. Brown (works manager, Bonnington Castings, Limited); "Steps to Higher Productivity," by Mr. J. G. Allen (commercial manager), and Mr. D. W. Atkinson (assistant foundry manager, Head, Wrightson & Company, Limited), and (B) steelmaking methods, "First Trials with Oxygen in a Basic-arc Furnace," by Mr. B. L. Collins (chief metallurgist, Osborn Foundry & Engineering Company, Limited), and "Measuring Carbon Content of Liquid Steel," by Mr. G. T. Hampton, F.I.M. (works metallurgist, F. H. Lloyd & Company, Limited).

Session II—Mechanical Aids

With Mr. A. H. Catton (managing director, Catton & Company, Limited), as chairman, "Core Blowing for Small Cores, Using Standard Core Boxes," by Mr. L. W. Sanders, A.I.M. (chief metallurgist, Lake & Elliot, Limited); "Burning-off Machine," by Mr. C. B. Carter (chief draughtsman) and Mr. P. Stokes (burner), F. H. Lloyd & Company, Limited; "The Use of the Wheelabrator to Increase Productivity," by Mr. G. P. Elson, B.Sc. (Met.) (technical adviser, Thos. Firth & John Brown, Limited); "Handling Devices in a Jobbing Steel Foundry," by Mr. G. M. Menzies (managing director, North British Steel Foundry, Limited), and "Trailer Transport," by Mr. L. Magee (foundry production planner, English Steel Corporation, Limited), were presented.

Session III—Working Conditions and Amenities

For this session Mr. R. W. Casasola (executive member, Amalgamated Union of Foundry Workers) took the chair. The Papers presented were:—"Amenities and Good Housekeeping," by Mr. R. J. Richardson (managing director, Brown Lennox & Company, Limited); "Health and Safety—The Trade-union View," by Mr. W. MacCreadie (organiser, Amalgamated Union of Foundry Workers); "Medical Facilities," by Mr. J. S. Minton (personnel manager, F. H. Lloyd & Company, Limited), and "Washing and Changing Rooms," by Mr. F. A. Martin, O.B.E., B.Sc., A.R.I.C. (managing director, Osborn Foundry & Engineering Company, Limited).

Session IV—Methods and Processes

The subjects coming under this heading were "Sand Reclamation," by Mr. A. F. Tosh (works manager, Summerson's Foundries, Limited); "Manufacture of Cores Utilising Principles of Machine Moulding," by Mr. A. Hill (development engineer, Catton & Company, Limited); "The Use of Exothermic Compounds to Reduce Feeder Heads," by Mr. A. C. Brearley, B.Met. (chief metallurgist, K. & L. Steelfounders & Engineers, Limited); "Improved Fettling Methods," by Mr. F. Perks (heavy fettling shop foreman, F. H. Lloyd & Company, Limited), and "Welding Cabin Device," by Mr. W. L. Hardy (foundry manager, Lake & Elliot, Limited). Mr. F. N. Lloyd acted as chairman for this session.

Session V—Layout and Statistics

This session was under the chairmanship of Dr. R. Hunter, Ph.D., B.Sc., F.I.M. (director, Clyde Alloy Steel Company, Limited), and was divided into (A) Layout and (B) Statistics. Under the former, "The Installation of a New Pattern Shop," by Mr. J. Brennan (chief foundry planner, Wm. Beardmore & Company, Limited); "Effects of Alteration in Moulding Machine Layout," by Mr. J. Currie (director and general manager, Blackett Hutton & Company, Limited), and "The Reorganisation of a Machine Moulding Section," by Mr. R. F. Ottignon (development director, K. & L. Steelfounders & Engineers, Limited), were presented. On statistics, Papers were given on "Productivity Statistics," by Mr. D. H. Aston (cost accountant, F. H. Lloyd & Company, Limited), and "Introduction to Budgetary Control," by Mr. N. Patterson (cost accountant, Catton & Company, Limited).

The first four sessions were followed by group discussions in addition to the usual general discussions and summing up. In the concluding section of the convention, with Mr. F. W. Rowe, B.Sc., F.I.I.A., as chairman, future trends in improving productivity were discussed by Mr. F. A. Martin, O.B.E., B.Sc., A.R.I.C. (chairman, B.S.F.A. productivity committee), and there was a summary of the present convention by Mr. F. W. Rowe. Mr. T. H. Summerson, J.P. (vice-chairman, B.S.F.A.) compared the first and second gatherings. The closing speech of the assembly was given by Mr. F. W. Rowe.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

DRYING STOVE FATALITIES

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—This is another of the many letters which you have probably received concerning the much publicised core-room fatality in England.

Many suggestions have been noted for preventing a repetition of the mishap, but a system that is almost standard on this continent on batch-type core-ovens make such a happening almost impossible. The latch that holds the door shut works in a sloping bed rather than a slot, and is held in the notch by a spring. A push from the inside will open the door, but the action is sufficiently firm so that the door does not come open unnecessarily. This system is, as I say, almost standard equipment, and was originally worked out as a preventive of damage in case of a core-oven explosion. In case of an explosion, the door flies open and releases the pressure without the demolition of the oven.

Yours, etc.,
J. E. REHDER.
Foundry Engineer
Canadian Department of Mines and
Technical Surveys.
568, Booth Street, Ottawa.
April 5, 1950

A.D.A. Elects New President

Annual General Meeting in London

The annual general meeting of The Aluminium Development Association was held recently. The new president is Mr. Edward Player, managing director of Birmid Industries, Limited, who has represented that company on the A.D.A. Council since 1945. Mr. Player is also joint managing director of Birmingham Aluminium Casting (1903) Company, Limited, chairman and joint managing director of Birmetals, Limited, managing director of Sterling Metals, Limited, and chairman of Perry Barr Metal Company, Limited. Mr. E. Austyn Reynolds, who was elected vice-president, represents T.I. Aluminium, Limited, on the A.D.A. Council, and for some years was also a member of the executive committee. Mr. F. G. Woollard was re-elected as chairman of the excutive committee for a further year.

MR. E. PLAYER, WHO HAS BEEN ELECTED PRESIDENT OF THE ALUMINIUM DEVELOPMENT ASSOCIATION.

An abstract of the speech by Mr. Kenneth Hall, the retiring president, is given below:—

The year 1949 has seen the organisation and position of the Association further consolidated and the general pattern of development more clearly defined. Certain major developments, however, have inevitably been in part suspended or delayed by the incidence of devaluation and the consequent rise in the cost of aluminium. But although fruition of some of these projects may be retarded until the situation becomes more stabilised, this has in no way occasioned any slackening of the Association's development work. The production of British Standards involving aluminium has made good progress, indicating the acceptance of aluminium in many fields.

Ten new publications and three revised versions of existing publications have been issued by the Association. Information provided primarily for use by member companies has included several technical memoranda reviewing particular fields of development or summarising available data on a specific subject. In general educational activities there has been a marked increase, and there are now some 400 schools on the Association's list receiving various forms of visual and other assistance. The issue of educational films increased by 25 per cent., while technical lectures by the staff were maintained at the high level of the previous year.

Wetting Agent for Dust Suppression

Although water affords the generally accepted basis of reducing dust incidence in foundries, physical problems often arise where large quantities are involved. It is, therefore, obviously advantageous when, by the addition of some wetting agent, the total quantity can be reduced, without impairing efficiency. Shell Chemicals, Limited, are now marketing a wetting agent under the trade name of "Teepol" and claim that by the addition of a small percentage of this agent (normally 0.2 per cent.) into the body of the water, a water reduction of as much as 50 per cent. can be effected with no loss of efficiency. This surface-active compound is effective in reducing the surface tension of water, *i.e.*, the force extended by molecules of a liquid at its surface, which tends to maintain a continuous, unbroken surface when in contact with air. By breaking down the molecular cohesion, the agent tends to grip the minute particles, overcomes "greasy" coatings, and thus effectively deals with otherwise intractable dusts.

One of the main obstacles in effectively using wetting agents in works has been the difficulty of maintaining a constant flow of liquid at the correct strength at operating parts. This would appear to have been overcome by an injector designed by the Permutit Company, Limited, London.

Small-diameter Water Pipes

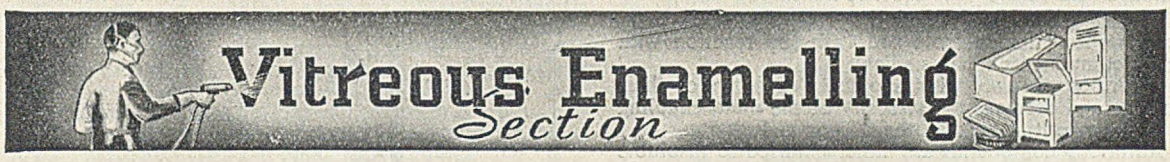
The suitability of various materials for small-diameter water pipes, especially for farm supplies, is to be investigated by a Working Party at the Ministry of Health. The Ministry says that a material commonly used for this purpose at present is galvanised steel, but in some areas pipes made from it are liable to severe external corrosion when laid underground, or to internal corrosion due to the action of the water. It is in these areas that a reasonably inexpensive alternative is required. The Working Party will mainly deal with plastics and other non-metallic materials.

The chairman of the Working Party will be Mr. H. W. Coales, of the Ministry of Health. The following members have been appointed:—Mr. F. L. Barrow (Building Research Station, Department of Scientific and Industrial Research); Lt.-Col. F. G. Hill (Ministry of Health); Mr. J. O. Jones and Mr. T. C. Ketchen (Ministry of Agriculture and Fisheries); Mr. A. Key (Ministry of Health); Mr. N. J. Pugh (British Waterworks Association); Mr. D. Whiteley (Institution of Water Engineers).

Steel Distribution Scheme

The abolition of the steel distribution scheme is urged by the Iron and Steel Trades Confederation in the current issue of its journal, "Man and Metal." Every scrap of evidence available, says the writer, points to the fact that the steel shortage, except for sheets and tinplates, is now virtually over and the Government should now discontinue, or at least modify, controls for which there is no further need. He adds that their unnecessary retention cannot do the slightest good and that they might well do a great deal of harm, not only to the industry itself, but to our precariously balanced economy, one of the strongest supports of which is steel.

The journal then comments on the large administrative and clerical staffs required, not only by the Government, but by steel manufacturers and consumers to carry out the scheme. This is a sheer waste of man-power and materials if, as the Confederation believes, the scheme can no longer be vindicated.



Raw Materials for Vitreous Enamels*

Some Considerations on their Selection and Function

By S. H. Ryder, B.Sc., A.R.I.C.

THE choice of raw materials for the manufacture of any industrial product will be governed by the functional properties, *i.e.*, the contribution each material makes to the quality and properties of the finished product, the cost, including prime cost and relative processing costs, and adequate purity, constancy of composition and availability.

In considering the various materials available to the enamelling industry, it is proposed, therefore, to discuss first their functional value in so far as it affects the process of formation of a vitreous enamel, second the contribution each material ultimately makes to the physical properties of the finished enamel, and third the question of costs.

Periodic Classification

In order to systematise, if only to a small extent, the consideration of raw materials, it is of interest to refer to the "periodic classification."

This systematic arrangement of all the terrestrial elements then known was proposed by Mendeléeff in 1869. The modern version of Mendeléeff's classification, illustrated in Fig. 1, shows that when all the 92 elements (with the exception of the missing elements nos. 85 and 87) are arranged in the order of increasing atomic weight so that elements with similar properties fall in the same vertical "groups," this periodic repetition of chemical characteristics results in a series of horizontal "periods" containing two elements in period I, eight in periods II and III, eighteen in periods IV and V, and thirty-two in period VI.

The fundamental soundness of Mendeléeff's classification has been fully confirmed by modern atomic structural theory which identifies the completion of each horizontal period with the filling of a further electronic orbital envelope. Modern electronics also furnishes the explanation of the progressively increasing membership of the periods in the series two = 2×1^2, eight = 2×2^2, eighteen = 2×3^2 and thirty-two = 2×4^2.

Fig. 1 illustrates the principal function of the elements most commonly used in vitreous enamels and classified as colouring agents, fluxes, opacifiers and adherence promoters. The fact that elements exhibiting the same "function" in an enamel occupy neighbouring positions in the periodic classification indicates that the basic chemical character of each element is maintained in the vitreous state, and thus gives a basis for predicting the effects to be obtained from the addition of new elements to enamel compositions.

A practical illustration of the chemical background to the vitreous state is afforded by British Patent Specification No. 544,734, which describes the chemical preparation of an enamel or glass: "Lead borate glasses can be formed at ordinary temperatures by dissolving lead oxide and boric oxide in polyhydric alcohols and removing the solvent (evaporation). Calcium, silicon or alkali-metal oxides can be incorporated and the solution may be coated on to metals to form an enamel."

Before examining in more detail the effect of particular components on the properties of the finished enamel, a few points concerning two important groups of enamel raw materials, *i.e.*, frit materials and opacifiers, will be discussed.

Frit Materials

Mixing of Smelter Raw Materials

Mechanical mixing is highly desirable as it is the most efficient way of bringing the particles of refractory and fluxing materials into the intimate association required for them to undergo chemical union, *i.e.*, to melt. Many materials such as soda ash, saltpetre and borax readily absorb moisture and should be stored in a dry place; "moist" materials are very difficult to mix, with consequent loss of melting speed. Mechanical mixing reduces the tendency to "local" attack of refractory where flux concentrations are high, and by minimising inhomogeneity helps to produce maximum durability in the finished vitreous enamel.

Reactions during Smelting

Fig. 2 is a diagrammatic representation of the principal reactions occurring during the smelting operation. The inverted temperature scale gives the approximate temperature ranges at which the "fluxes" listed on the left-hand side of the diagram, first melt and then react with the "refractories" shown on the right-hand side, passing into the liquid melt represented by the vertical broad band headed "fusion." The narrow band under "agitation" represents the agitation of the batch by gaseous products of the melting and reaction processes.

Specific points to be noted include the following:—

Sodium and potassium nitrates ($NaNo_3$ and KNO_3) in addition to being powerful fluxes are strong oxidising agents and help to avoid reduction of the melt both by absorption of reducing gases sometimes present in coal- or oil-fired furnaces and by keeping a high colour tone. Gaseous products of reaction are very important in agitating the batch, *e.g.*, steam from borax and boric

*A Paper presented at several section meetings of the Institute of Vitreous Enamellers. The Author is chief chemist, C. E. Ramsden & Company, Limited, Stoke-on-Trent.

Raw Materials for Vitreous Enamels

acid, carbon dioxide from soda ash (by reaction with acidic components such as silica).

Fluorides dissolve with evolution of some of their fluorine and decrease the viscosity of the melt, enabling it to increase its attack on the felspar and quartz.

Antimony compounds are either oxidised to insoluble antimony pentoxide (Sb_2O_5) or dissolved in the melt.

Tin oxide, zirconia, etc., may be partially dissolved, especially if overheated. Zirconia appears to form an immiscible glass dispersed in the melt.

Factors Influencing Speed and Efficiency of Smelting

Efficient mixing of the batch before charging, to which previous reference has been made, and level spreading of the charge in the furnace, avoiding batch piles which tend to baffle flame propagation, are important.

The bulk density of the batch has a direct effect on the efficiency of heat transfer; bulky or light batch has a higher proportion of "pore" or air space which acts as an insulating medium, retarding heat transfer.

The evolution of gas during smelting assists the melting operation in two ways: (*a*) by agitation of the batch, thus exposing fresh surfaces both to the heating action of the flame and to the solvent action of the liquid frit, and (*b*) by dissolving in the liquid melt and thereby increasing its mobility, which in turn increases the rate of reaction of uncombined frit components.

It is interesting to note that the volume of gas evolved during the fritting of a normal vitreous-enamel batch is quite substantial. For example, a 1,000-lb. batch of an enamel containing 35 per cent. borax and 10 per cent. soda ash loses during smelting 165 lb. of water and 42 lb. of carbon dioxide which, on the assumption that the gases would be evolved over a period of 30 minutes, is equal to an average volume of 9 cu. ft. per second or 540 cu. ft. per minute of gas at a temperature of 930 deg. C.

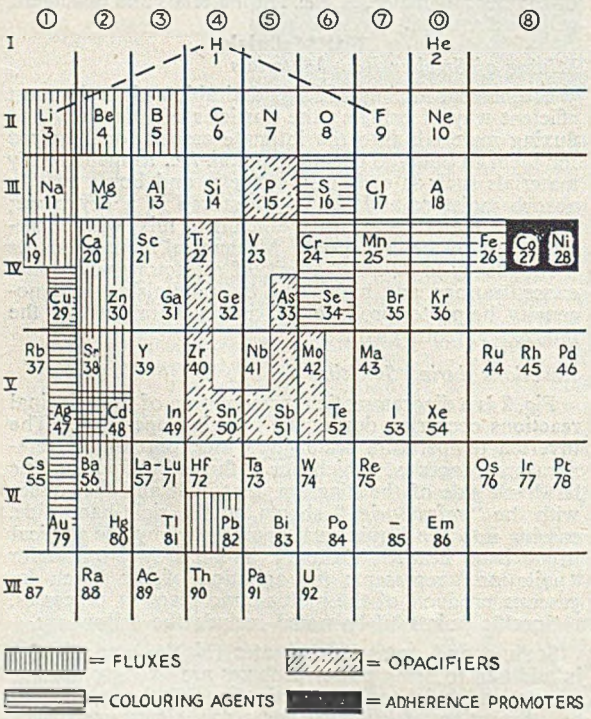


FIG. 1.—DIAGRAM ILLUSTRATING THE PRINCIPAL FUNCTION OF THE ELEMENTS MOST COMMONLY USED IN VITREOUS ENAMEL.

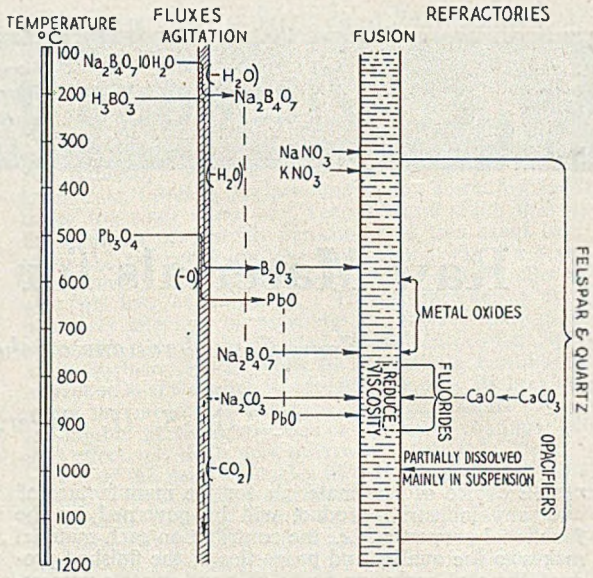


FIG. 2.—DIAGRAMMATIC REPRESENTATION OF THE REACTIONS OCCURRING DURING THE SMELTING OPERATION.

Opacifiers

These can be classified in three groups according to the mechanism of their occurence in the fired enamel.

The simplest group are the "insoluble" type 1 opacifiers, such as tin oxide. Classical theory postulates that opacity in a glass is produced by reflection, refraction and diffraction of light and as these first two mechanisms should occur only with particles having an effective diameter greater than the wavelength of light, it follows that the size grading of this type of opacifier should have a definite influence in its opacification efficiency. A further theoretical criterion for the achievement of maximum opacity is that the insoluble particles should be highly dispersed and of irregular shape and size. The degree of dispersion is controlled to some extent by the charge on the particles and is assisted possibly by other enamel components functioning as dispersive agents; thus fluorides are said to disperse tin-oxide particles in some dry-process cast-iron enamels.

An apparent anomaly exists in the assessment of the critical particle-size range for efficient opacification by an "insoluble" opacifier. Theoretical considerations referred to above indicate that particles smaller than 0.4 micron (the lower limit of the visible spectrum) should be much less effective than particles of larger dimensions and yet a typical grade of light tin oxide giving excellent opacity in vitreous enamels contains 80 per cent. by weight of particles with a diameter of less than 0.5 micron.

A recent investigation has indicated that the maximum diffusion of visible light in opaque systems exists when the opacifying particles are 0.2 to 0.3 microns in diameter. It is possible that the optically effective diameter of a particle may be considerably greater than its actual diameter due to partial solution of the opacifier in the surrounding glass extending the optical sphere of influence of the particle.

A further very important group of opacifiers are classified as "crystallites." They are normally fritted in, and opacity is developed during smelting by crystallisation or devitrification. Examples of this type are arsenic trioxide in jewellery enamels or lead frits, and antimony pentoxide, fluorides and zirconia in vitreous enamels.

Efficiency of opacification is controlled by the composition of the base enamel and by the thermal treatment, particularly of the frit during cooling.

An investigation by King and Andrews (*Journ. Am. Cer. Soc.* 1941) on the development of opacity in zirconia enamels led to the conclusion that a type II opacified enamel should fulfil the following conditions:—

The opacifier must have a fairly high solubility in the frit at the smelting temperature and a low solubility at the firing temperature.

Crystallisation during fire must be rapid and crystal growth should not be too slow, otherwise a "blue" effect is produced due to scatter of blue light and greater absorption of light at the red end of the spectrum. This effect, known as Rayleigh scattering, is only produced by very fine particles of a size less than 0.1 micron.

A third type of opacification is produced by the presence of an immiscible constituent. Gas opacification affords an example of this type of opacity.

The X-ray investigation of opacified enamels has indicated that sodium fluoride separates from all fluoride-containing batches, aluminium fluoride produces sodium fluoride (together with crystallised calcium fluoride in presence of fluorspar), fluorspar produces sodium fluoride and calcium fluoride, tin oxide is not dissolved to any appreciable extent but remains as crystalline SnO_2, antimony trioxide is oxidised during smelting to antimony pentoxide, and sodium antimoniate yields antimony pentoxide by decomposition.

Effect of Ultimate Enamel Components on Physical Properties

It has been found that many of the physical properties of enamels are related to the chemical composition in an approximately "additive" manner. This means that if the percentage composition of an enamel is known in terms of its component oxides and fluorides, a series of factors applicable to each component can be used to calculate the total quantitative value of the particular property involved.

The general equation for the calculation of an additive property is:—

$$X = P_1X_1 + P_2X_2 + P_3X_3 + \ldots .$$

where X = value of the property required
P_1 = percentage of component 1, etc.,
X_1 = factor for component 1, etc.

The extent to which the determined values of each physical property vary from the calculated values (*i.e.*, the relative "additivity" of each property) is a measure of the structural effects of the component molecules upon each other.

Calculated values should only be used as indications of "trends" with variations in composition and not as absolute values of the property involved. Calculation of a property should never be substituted for its practical determination, but only as an approximate assessment of its value.

Table I sets out a series of factors applicable to the calculation of a number of physical properties. Much of the work quoted was carried out in connection with glasses and should be applied with caution to enamels.

The following points are of interest in connection with particular physical properties:—

Thermal Expansion

Winkelmann and Schott (1894) gave factors applicable to glasses.

Mayer and Havas (1904) gave factors applicable to enamel glasses.

English and Turner (1920) gave factors applicable to glasses.

Fetterolf and Parmelee (1929) gave factors applicable to glasses.

Hall (*Journ. Am. Cer. Soc.*, vol. 13, p. 182) (1930) gave factors applicable to glasses.

TABLE I.—*Factors Applicable to the Calculation of Physical Properties.*

Component.	Thermal expansion.				Heat conductivity, P. & F.	Density.		Tensile strength, W. & S. kg. per sq. mm.	Crushing strength, W. & S. kg. per sq. mm.	Elasticity, C. & T.	Hardness, Auerbach	Specific heat, H. & C
	M. & H. × 10-7	W. & S. × 10-7	E. & T. × 10-7	F. & P. × 10-7		W. & S.	Baillie.					
SiO_2 ..	0.8	0.8	0.15	—	0.0220	2.3	2.24	0.09	1.23	40	+ 3.32	0.001913
Al_2O_3 ..	5.0	5.0	0.42	—	0.0220	4.1	2.75	0.05	1.0	120	+10.1	—
B_2O_3 ..	0.1	0.1	−1.98	—	0.0160	1.9	3.00	0.065	0.9	—	+ 0.75	0.002272
Na_2O ..	10.0	10.0	12.96	12.5	0.0160	2.6	3.20	0.02	0.52	110	− 2.65	0.002674
K_2O ..	8.5	8.5	11.7	—	0.0010	2.8	3.20	0.01	0.05	—	+ 3.9	0.001860
PbO ..	4.2	3.0	3.18	—	0.0080	9.6	10.30	0.025	0.48	—	+ 1.45	0.000512
ZnO ..	2.1	1.8	2.1	1.85	0.0160	5.9	5.94	0.15	0.6	—	+ 7.1	0.001245
CaO ..	5.0	5.0	4.89	—	0.0320	3.3	4.30	0.20	0.20	240	− 6.3	0.001903
MgO ..	0.1	0.1	1.35	—	—	3.8	3.25	0.01	1.1	300	—	0.002439
BaO ..	3.0	3.0	4.2	5.7	0.0110	7.0	7.20	0.05	0.65	—	+ 1.95	0.000673
As_2O_3 ..	2.0	2.0	—	—	—	4.1	2.90	0.03	1.0	—	—	0.001276
P_2O_5 ..	2.0	2.0	—	—	0.0160	2.55	—	0.075	0.76	—	+ 1.32	0.001903
Sb_2O_3 ..	3.6	—	—	—	—	—	—	—	—	—	—	—
SnO ..	2.0	—	—	—	—	—	—	—	—	—	—	—
TiO_2 ..	4.1	—	—	—	—	—	—	—	—	—	—	—
ZrO_2 ..	2.1	—	—	—	—	—	—	—	—	—	—	—
Na_3AlF_6 ..	7.4	—	—	—	—	—	—	—	—	—	—	—
NaF ..	7.4	—	—	—	—	—	—	—	—	—	—	—
AlF_3 ..	4.4	—	—	—	—	—	—	—	—	—	—	—
CaF_2 ..	2.5	—	—	—	—	—	—	—	—	—	—	—
Cr_2O_3 ..	5.1	—	—	—	—	—	—	—	—	—	—	—
CoO ..	4.4	—	—	—	—	—	—	—	—	—	—	—
CuO ..	2.2	—	—	—	—	—	—	—	—	—	—	—
FeO ..	4.0	—	—	—	—	—	—	—	—	—	—	—
NiO ..	4.0	—	—	—	—	—	—	—	—	—	—	—
MnO ..	2.2	—	—	—	—	—	—	—	—	—	—	—

NOTES.—*Thermal Expansion:* All factors given are for "cubical" expansion a, where $a = a_1p_1 + a_2p_2 + a_3p_3 + \ldots\ldots$ To obtain "linear" expansion λ divide by 3, *i.e.*, $\lambda = a/3$.

Elasticity: W. & S. found the highest factor (130-180) for Al_2O_3 and a comparatively low factor (30-40) for MgO.

Key to initials used in table:—

M. & H. = Mayer and Havas. E. & T. = English and Turner. C. & T. = Clark and Turner.
W. & S. = Winkelmann and Schott. F. & P. = Fetterolf and Parmelee. H. & C. = Hodkin and Cousen.

Raw Materials for Vitreous Enamels

Harrison (1933), Bureau of Standards, sheet iron ground coats.

Density

In the case of this one physical property the factors are inverted and the following formula must be used:—

$$\frac{100}{D} = \frac{P1}{V1} + \frac{P2}{V2} + \frac{P3}{V3} + \cdots$$

where P = percentage of oxide,
V = density of the oxide used,
D = density of the glass.

Tensile Strength and Crushing Strength

These factors were determined by Winkelmann and Schott in the course of their classical researches on the properties of glasses. The apparent value of zinc oxide and lime in increasing the tensile strength is of note and it is interesting to observe that magnesia increases the compressive strength, but depresses the tensile strength. In general the strength in compression, *i.e.*, crushing strength, is approximately twenty times greater than the strength in tension, *i.e.*, tensile strength. The factors given apply to strengths in kilograms per sq. mm.

A typical enamel composition with an "average" factor for crushing strength of 0.8 gives a calculated value of approximately 50 tons per sq. in. This very high strength in compression, and relatively low strength in tension is a fundamental characteristic of all vitreous materials.

Hardness

This series of factors was given by Auerbach as a results of investigations on the surface hardness of glasses in the fully annealed state. The beneficial effects of alumina and zinc oxide are in contrast to the reduction of hardness by calcium oxide, indicated by the high negative factors.

Specific Heat

In connection with all these apparently quite arbitrary factors, *e.g.*, Hodkin and Cousen's factors for specific heat of glass oxides (for calculating the specific heat of glasses), it is interesting to find that they are related to the atomic weights of the oxides. Fig. 3 gives the plot of "specific heat calculation factors" against molecular weight. The graph shows that oxides containing one metallic atom, MO and MO_2, fall approximately on one curve, whereas oxides M_2O, M_2O_3 and M_2O_5, form a higher curve. The position of phosphorus pentoxide, P_2O_5, is anomalous, possibly because of the fundamentally non-metallic nature of phosphorus. This evidence of a correlation between Hodkin and Cousen's practically ascertained factors for the specific heats of glass-forming oxides and their molecular weights is reminiscent of Dulong and Petit's law for the "atomic heats" of metallic elements.

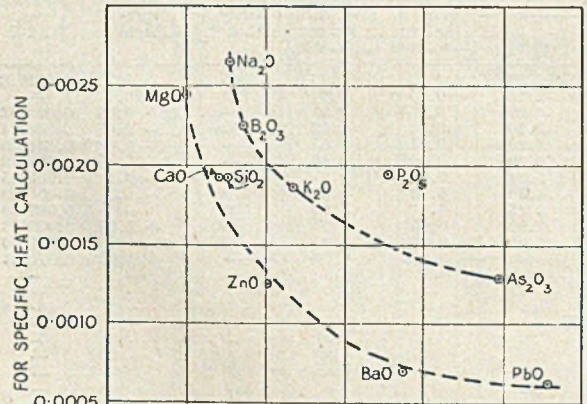


FIG. 3.—GRAPH SHOWING THE VALUES OF SPECIFIC-HEAT CALCULATION FACTORS AGAINST MOLECULAR WEIGHT.

Miscellaneous Points Concerning Specific Raw Materials

Barium carbonate, although not often used, is an efficient flux reacting with silica at temperatures as low as 700 deg. C. Barium orthosilicate ($2BaO.SiO_2$) and metasilicate ($BaO.SiO_2$) form at temperatures as low as 900 deg. C. although in the presence of soda these reactions may begin as early as 400 deg. C. Up to 10 per cent. in sheet steel enamels improves gloss, mechanical strength, elasticity and resistance to organic acids, and up to 7 per cent. can be added to sheet iron enamels low in alkalis. If antimony is to be used in the presence of barium it should be added as sodium antimoniate and not as antimony oxide which often contains sufficient sulphur to form insoluble barium sulphate giving a "puckery" skin. Up to 12 per cent. in leadless cast-iron enamels gives a better lustre and a harder surface.

Bentonite, a clay derived from volcanic ash, is mainly montmorillonite ($Al_2O_3.4SiO_2.9H_2O$) and is a very powerful suspending agent reducing the amount of ball clay needed. The use of bentonite improves the film strength of the dried enamel.

Typical analysis: SiO_2 — 64.32, Al_2O_3 — 20.74, Fe_2O_3 — 3.49, CaO — 0.46, MgO — 2.26, $K_2O + Na_2O$ — 2.90, TiO_2 — 0.11, S — 0.35, H_2O — 5.15.

Borax ($Na_2B_4O_7.10H_2O$) is the principal flux in enamels. The use of "dehydrated" or "fused" borax ($Na_2O.2B_2O_3$) is often advocated to increase frit melting speed, reduce fritting costs and involve the use of less storage space. It melts without intumescence at 735 deg. C.

Boric acid is used to introduce boric oxide when the alkalis must be kept low as in acid-resisting enamels. Boric acid is volatile in steam, which can carry 2.8 per cent. This can lead to quite high boric-acid losses if smelting is too prolonged.

Felspar is the main ingredient of most enamel batches, introducing potash at a cheaper price than in any other form, and silica and alumina in a combined state that is readily fusible. Note that muscovite mica ($K_2O.3Al_2O_3.6SiO_2.2H_2O$), an impurity frequently present in commercial felspars having been produced by partial weathering of the spar, is readily soluble in enamel smelts whereas biotite mica ($K_2O.2Al_2O_3.4MgO.6SiO_2.H_2O$) is insoluble, maintaining its identity throughout smelting and appearing as brown or black specks in the finished product. Vermiculite, an hydrated biotite mica containing iron and magnesia, has been proposed as a flaky insoluble colorant in certain enamels.

Fluorspar functions as a flux and a subsidiary opacifier due to the formation of calcium-fluoride crystals, "fluorite," on cooling. It tends to act as a reducing agent in the smelter and therefore requires oxidising conditions during smelting. It is rather corrosive to furnace linings and more than 3 per cent. may cause a decrease in acid resistance. Fluorspar is not suitable

for addition to antimony opacified enamels in which it gives a bluish-green tint.

Lithium compounds.—A number of these have recently been advocated as enamel components possessing some advantages over more conventional materials. Lithium cobaltite ($LiO_2.Co_2O_3$), when added at a concentration of 0.30 per cent. to certain groundcoat frits is stated to have replaced 0.60 per cent. cobalt oxide without any appreciable change in adherence. Lithium manganite is said to be very promising as a smelter and as a mill addition in groundcoats. The replacement of the 1 to 2 per cent. manganese in a standard groundcoat enamel by lithium manganite has resulted in a reduction in firing temperature of between 20 deg. C. and 40 deg. C. Lithium titanite and lithium metasilicate have also been put forward as promising enamel constitutents.

Lithium minerals.—*Amblygomite*—a natural fluophosphate of aluminium and lithium, approximately to the formula $2LiF.Al_2O_3.P_2O_5$. It occurs mainly in the U.S.A. and Brazil. *Lepidolite*—a natural fluosilicate of alminium, lithium and potassium of approximate formula $LiF.KF.Al_2O_3.3SiO_2$. Its theoretical lithia content is 6.0 per cent., but in practice the ore often contains as little as 3.5 per cent. Li_2O due to partial replacement of lithium by potassium and sodium. *Petalite*—a naturally accurring alumino-silicate of lithium, often found in quite a high state of purity. *Spodumene*—a silicate of aluminium and lithium containing 4 to 8 per cent. lithia.

Typical analyses of lithium minerals are shown in Table II.

Nickel oxides.—Green nickel oxide (NiO) passes to the black oxide (Ni_2O_3) on heating in air to 400 deg. C. On further heating, however, the black oxide reverts to the green oxide at 600 deg. C.

Potassium nitrate functions as an oxidising flux. An addition of 2 to 4 per cent. is usually sufficient to maintain oxidising conditions during smelting. It should be free from chlorides.

Sodium antimoniate is an effective opacifier when used in the smelter batch. It is said to be superior to antimony oxide on account of its chemical form, as the antimony is already in the fully oxidised pentavalent state. Its relative non-toxicity makes it a safer raw material than the highly poisonous antimony oxide.

Sodium silico-fluoride (Na_2SiF_6) is a subsidiary opacifier usually used in conjunction with fluorspar, cryolite, etc. It is quite soluble in water and has therefore to be smelted into the enamel. In the smelt it reacts with alumina and crystallises out as synthetic cryolite.

TABLE II.—*Analyses of Lithium Minerals.*

	Amblygomite.	Lepidolite.	Petalite.	Spodumene.
Silica (SiO_2)	5.10	52.9	77.18	62.91
Alumina (Al_2O_3) ..	22.96	26.8	16.04	28.42
Lithia (LiO_2)	8.48	4.65	4.36	6.78
Potash (K_2O)	0.30	10.33	—	0.09
Soda (Na_2O)	1.63	0.13	1.14	0.46
Phosphoric oxide (P_2O_5)	54.42	—	—	—
Iron oxide (Fe_2O_3) ..	0.02	0.19	0.14	0.53
Manganese oxide (MnO)	—	0.59	—	—
Calcium oxide (CaO) ..	0.15	0.92	0.22	0.11
Magnesia (MgO) ..	—	0.31	0.20	0.13
Fluorine (F)	2.67	3.08	—	—
Loss on ignition ..	4.80	0.66	0.16	0.28

Raw Material Costs

In considering this most important aspect of any commercial enamel it is useful to draw up a table (Table III) listing the principal raw materials and the calculated cost of the equivalent oxides. With single-component materials such as soda ash or alumina hydrate, the calculation is direct.

With multi-component materials such as felspar the calculation can be carried out as follows: Calculate silica content at standard quartz price; calculate sodium-oxide content at standard Na_2O price (ex soda ash); either calculate all costs on K_2O—£88 5s. against standard £111, in which case Al_2O_3 is "nil," or assume alumina at standard calculated alumina price of £37 5s., in which case K_2O costs £20 4s.

Table III illustrates points such as: The relative cost of alumina from five sources; the relative cost of the oxidising function of a nitrate addition is less in terms of potash nitrate if it can replace potassium carbonate; if no potassium carbonate is already present in the batch it is more economical to add sodium nitrate. It illustrates also the relative cost of potash from three sources, the cost of magnesia from two sources, the cost of antimony pentoxide from two sources, the cost of fluorine from four sources, and the cost of boric oxide from two sources.

It can be pointed out quite justifiably that these economic considerations are very primitive and that the consideration of raw-material economics is much more complex, involving the evaluation and investigation of many technical factors.

Nevertheless, these elementary considerations should not be lost sight of, but should be occasionally brought under review for consideration together with all the other factors involved.

TABLE III.—*Raw Material Costs.**

Material.	Price per ton (in £).	Equivalent cost of oxide (£ per ton).									
		SiO_2.	Al_2O_3.	Na_2O.	K_2O.	CaO.	MgO.	BaO.	Sb_2O_5.	F.	B_2O_3.
Quartz	6.0	6.0	—	—	—	—	—	—	—	—	—
Alumina (calcined) ..	37.5	—	37.5	—	—	—	—	—	—	—	—
Alumina hydrate ..	26.5	—	45.7	—	—	—	—	—	—	—	—
China clay	12.0	6.0	23.3	—	—	—	—	—	—	—	—
Soda ash	10.0	—	—	17.1	—	—	—	—	—	—	—
Sodium nitrate ..	21.0	—	—	57.0	—	—	—	—	—	—	—
Soda felspar	13.5	6.0	39.0	17.1	—	—	—	—	—	—	—
Pot. carbonate (hyd.) ..	60	—	—	—	111	—	—	—	—	—	—
Pot. nitrate	55	—	—	—	118	—	—	—	—	—	—
Potash felspar	13.5	6.0	Nil	17.1	88·5	—	—	—	—	—	—
Whiting	3.5	—	—	—	—	6.25	—	—	—	—	—
Magnesia	70	—	—	—	—	—	70	—	—	—	—
Magnesium carbonate ..	75	—	—	—	—	—	156	—	—	—	—
Barium carbonate ..	26.25	—	—	—	—	—	—	33.98	—	—	—
Antimony oxide ..	190	—	—	—	—	—	—	—	181	—	—
Sod. antimoniate ..	224	—	—	17.1	—	—	—	—	264	—	—
Calcium fluoride ..	16	—	—	—	—	6.25	—	—	—	24.0	—
Sodium fluoride ..	70	—	—	17.1	—	—	—	—	—	127	—
Cryolite	70	—	37.5	17.1	—	—	—	—	—	81	—
Sod. silico-fluoride ..	30	6.0	—	17.1	—	—	—	—	—	37	—
Borax	30	—	—	17.1	—	—	—	—	—	—	74.5
Boric acid ..	52	—	—	—	—	—	—	—	—	—	92.4

* Prices may have been subject to fluctuation since this Paper was delivered.—ED.

Institute of Vitreous Enamellers

Spring Conference at Torquay

A most successful conference was held at Newton Abbot and Torquay on April 20 and 21. On the first morning a Paper was read by Mr. R. P. Fraser describing experimental work that has been done on the enamelling of light metals, and a number of most interesting examples were exhibited. A lively discussion followed which demonstrated the interest that the matter had aroused. In the afternoon a visit was paid to the Newton Abbot works of Candy & Company, Limited, manufacturers of the "Devon" fire. Here was seen the production of pottery ware and enamelled tiles.

On the Friday, Dr. H. W. Webb presented a Paper on "Clays." Dr. Webb gave a most interesting introduction to the Paper, which had previously been circulated, and many experienced enamellers who were present remarked on the fresh information that they had gained. In the afternoon a visit was paid to the clay mines of Watts, Blake, Bearne & Company, Limited, near Newton Abbot, where seams of various types of secondary clay were being worked. Problems connected with mining which have a considerable effect on the final product were explained, and the new plant used for the dehydration of clay was examined.

The conference finished with a dinner at Torquay, when over 70 members and their ladies attended. The Council was most appreciative of the hospitality extended to the Institute by the Borough of Torquay and by the two firms who were good enough to allow members to visit their works.

Beilby Memorial Awards, 1949

The administrators of the Sir George Beilby Memorial Fund, representing the Institute of Metals, the Royal Institute of Chemistry and the Society of Chemical Industry, have decided to make three awards, each of one hundred guineas, from the Fund for 1949. These awards have been made to F. R. N. Nabarro, M.B.E., M.A., B.Sc. (Oxon.), in recognition of his application of mathematical methods to the elucidation of the mechanical properties of metals; Charles Eric Ransley, M.Sc., Ph.D. (Lond.), F.I.M., in recognition of his experimental contributions to knowledge of the behaviour of gases in metals, and Keble Watson Sykes, M.A., B.Sc., D.Phil. (Oxon.), in recognition of his experimental contributions to the study of the combustion of carbon and its oxidation by steam.

Awards from the Fund are made to British investigators in science as a mark of appreciation of distinguished work, particularly in such fields as fuel economy, chemical engineering and metallurgy in which Sir George Beilby's special interests lay. In general, the awards are not applicable to the more senior investigators, but are granted as an encouragement to relatively young men who have done independent work of exceptional merit over a period of years.

THE MARCO CONVEYOR AND ENGINEERING COMPANY, LIMITED, of Rowin Works, Lynn Road, Leytonstone, London, E.11, announce that they have received a repeat order from Radiation, Limited, Richmonds Gas Stove Company, Warrington, to supply a mechanised plant for the production of castings to be similar in all respects to that they supplied and erected a few years ago.

Regional Meetings

Southern Section

The annual general meeting of the Southern section of the Institute of Vitreous Enamellers was held on April 12 at the Howard Hotel, Norfolk Street, London, W.C.2, Mr. A. B. Kent presiding. About thirty members were present. Following the reading of the minutes of last year's annual general meeting, the honorary secretary, Mr. J. Hooper, presented his report for the current session. He disclosed that an average attendance of 34 at the four section meetings which had been held represented an increase of about 50 per cent. over the previous session, which fact would seem to endorse the section policy of holding fewer meetings in the hope that attendance would be improved.

Election of Officers

All the administrative officers having resigned, according to the rules of the Institute, they were re-elected *en bloc* together with Mr. J. J. Guy who was unanimously elected to the section committee. The office of vice-chairman, created in last year's exceptional circumstances, was allowed to lapse.

Following the business meeting, a Paper was presented by Mr. J. H. Gray (Stewart and Gray, Limited) on methods of plant control for reducing enamelling rejects. This was essentially a practical Paper, as also was the considerable discussion which followed, many speakers expressing appreciation of the numerous innovations revealed during the course of Mr. Gray's remarks.

The meeting concluded with a brief discussion of future programmes, and the secretary's proposal to organise in the near future a social function on similar lines to the one held last year, was warmly endorsed.

Midland Section

At the annual general meeting of the Midland section of the Institute of Vitreous Enamellers held recently in Birmingham, the following were elected officers for 1950-51:—*Chairman*, Mr. A. K. Williams; *vice-chairman*, Mr. J. Biddulph; *committee*, Mr. J. Price, Mr. A. Murdoch and Mr. H. Laithwaite; *honorary secretary*, Mr. D. Sleath, and *honorary lanternist*, Mr. A. Rodway.

Management Conference

At the Spring Conference of the British Institute of Management, to be held from May 18-21, at Cliftonville, near Margate, in addition to general lectures by Mr. Nigel Balchin, Professor G. D. H. Cole, and Mr. W. J. Kenney, there are 15 sectional meetings on practical problems relevant to industrial management practice. These cover subjects such as: financing of medium and small businesses, whether direct incentive schemes tend to limit output, whether centralised purchasing has a detrimental effect on industry, whether joint consultation is effective, and whether greater use should be made of mechanical-handling methods. There are also to be some 64 informal discussions on subjects ranging from remuneration of managers to market research and forecasting and the training of existing senior executives. It is expected that some 600-700 delegates will be present.

A NEW COMPANY entitled "Mullard Overseas, Limited," has been incorporated to co-ordinate the export trade of Mullard Electronic Products, Limited, from the United Kingdom.

H.F. Furnace for Metallurgical Research

Amongst the high-frequency heating equipment which the General Electric Company, Limited, have recently exported to Norway for Norwegian Government metallurgical research is a 5 kw. induction furnace specially designed in the company's research laboratories. The furnace, which is the smaller unit shown in Fig. 1, is housed in a sheet-metal cabinet with a top of heat-resisting material. A lever, operating through a notched gate, is used to raise or lower the crucible. During operation, the furnace is covered with a lid which has a small hole to allow observation of the charge or the insertion of a pyrometer. The lid, table top and removable rear panel are all fitted with safety switches to prevent power being switched on when they are not in position.

Two crucible assemblies are used with the equipment, a graphite crucible for melting metals for which contact with graphite is permissible and also melting non-metallic charges: and additionally a refractory crucible for ferrous charges. Power for the furnace is supplied from a standard G.E.C. 5 kw. high-frequency heating generator (left-hand side, Fig. 1) and typical performance figures for the plant are: copper, 4½ lb. raised to melting point in about 15 minutes; steel, 2¼ lb. melted in 12 to 15 minutes. The over-all power consumption of the equipment when in full operation is 10 kw. from a 400 to 440 volt, three-phase supply.

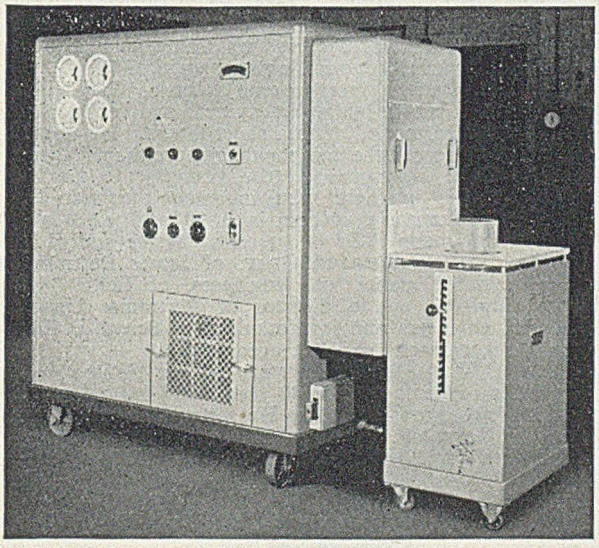


FIG. 1.—G.E.C. 5KW. HIGH-FREQUENCY INDUCTION FURNACE AND ANCILLARY EQUIPMENT.

Patternmakers and C.S.E.U.

The United Patternmakers' Association has taken a ballot of its members on the question of continued affiliation to the Confederation of Shipbuilding and Engineering Unions. The ballot showed a majority in favour of withdrawal, and the Association's executive committee now has the power, if it should so decide, to discontinue the Association's affiliation to the Confederation.

QUALCAST, LIMITED, ironfounders and lawn-mower manufacturers, of Derby, has taken over Cuffins Jig, Tool & Fixture Makers, Limited, Leicester, under the name of Qualcast (Cuffins), Limited. Mr. R. J. Dennis will be managing director of the Leicester business.

Parliamentary

Steel Exports to Canada

When MR. RUSSELL asked the President of the Board of Trade what steps he was taking to encourage greater exports of steel and steel manufactures to Canada, where a ready market existed for these products, MR. WILSON said that his department lost no opportunity of urging upon the U.K. steel industry the importance of Canada as a market for its products. Exports of iron and steel and manufactures to Canada in 1949 were over twice as great as in the previous year, and he had every hope that as the result of the industry's efforts exports in 1950 would be even greater.

MR. RUSSELL then asked if the Minister could explain how it was that several foreign countries were getting a far greater proportion of our iron and steel exports than Canada, taking into consideration the difference in populations.

MR. WILSON: "If the hon. gentleman is referring to exports to other countries in Europe, Canada has been a first charge on our steel exports. We would like to have sent far more steel to Canada, but it has not been available because the British steel industry was not doing enough to meet all our requirements."

Conditions at West Riding Foundries

In reply to MR. WILLIAM PALING, who asked to what extent the recommendations of the Garrett Report had been put into operation at foundries in the West Riding of Yorkshire, MR. ISAACS, Minister of Labour, said that the recommendations were numerous and detailed, and their implementation was inevitably gradual. The extent to which it had become practicable to implement them varied as between one foundry and another. It was therefore impossible, he said, in a short statement to indicate that extent to which they were now being carried out in West Riding foundries, of which he understood there were some 250.

"I can say, however," said Mr. Isaacs, "that a great many additional improvements were made last year, that further improvements are confidently expected, and that a fuller account will be included in the next annual report of the Chief Inspector of Factories."

Engineering Scholarships

A scholarship of the annual value of £95 offered by the Power-Gas Corporation, Limited, is available to enable suitably qualified students to undertake a degree course at Durham University in either civil engineering or mechanical engineering. Although an open scholarship, other things being equal, preference will be given to candidates who reside within the boundaries of the boroughs of Stockton-on-Tees or Thornaby-on-Tees, or who attended a school in Stockton or Thornaby, or who are employees or the children of employees of the corporation, or of Ashmore, Benson, Pease & Company, Limited, Stockton-on-Tees.

An award will usually be made to a candidate at the age of normal entry into the university, but exceptions may be made when the circumstances warrant them, and the scholarship, which normally will be tenable for three years, will in exceptional cases be extended for a fourth year.

So long as the engineering courses are confined to the Newcastle division of the University of Durham, the award will be made by the Academic Board of the Newcastle Division of the University of Durham (King's College) on the recommendation of a selection committee on which the Power-Gas Corporation shall have a seat.

News in Brief

THE Administration of Enemy Property Department of the Board of Trade is now at Lacon House, Theobalds Road, London, W.C.1.

CANADA FOUNDRIES & FORGINGS, LIMITED, Brockville, Ontario, announce a net profit for 1949 of $121,419, compared with $218,027 in the previous year.

PLANS HAVE BEEN APPROVED for the proposed erection by Staveley Iron & Chemical Company, Limited, of a social centre with training and lecture halls at Staveley.

A. BARTON (ENGINEERS), LIMITED, St. Helen's Junction (Lancs), have acquired the firm of John Wigham & Sons, Limited, marine engineers, ironfounders, etc., of South Hylton, Sunderland.

BARTRAM & SONS, LIMITED, the Sunderland shipbuilders, have recently advertised in Denmark and Sweden for skilled draughtsmen because suitable candidates were not available in this country.

A WARRANT for the installation of a limestone-grinding plant at Clippens Lime Works, Straiton, Loanhead, at a cost of about £15,500, has been granted to Bairds & Scottish Steel, Limited, West George Street, Glasgow.

PROFESSOR SIR IAN HEILBRON, D.S.O., F.R.S., has been appointed chairman of the Advisory Council for Scientific and Industrial Research in the place of Sir Geoffrey Heyworth who resigned owing to pressure of other public duties.

THE MINISTER OF FOOD announces that no change will be made in the prices of refined oils and imported edible animal fats allocated to primary wholesalers and large trade users during the eight week period ending June 17, 1950.

PARSONS ENGINEERING COMPANY, LIMITED, announce that all "Petter" AV2M two-cylinder marine engines which have "Meadows" gearboxes and other parts made by Parsons are now being assembled and tested at its Town Quay Works, Southampton.

MR. ANDREW M. HUNTER, director of A. & J. Hunter (Ironfounders), Limited, Ayr, was congratulated recently by Mr. John Kelly, firm's oldest employee, on the occasion of his golden wedding and was presented with a table lamp by the employees.

THE LARGEST DISPLAY the office equipment and machinery industry has organised since it was first represented at the British Industries Fair in 1934 will be staged at this year's B.I.F. Exhibits of 96 manufacturers will be on show at the Olympia (London) section.

KEITH BLACKMAN, LIMITED, of Mill Mead Road, Tottenham, London, N.17, have appointed Vokes (Canada), Limited, Hermant Building, 21, Dundas Square, Toronto, as their sales, service, and stockholding organisation in Canada. Space has been taken at the Toronto Trade Fair.

PROSPECTING for magnetite ore is being carried out by the Geophysical Prospecting Company, Limited, Victoria Street, London, S.W.1, at a hill on the Shetland Islands. During the war, a considerable amount of high-quality iron ore was brought to the surface at this site, when the assay of magnetite was stated to have been between 60 and 70 per cent.

AT THE annual general meeting of the Silica & Moulding Sands Association, held in London on April 20, Mr. Thomas Watson, director of General Refractories, Limited, was unanimously elected president for the ensuing year in succession to Mr. Haydn Taylor, director of the Standard Brick & Sand Company, Limited. Mr. F. C. Arnold, director of Joseph Arnold & Sons, Limited, was appointed vice-president of the Association for 1950/51.

Obituary

DR. W. J. REES

Dr. W. J. Rees, O.B.E., D.Sc., F.R.I.C., who for 28 years was head of the Refractory Department of Sheffield University, has died in hospital. He was appointed to his position at Sheffield University in 1917 and resigned in 1946, but continued his research work. He was for many years honorary secretary of the Refractories Association of Great Britain, and was a past-president of that body. He was also a former president of the British Ceramic Society. As a member of the Institute of British Foundrymen, which he joined in 1933, he was extremely active and contributed a number of Papers on foundry sands and refractories, for one of which he was awarded the Institute's diploma. He made a real hobby of his work and was never happier than when participating in technical conferences. The many researches he inaugurated at Sheffield University are still being continued and will, with those finished, be a lasting tribute to his memory.

MR. DOUGLAS GALLIE, a director of Glasgow Steel Roofing Company, Limited, and of Glasgow Expanded Metal Company, Limited, died on April 22.

MR. HARALD RAYLTON DIXON, a director of the North Eastern Marine Engineering Company (1938), Limited, Wallsend-on-Tyne, has died at Maltby, Middlesbrough.

MR. SAMUEL WRIGHT, late of Peter Wright & Sons, anvil and vice manufacturers, of Stourbridge (Worcs), before the firm was acquired by Isaac Nash & Sons, Limited, Stourbridge, has died at the age of 72.

MR. R. BROWN, late general tester at Glenfield & Kennedy, Limited, hydraulic enginers and founders, of Kilmarnock, has died after a short illness. He was 79. Mr. Brown served the company for more than 50 years.

DR. CARL MANNESMANN, the youngest of the five Mannesmann brothers who invented the seamless-tube manufacturing process in 1890 and established the Mannesmann AG, died recently at the age of 90.

MR. FRANCIS WILLIAM GRAY, of James Bertram & Son, Limited, paper mill engineers, of Leith Walk, Edinburgh, 6, and a director of Bertrams, Limited, general engineers and ironfounders, of Sciennes, Edinburgh, 9, died on April 19, aged 79.

MR. MARTIN PRICE, secretary of the South Wales Institute of Engineers for 40 years until his retirement in 1947, died on April 22. He served for many years on the Court of Governors of the University College of South Wales and Monmouthshire. He was 84.

Accommodation at Buxton

Many of the Buxton Hotels are now fully booked for the period of the I.B.F. Conference, but for the guidance of members who may not yet have secured accommodation and wish to do so, the following hotels at the time of going to press are still accepting bookings:—Savoy Hotel, single and double rooms; Lee Wood Hotel, single and double rooms; Alison Hotel, single room (one only); Argyle Hotel, twin-bedded and single rooms; Buckingham Hotel, double rooms; Egerton Hotel, twin-bedded and double rooms; Portland Hotel, single, double and twin-bedded rooms, and the Eagle Hotel, single and double rooms.

It should be noted that the above accommodation is available only for four-night bookings, though all hotels have accommodation for shorter periods which do not include the night of Wednesday, June 7. The terms, addresses and telephone numbers of the hotels mentioned will be found on page 4 of the Conference circular.

Company News

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

A. Reyrolle & Company, Limited, manufacturing electrical engineers, of Hebburn (Co. Durham):—The chairman, SIR CLAUDE D. GIBB, F.R.S., says that export business now amounts to some 40 per cent. of the total orders received. Every effort is being made to maintain, and even increase, the company's share of the world's markets, but during 1949 there was a marked change from a seller's to a buyer's market, coupled with increased competition from Continental, American, and Japanese manufacturers. He warns that 1949, in many directions, saw the peak of what might be termed the easy times. Quality, efficiency, price, and delivery periods are the only criteria now deciding the placing of orders.

The 1949 accounts, says Sir Claude, are an all-time record in every direction. The year was an exceptional one in many respects. Several large contracts received in earlier years under very favourable conditions were completed and brought into the accounts. The easing of the material supply position enabled the works to achieve production targets with a minimum of last-minute rushing and overtime, and large batching of similar products was possible to a degree not likely to be repeated in a keen buyer's market with a growing demand for shorter delivery periods.

Monsanto Chemicals Limited:—Although business in 1949 was in some ways disappointing, the completion of a number of new units which came into production during the year brought the company's expansion programme well along and, as a result, at the end of the year sales had reached the budgeted rate, says MR. E. A. O'NEAL, the chairman.

Turnover for the full year in 1949 fell below expectations of the board, though sales were up, being 8.75 per cent. higher than in 1948. Direct export sales in 1949 were 31.16 per cent. of the total sales, as compared with 28.75 per cent. in 1948, and the volume of exports in 1949 increased 20.7 per cent. over the volume in 1948. Sales in dollar markets also showed an appreciable growth. Many of the new projects for which capital was raised by the issue of additional ordinary shares in May, 1949, were completed by the end of the year—all were under construction. A review of the capital required to fulfil this programme, Mr. O'Neal adds, indicates that sufficient cash will be available to meet the requirements.

Textile Machinery Makers, Limited:—The group's facilities for research at Helmshore have been considerably extended. It has consequently been possible to establish a high level of research, and it is important that this level should in the future be maintained and extended where possible, irrespective of the then current results of the group. To this end a research reserve has been established with an allocation from this year's profits of £100,000. The total output of textile machinery in 1949 was considerably in excess of the record figure of 1948. While orders received from the home market showed a considerable increase over the previous year, the total orders booked for home and oversea during the year were appreciably below the volume of production and the forecast made a year ago that there would be a considerable reduction in output in 1950 seems likely to be fulfilled.

Company Results

(Figures for previous year in brackets.)

HERBERT MORRIS—Interim dividend of 5%, tax free (same).

TEXTILE MACHINERY MAKERS—Net profit for 1949, £576,936 (£480,703); dividend of 6%, £83,803 (same); forward, £320,006 (£280,159).

MANGANESE BRONZE & BRASS COMPANY—Profit, after depreciation, and crediting £24,906 in respect of previous periods, £199,886 (£228,830); taxation, £110,589 (£130,144); dividend of 30% (same); forward, £62,231 (£71,620).

BEDE METAL & CHEMICAL COMPANY—Trading profit for 1949, £33,113 (£34,306); depreciation, £5,000 (same); taxation, £15,162 (£16,330); reserve for plant replacements and development, £4,000 (£5,700); dividend of 1s. 6d. per share on the 8s. shares, £7,197 (same); forward, £10,709 (£10,564).

GLENFIELD & KENNEDY—Consolidated group trading profit for 1949, £754,950 (£565,777 for 1948, being the results of the parent company and two minor subsidiaries for nine months and of the three major subsidiaries for a full year); depreciation, £114,215 (£92,635); taxation, £350,282 (£271,324); dividend of 20% (same); forward, £60,633.

JOHN G. KINCAID & COMPANY—Profit for 1949, £294,979 (£203,293); investment income, £3,681 (same); depreciation, £30,000 (£20,000); taxation, £155,000 (£102,000); net balance, £93,544 (£46,190); to building extensions, £20,000 (£50,000); directors' pensions, £15,000 (£10,000); dividend equalisation, £20,000 (nil); dividend of 12½% (same); forward, £71,970 (£69,706).

CRAVEN BROS. (MANCHESTER)—Profit for 1949, after £13,808 (£11,955) working directors' remuneration, £126,688 (£85,924); tax provision no longer required, £13,610 (£25,000); tax, £37,500 (£30,000); depreciation of fixed assets, £20,000 (same); deferred repairs, £13,208 (nil); net profit, £64,946 (£59,279); dividend of 15% (same); forward, £244,732 (£212,136).

MONSANTO CHEMICALS—Consolidated accounts for 1949 show balance from trading account, £959,127 (£997,756); balance, after depreciation, etc., £318,085 (£394,806—attributable to Monsanto group, £296,384 (£375,172), minority interests £21,701 (£19,634); tax provision not required, nil (£13,000); dividend of 45% on larger capital dividends paid by subsidiary to minority interests, £17,302 (£18,298); forward, £514,782 (£467,687)—attributable to Monsanto group £487,992 (£445,296), minority interests £26,790 (£22,391).

New Patents

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 2s. each. The numbers given are those under which the Specifications will be printed, and all subsequent proceedings will be taken.

628,104 BRITISH THOMSON-HOUSTON COMPANY, LIMITED. Electric arc-furnace control systems.

628,169 HELLEFORS BRUKS AKTIEBOLAG. Method of introducing bismuth into steel or iron baths or into a steel alloy.

628,265 CHROMIUM MINING & SMELTING CORPORATION, LIMITED. Method of producing grey cast-iron products.

628,272 TORRANCE & SONS, LIMITED, and WADHAM, H. Roll mills.

628,289 BENDIX AVIATION CORPORATION. Heat-treatment of magnesium-alloy castings.

628,342 DE HAVILLAND ENGINE COMPANY, LIMITED, HALFORD, F. B., CLARKE, K. W., and PAGET, G. W. Moulds for castings.

628,355 ERIE MINING COMPANY. Process of moulding balls of ore material.

628,398 TANBERG, R. Feeding raw materials to smelting furnaces.

628,522 ROBERT, P. Device for ensuring the fixity of a core in a mould.

628,583 HARDING, C. G. Rolling mills.

628,665 AKTIEBOLAGET SVENSKA KUGELAGERFABRIKEN. Coupling boxes for rolling mills and the like.

628,707 IMPERIAL CHEMICAL INDUSTRIES, LIMITED, and DELANEY, J. B. Tempering and cleaning of ferrous metals.

628,726—HIND-GRIFFITHS FURNACES, LIMITED JOHNSON, S. B., and HIND, W. B. Furnaces or kilns of the tunnel type.

628,947 TRIGGS, W. W. (Alloy Research Corporation). Production of stainless steel.

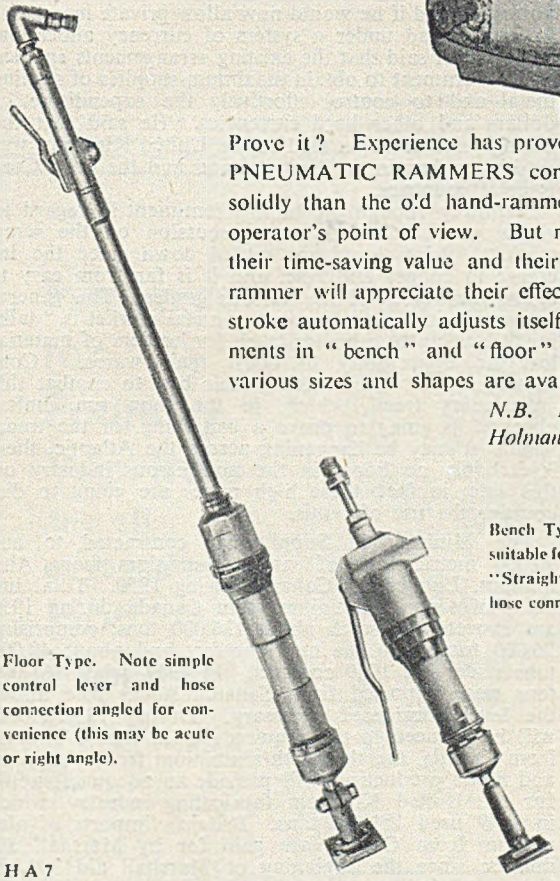
629,037 Soc. POMPES NOEL. Casting device for centrifugal casting machines.

★ B.I.F. BIRMINGHAM
OUTSIDE STANDS Nos. 1205 & 1104
MAY 8th – 19th.

"IT'S QUICKER WITH THE HOLMAN -AND BETTER"

Prove it? Experience has proved it time and again in foundries everywhere. HOLMAN PNEUMATIC RAMMERS consolidate loose material much more swiftly, smoothly and solidly than the old hand-rammer. They take all the labour out of the job. That's the operator's point of view. But managements also praise these robust, hard-hitting tools for their time-saving value and their sheer efficiency day after day. All who have ever used a rammer will appreciate their effectiveness even on varying levels of material, when the piston stroke automatically adjusts itself. The four machines in the range cover almost all requirements in "bench" and "floor" work. Round or hexagon piston rod. Butts and peins in various sizes and shapes are available. DELIVERY EX STOCK.

N.B. Illustrated brochures, with specifications, of these and other Holman Pneumatic tools await your request.



Floor Type. Note simple control lever and hose connection angled for convenience (this may be acute or right angle).

Bench Type. Especially suitable for foundry work. "Straight" or "angled" hose connection.

TYPE	SIZE	L'TH ins.	WT. lb.
BENCH	0	17	9
BENCH	10	23	18
FLOOR	20	48	22
FLOOR	30	47	27

HA 7

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Raw Material Markets

Iron and Steel

The engineering foundries have good orders on hand for castings for the motor, tractor, and agricultural-implement trades, which have heavy export programmes. With the calls for castings from other users, including the electrical, gas, and allied trades, and plant and machinery for the export market, the engineering foundries are obtaining much higher outputs than for some time past, and in some instances have found it necessary to put on additional shifts. Their requirements of pig-iron have increased proportionately. They would like to secure larger tonnages of the low- and medium-phosphorus grades, but production is insufficient to meet all their needs, which are being augmented with other grades, chiefly hematite and refined iron.

The hematite makers have so far been able to satisfy as have also the refined-iron makers, but with home and export business to meet some of the refined-iron producers are now fully covered. The engineering foundries are also taking up supplies of Derbyshire high-phosphorus iron, which is in short supply because of reduced outputs from that area. The blowing-in of other furnaces will alone relieve the position.

Other foundries are not engaged at anything approaching the level of the engineering establishments. Fluctuating demands are made for castings from the jobbing foundries, and many of the light foundries could undertake a larger amount of work, as home requirements, together with the orders on hand for castings for the export market, are not heavy and do not ensure maximum production. The pig-iron they need is readily available, and could be secured in sufficient quantities to enable them to obtained increased outputs.

Steelmaking pig-iron is in good supply, and the raising of the price of basic iron from £9 17s. 6d. to £10 5s. 6d. as from May 1 will not affect the demand.

Scrap supplies meet immediate needs, but available parcels of suitable cast-iron and steel cupola scrap are readily accepted.

Foundry coke is being received in scheduled quantities. Ganister, limestone, firebricks, and ferro-alloys are obtainable to meet requirements, although extended delivery is still called for in the case of firebricks.

Outputs of all grades of sheets, both black and galvanised, are fully booked, and re-rollers have orders on hand to replace production for many months ahead. The amount of business available far exceeds output capacity.

Non-ferrous Metals

The tin market finished last week with a burst of strength. Nevertheless, on the week's trading, and in comparison with the previous Friday, the market was lower by £2 or so. Lead advanced by £2 last week to £88, this rise coming as a result of the improvement in the New York quotation. The recovery in lead has been rather surprising in view of all the talk about over supplies of this metal. In fact, it is only a few weeks ago that a general impression prevailed of a further fall in lead from £84. So the situation changes, and partially, no doubt, this better sentiment must be ascribed to the firmer tone prevailing in copper and zinc.

United Kingdom zinc prices were increased by £2 per ton to £97 10s. per ton on Tuesday. On the previous day the United States price moved up by ¼ per cent. per lb.

Metal Exchange tin quotations were as follow:—

Cash—Thursday, £587 10s. to £587 15s.; Friday, £589 10s. to £589 15s.; Monday, £589 15s. to £590; Tuesday, £589 to £589 5s.; Wednesday, £593 15s. to £594.

Three Months—Thursday, £587 10s. to £588; Friday, £589 10s. to £590; Monday, £591 5s. to £591 15s.; Tuesday, £589 to 591; Wednesday, £593 15s. to £594.

Commodities, on the whole, are looking very firm, although it is true that rubber took a toss last week after the quotation had been pushed up to an unduly high level. Towards the end of last week a section of the non-ferrous industry here appeared to have persuaded itself that a further rise in both copper and zinc was imminent. Last Friday, for example, there were would-be buyers who seemed to be convinced that the week-end would bring an increase in the American quotation. Copper is particularly favoured for an advance and, in fact, it does seem not unlikely that the quotation will level off at 20 cents before long, but US consumers must now be well bought and quieter times are overdue. It is quite certain that at 19½ cents all copper producers are carrying good profits and are very well satisfied to be marketing their product at such a lucrative price.

The Minister of Supply intimated in the House of Commons on Tuesday that he was not at present prepared to abandon bulk buying of lead as the relative abundance of the metal might prove to be only temporary. Asked if he would now allow private merchants to import lead under a system of currency allocation, the Minister said that the existing arrangements enabled the Government to obtain maximum supplies of sterling metal and to control effectively the expenditure of dollars and other hard currencies. He said that the selling price of virgin lead in the United Kingdom was no higher than in the United States and the chief Continental countries.

Naturally enough the bullish sentiment in regard to virgin metals has had its repercussion on the scrap market. Prices have not settled down since the increase in copper and zinc, and it is far from easy to assess the values of the various grades. The general impression is that the secondary metal market is "talking" itself up to a higher level, for holders of material lose no opportunity to boost their wares. Consumers are, of course, doing their best to combat this inflationary trend, which, in the long run, unless checked, is going to prove a bad thing for the trade. Whatever may be happening across the Atlantic, there is certainly no boom in the non-ferrous industry on this side; in fact, these high prices are going to discourage the use of semis.

The Ministry of Supply has contracted to buy 96,000 metric tons of virgin aluminium from Aluminium, Limited, of Canada, during 1950. Total imports of virgin aluminium from Canada during 1950 are expected to reach about 136,000 tons, comprising 96,000 tons from the new contract and about 40,000 tons under the 1949 contract. In 1949, when 161,000 tons were imported from Canada, stocks rose above the level considered necessary. During 1950 stocks will be reduced to the required level. These imports from Canada, together with aluminium from European and home production, will provide an adequate supply for the United Kingdom fabricating industry, which in 1949 used 181,500 tons. Britain's imports of aluminium from Canada are paid for by Marshall aid dollars; since the beginning of Marshall aid 300,000 tons of Canadian aluminium have been paid for in this way.

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

(Delivered, unless otherwise stated)

May 3, 1950

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £10 4s.; Birmingham, £10 0s. 6d.

Low-phosphorus Iron.—Over 0 10 to 0.75 per cent. P, £11 15s. 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 2s. 6d.; South Zone, £12 5s.

Scotch Iron.—No. 3 foundry, £11 18s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £12 14s. 6d.; South Zone, £12 17s.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £13 4s. 6d.; South Zone, £13 7s.

Cold Blast.—South Staffs, £15 16s. 6d.

Hematite.—Si up to 2½ per cent., S & P over 0.03 to 0.05 per cent.; N.-E. Coast and N.-W. Coast of England, £11 16s. 6d.; Scotland, £12 3s.; Sheffield, £12 9s.; Birmingham, £12 15s.; Wales (Welsh iron), £11 16s. 6d.

Spiegeleisen.—20 per cent. Mn, £17 8s.

Basic Pig-iron.—£10 5s. 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., £25 14s. 8d.

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, £162; high-grade fire-refined, £161 10s.; fire-refined of not less than 99.7 per cent., £161; ditto, 99.2 per cent., £160 10s.; black hot-rolled wire rods, £171 12s. 6d.

Tin.—Cash, £593 15s. to £594; three months, £593 10s. to £594; settlement, £594.

Zinc.—G.O.B. (foreign) (duty paid), £97 10s.; ditto (domestic), £97 10s.; "Prime Western," £97 10s.; electrolytic, £98 5s.; not less than 99.99 per cent., £99 15s.

Lead.—Good soft pig-lead (foreign) (duty paid), £88; ditto (Empire and domestic), £88; "English," £89 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, all English destinations, £113 10s.; rolled zinc (boiler plates), all English destinations, £111 10s.; zinc oxide (Red Seal), d/d buyers' premises, £92 15s.

Other Metals.—Aluminium, ingots, £112; antimony, English, 99 per cent., £160; quicksilver, ex warehouse, £17 7s. 6d. to £17 10s.; nickel, £321 10s.

Brass.—Solid-drawn tubes, 16⅝d. per lb.; rods, drawn, 23d.; sheets to 10 w.g., 20⅜d.; wire, 21⅜d.; rolled metal, 19⅝d.

Copper Tubes, etc.—Solid-drawn tubes, 18⅜d. per lb.; wire, 182s. 6d. per cwt. basis; 20 s.w.g., 209s. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £101 to £115; BS. 1400—L.G.3—1 (86/7/5/2), £110 to £122; BS. 1400—G1—1 (88/10/2), £158 to £200; Admiralty GM. (88/10/2), virgin quality, £185 to £195, per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £162-£210; L.P.Bl, £120-£128 per ton.

Phosphor Bronze.—Strip, 28⅜d. per lb.; sheets to 10 w.g., 30⅜d.; wire, 30⅜d.; rods, 28½d.; tubes, 33½d.; chill cast bars: solids, 28½d., cored, 29½d. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 1s. 10½d. per lb. (7%) to 2s. 8½d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 2s. 4½d. (7%) to 3s. 2½d. (30%); to 12 in. wide, × .056, 2s. 4½d. to 3s. 2⅝d.; to 25 in. wide × .056, 2s. 6½d. to 3s. 4⅝d. Spoon and fork metal, unshcared, 2s. 2⅜d. to 3s. 1d. Wire, 10g., in coils, 2s. 9½d. (10%) to 3s. 8d.; (30%). Special quality turning rod, 10% 2s. 8½d.; 15%, 3s. 1d.; 18%, 3s. 5½d.

Personal

MR. AND MRS. ANDREW M. HUNTER celebrated their golden wedding last week. Mr. Hunter is a director of A. & J. Hunter, Limited, brass and iron founders, of Ayr.

MR. A. TONKS, northern region manager for George Salter & Company, Limited, spring makers and iron-founders, of West Bromwich, has retired after 59 years' service with the company.

DR. R. HARGREAVES, formerly technical manager of the Aero Piston Ring Company, Limited, Leeds, has joined the Tiltman Langley Laboratories, Limited, Redhill (Surrey), as chief metallurgist.

MR. FRANK L. DUNN, who has been with Jury Holloware (Stevens), Limited, Brierley Hill (Staffs), for 18 years, has received presentations on leaving to take up an appointment in Rhodesia.

MR. J. H. WEARS, O.B.E., who has recently retired from the position of works manager of the English Electric Company, Limited, Stafford, after 22 years with the company, has been presented with a car radio set by the workers in the foundry and welding departments.

DR. C. M. MOIR and MR. R. SUMMERS have been appointed chairman and vice-chairman, respectively, of the Scottish branch of the Institution of Structural Engineers. Other appointments include MR. J. CAMERON as hon. treasurer and MR. D. C. DRUMMOND as hon. secretary.

DR. J. W. ARMIT, a director of Imperial Chemical Industries' Wilton plant, has been elected president of the Tees-side Chamber of Commerce in succession to MR. T. H. SUMMERSON, chairman of Thomas Summerson & Sons, Limited, manufacturers of railway plant, etc., of Darlington.

MR. K. G. LEWIS, head of the Department of Science and Metallurgy at the Constantine Technical College, Middlesbrough, has been appointed Principal of Kenrick Technical College, West Bromwich, in succession to MAJOR R. PRESCOTT, who will retire at the end of the present term.

MR. A. A. TRIGG, chief engineer of the Parker Construction Company, Limited, Nottingham, has been elected chairman of the East Midlands centre of the Institution of Incorporated Plant Engineers. The new vice-chairman is MR. B. A. CLARK, technical director, Clark's Dye Works, Limited, Retford.

SIR HOLLAND GODDARD, chairman and governing director of Wadkin, Limited, Leicester, and chairman of the National Steel Foundry (1914), Limited, Leven (Fife), and MR. W. J. MORGAN, secretary of the Machine Tools Trade Association, are in Canada to represent seven U.K. engineering firms at the Canadian International Trade Fair at Toronto.

MR. E. FLINTHAM, secretary of the Wolverhampton branch of the Institute of Welding since 1944, has retired, his place being taken by MR. J. R. THOMAS, group welding engineer to the John Thompson Engineering Company, Limited, Ettingshall Works, Wolverhampton. MR. HOWARD THOMPSON has been re-elected president of the branch and MR. C. SPENCER, of Bayliss, Jones & Bayliss, Limited, Wolverhampton, elected chairman.

MR. BERNARD THOMAS, a former president of the Staffordshire Iron and Steel Institute, and, at one time, technical manager of Edward Elwell, Limited, edge-tool manufacturers, of Wednesbury (Staffs), has been appointed chairman of the Birmingham area section of the Institute of Metals. Because of pressure of work, Mr. Thomas has been forced to relinquish the appointment he has held for 20 years as visiting lecturer on metallurgy and heat-treatment of metals to the County Technical College, Wednesbury.

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

CHIEF BUYER seeks change; 20 years' experience purchase engineers' tools and stores, raw materials for steel, iron and brass foundry production and negotiation large contracts; wide range of suppliers' light and heavy industries; capable of operating modern record system and controlling purchasing department staff; ability to co-operate fully with colleagues at all levels.—Box 422, FOUNDRY TRADE JOURNAL.

FIRST-CLASS MOULDER (37) (I.B.F.), residing Manchester area, wide experience ferrous and non-ferrous founding, seeks post as REPRESENTATIVE in foundry supply industry; car owner, 'phone; will travel anywhere.—Box 410, FOUNDRY TRADE JOURNAL.

FOUNDRY EQUIPMENT DESIGNER seeks progressive position offering scope for initiative and inventive ability; excellent technical, practical experience and qualifications; go anywhere.—Apply Box 420, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER (36); sound practical, theoretical, managerial ability; 10 years executive in hydraulic, pneumatic castings; iron, non-ferrous; jobbing, mechanised.—Box 408, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN or WORKING FOUNDRY FOREMAN seeks change; 30 years' foundry experience; age 44; with practical experience of all non-ferrous alloys, practical moulder, bench, oddside or floor, with experience of complete control of all sections of foundry; willing to train unskilled labour; small foundry Southern England preferred, but not essential.—Box 424, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

APPRENTICE TRAINING.—A unique opportunity is offered to one interested in youth activities and experienced in the work of an Iron Foundry to instruct in a Foundry Apprentice Training Centre. He will be required to teach practical green and dry sand moulding and core making, together with elementary foundry calculations and science.—Applications in writing, giving age and present salary, details of practical, technical and youth work experience, should be addressed to the PERSONNEL OFFICER, Newton, Chambers & Co., Ltd., Thorncliffe, Sheffield. Previous applicants need not re-apply.

GOOD class MOULDERS required; accustomed to green sand, dry sand and loam, and general hematite castings; houses available.—MILLOM & ASKAM HEMATITE IRON CO., Millom.

FOUNDRY FOREMAN required; must have extensive experience of floor and machine moulded castings in grey iron up to 5 tons; for Foundry in the Midlands; good salary and prospects for right man.—Box 390, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

AN old-established Iron Foundry requires a GENERAL MANAGER; applicants should be between, say, 35 and 50 years of age; they should have a first-class technical background, have the ability to make developments, and to be solely responsible to the Board for the total economic operation and capital expenditure of the foundries.—Full details, including salary bracket, in confidence, to Chairman, Box 378, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN required for East London Jobbing Grey Iron Foundry; only men with first-class experience need apply; must be capable of controlling and training labour, and have a sound and practical experience.—Write, giving details of proven ability; salary £550 per annum; good prospects for the right man.—Box No. 185, W.B.G., 39, Cheapside, E.C.2.

FOUNDRY SUPERINTENDENT required by North-East Coast Jobbing Foundry making approximately 100 tons castings per week in green sand, dry sand and loam; only those with first-class practical experience all branches need apply; the post is permanent and progressive.—Apply Box 412, FOUNDRY TRADE JOURNAL.

FOUNDRY SUPERINTENDENT, C.I., M.I., and non-ferrous, required immediately for well-known Engineering firm in Leicestershire; wide practical experience in machine and floor moulding in up-to-date mechanised plants essential; only those who can handle a mixed labour force with understanding and efficiency need apply.—Write full details experience, age, and salary expected, to Box 418, FOUNDRY TRADE JOURNAL.

FOUNDRY SUPERINTENDENT, with commercial experience, age 35/45, for 50/60 ton per week Foundry in North-West; must be fully experienced in semi-repetition, loose and machine moulding up to 1 ton; excellent opportunity for good organiser in addition to above qualifications.—Write in confidence, stating age, experience, salary expected, to Box 368, FOUNDRY TRADE JOURNAL.

MIDLAND Mechanised Foundry (Grey Iron) require the following personnel :—WORKS' ENGINEER, METALLURGIST, PROGRESS AND PRODUCTION MANAGER. Applicants must have held similar positions. All these positions are covered by the Organisation's Superannuation Scheme. Replies will be treated in strict confidence. Our own staff is aware of this advertisement.—Reply, stating age and experience, Box 416, FOUNDRY TRADE JOURNAL.

WANTED.—Skilled IRON MOULDER for small Iron Foundry producing Castings for Refrigerator Compressors; to assist foreman as working charge hand; good opportunity for energetic young man.—Apply TERRY, Longford Engineering Co., Ltd., Bognor Regis.

SITUATIONS VACANT—*Contd.*

MANAGER required for Light Castings Foundry in East Midlands doing substantial and profitable business; only men with executive ability and with approximately £5,000 capital need apply; present managing director intends gradually to retire owing to ill-health; applicant will be able to acquire controlling interest in business over an agreed period.—Reply to Box 428, FOUNDRY TRADE JOURNAL.

METALLURGICAL ENGINEER (age 30/35 years) for Alloy Steel Foundry, Sheffield district, engaged in the production of High Quality Corrosive and Heat-Resisting Steel Castings, by Static and Centrifugal methods; the position is progressive, and offers good prospects; initiative and energy are essential; commercial experience an advantage.—Write, stating full details of career, etc., qualifications and salary required, to Box 374, FOUNDRY TRADE JOURNAL.

REQUIRED for Blackheath, Birmingham, ASSISTANT MANAGER, 30/35 years of age, for Alloy Steel Foundry; must be accustomed to the production of High Quality Corrosive and Heat-Resisting Steel Castings, by Static and Centrifugal methods; initiative and energy are essential; commercial experience would be an advantage.—Write, stating full details of career, etc., qualifications and salary required, to Box 376, FOUNDRY TRADE JOURNAL.

TRAINEE REPRESENTATIVE, 20/30 years, required by Birmingham Firm of Foundry and Engineering Agents operating in Midlands; previous selling experience not essential, but knowledge of foundry or engineering practice helpful.—Apply Box 414, FOUNDRY TRADE JOURNAL.

TOOL ROOM in the North-East, engaged on the manufacture of Gravity Dies for Aluminium and Brass Castings, has vacancy for a first-class WORKING FOREMAN with experience; staff position, with good salary, bonus, and excellent prospects for live wire, with energy and ambition; housing accommodation will be provided in due course if necessary.—Box 406, FOUNDRY TRADE JOURNAL.

WANTED.—Experienced CLERK, to take charge of progressive Foundry Office in Swansea area; state experience and salary required.—Apply Box 270, FOUNDRY TRADE JOURNAL.

BUSINESSES WANTED

BLACKHEART Malleable Iron Foundry required, with capacity for subcontract work or willing to dispose of part or whole of output or business.—Write Box 388, FOUNDRY TRADE JOURNAL.

IRONFOUNDERS require to purchase or lease small Foundry, Manchester district, preferably with small machine-shop attached; not necessarily going concern.—State particulars, Box 426, FOUNDRY TRADE JOURNAL.