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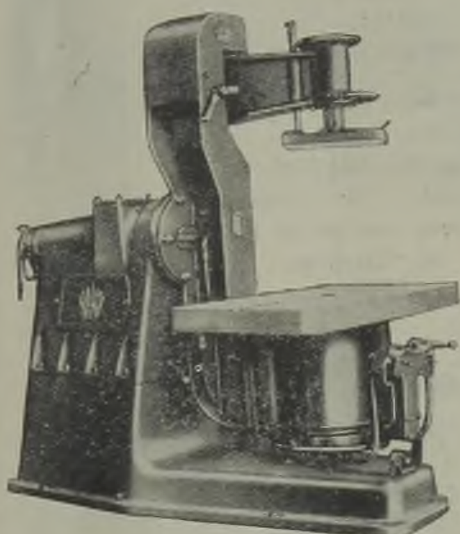

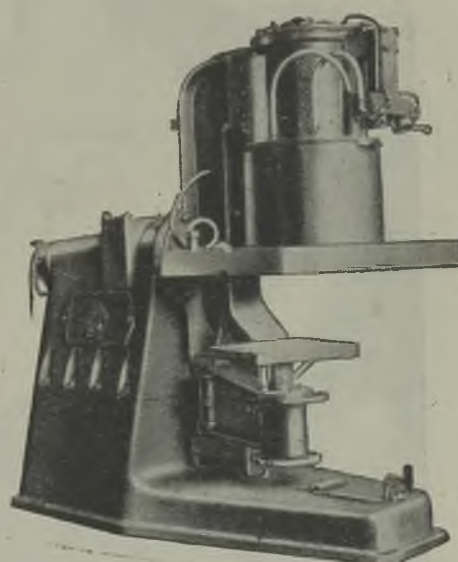

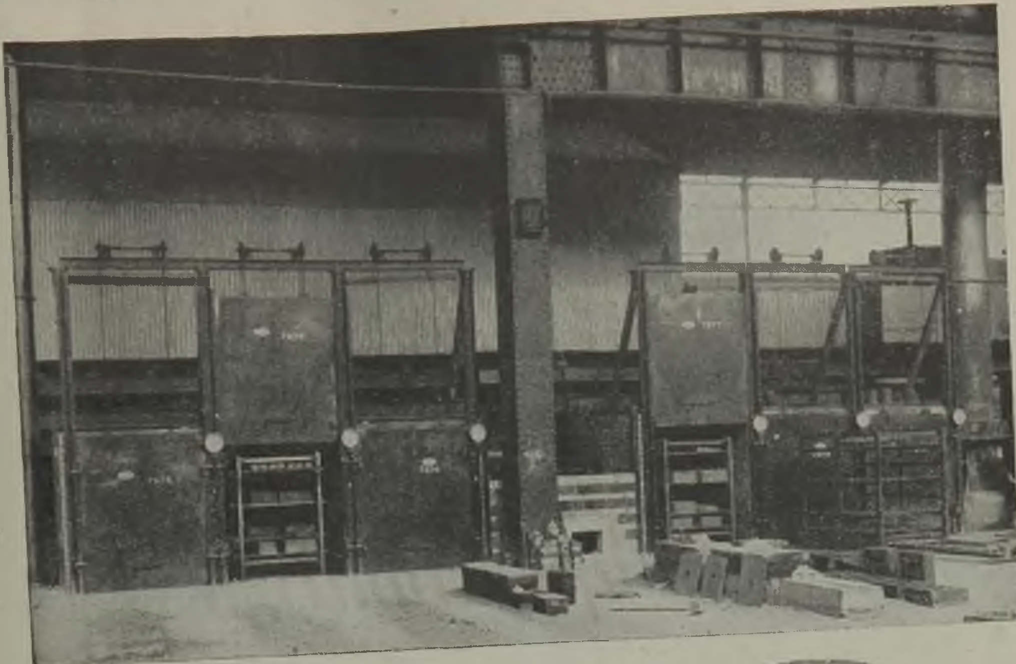

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FOUNDRY TRADE JOURNAL

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Peacetime Priorities and Controls

Now that victory is not too far off, the Press is carrying correspondence and signed articles urging the release of man-power and materials for the resuscitation of this or that industry. No doubt these claims are honest and praiseworthy, but they only underline the necessity for the continuation of controls. As we see this post-war world looming ahead, it appears to us that a simple system of industrial priorities needs immediate enunciation. Very high in the list we would place rehousing, because until this problem has been resolved, a very large section of the population will be disgruntled, and but little interested in the manufacture of goods for export, or even in materials essential for the rehabilitation of the Continent. The " man in the street " is not the least bit interested in long-term policies, and town and country planning, if he lacks his own fireside. In plain fact, the pressing problem is not one of new houses, but the permanent repair of existing property, using any and every material available. We are of opinion that this alone will tax to capacity the foundries making rainwater goods, flushing cisterns, baths, and all other types of domestic castings. The envisaged mass production of Portal houses will necessitate the production of many thousands of additional castings, and these should be in production now. Houses *per se* are useless unless furnishable, and here we would draw attention to the letter which Mr. W. C. Devereux wrote to " The Times " last week. He, in common with other manufacturers, is anxious to get busy with the provision of this type of material, but can do little until permission, at present withheld, is given to inaugurate a planning department, and obtain materials wherewith to experiment.

The vast problems confronting industry demand, before production is started, a small army of designers, draughtsmen, jig and tool men, layout experts and the like. Munition contracts are being curtailed; men and women are being laid off, clearing up, or are just wasting time. In the United States, the authorities are announcing weekly that permission has been accorded to industry to make so many gas cookers, electric irons, refrigerators, and so forth during the next quarter. There is so much to be done in this country, and perhaps this is the very reason why no relaxation is being given for fear a mistake is made and some sections of industry will claim a priority on the ground of national urgency. There is one matter which should be stressed, and that is when permission is accorded to any section of the industry to go ahead with peacetime manufactures, there will be a hold up unless consideration is given to the foundry industry.

There are dozens of foundries normally working for the textile industries; these would be grossly understaffed on a return to peace conditions. This is typical of most industries, and wisdom would be shown in giving priority to what, as its very name implies, is a fundamental industry. Yet planning does not start even here, for the manufacture of castings requires raw materials and machinery, and for some of these things urgent priorities for other purposes may impose difficulties. Yet for any well organised manufacturing community the existence of an intelligently operated and adequately equipped foundry industry is an essential. The priorities accorded in wartime, first for the Navy, then for the Air Force or Army, are likely to be followed in peace by clamour for exports, for ensuring food imports, for housing, for agriculture, and for transport. Thus there is every reason for the continuation of controls, but of the adventurous and not the restrictive type. Moreover, it is high time they got busy.

Contents

WORKMEN'S COMPENSATION

ADJUSTMENT OF PREMIUMS FOR 1944-45

Under the workmen's compensation scheme, if cover against the liability of the Acts is required, it must come through ordinary insurance companies, as there is no actual Government insurance scheme, and insurance is not compulsory (except for a limited extent to coal-mining), but the liability upon employers (increased by wartime measures) is continually present should that occur covered by the Acts (injury by accident or industrial disease).

Notwithstanding that there is no actual statute, there is an arrangement between the Home Office and the Accident Offices Association so that premiums are adjusted up or down each year. Whether premiums are increased or a rebate follows is dependent upon the result of a yearly balance sheet made up to December 31 each year, adjustments then being made from the following July.

On one side, the premiums side, appears the amount for premiums received, etc.; on the other side, the losses side, the amount paid in compensation or set aside. The proportion the losses amount bears to the premiums amount is then ascertained in percentage figures, this being the actual "loss ratio." This percentage is then set against a fixed "loss ratio" laid down in the scheme (now 70 per cent.), and if the actual "loss ratio" comes under this 70 per cent., the difference (if more than $\frac{1}{2}$ per cent.) applies for a rebate in premiums; if it comes to more than the 70 per cent., an increase in premiums would follow. But since 1924 there have always been rebates, ranging from 2.16 to 14.32 per cent.

The balance sheet operative for present adjustments (ending December 31, 1943) shows on the premiums side £6,660,738, on the losses side £4,171,041; thus an actual loss ratio of 62.62 per cent. applies. Taking this from the 70 per cent. means a difference of 7.38 per cent., so on all premiums falling due between July 1, 1944, and June 30, 1945, there will be a rebate of 7.38 per cent.

The employer's liability may now, as regards "weekly payments" (payable for disablement), reach 50s. weekly, or, if there are children, more (*e.g.*, man, wife and two children, £3); and as regards lump sum compensation (payable where death results), this may now reach £700 if there are children, and £400 without children.

Mr. P. Bennett has relinquished his position with Campbell & Gifford, Limited, consulting engineers, Weybridge, and has joined the foundry equipment department of Wallwork Gears, Limited, Oceanic House, Cockspur Street, London, S.W.1.

DOUBLE SUMMER TIME

When Double Summer Time ends all time-recording clocks should be stopped for one hour, and on no account should they be turned back.

NOTES FROM THE BRANCHES

London Branch (*East Anglian Section*).—A party of 24 members of the Section visited the works of Lake & Elliot, Limited, Braintree, Essex, on August 24. The visitors were welcomed by Mr. G. J. Lake. The tour included the ironfoundry with cupolas and sand preparation plant, the steel foundry with its converter and electric-arc furnaces, the core shops, heat-treatment department, trimming shop, pattern shop and laboratory. After the inspection, the party was entertained at tea, and immediately following this an ordinary meeting was held in the canteen. Mr. D. Carrick, senior vice-president, in the absence of the president, Mr. C. H. Kain, occupied the chair.

The American sound film, entitled "Wartime Calls on Women to Make Aluminium Air-Cooled Cylinder Heads," was shown. At the conclusion, Mr. Lake expressed the hope that the visitors had enjoyed the visit and the film. In reply, on behalf of the visitors, Mr. Carrick proposed a vote of thanks to the management for their kind permission to inspect the works, and for the hospitality which had been provided, and to the guides for their ready co-operation in answering questions throughout the tour. This was seconded by Mr. R. F. Coates, and was carried with acclamation. The secretary announced that the Section would next meet for the closing meeting of the Session, on September 28, in the Lecture Hall of the Central Library, Ipswich, at 6.45 p.m., when a "Foundry Inquest" would be held, at which specimen castings from several of the firms in the district would be put forward for comment and discussion.

IRONFOUNDRY FUEL NEWS—XX

As the drying or baking of moulds or oil sand cores is a comparatively low-temperature process, it should be done wherever possible by heat which is wasted from processes carried out at higher temperatures. It is, of course, unfortunate that there are so many practical difficulties in the way of using the waste gases from the cupola for such purposes, but the use of waste heat from, say, annealing furnaces is a much simpler proposition. One foundry in Lancashire has two adjoining annealing furnaces, but under present conditions is only needing to use one of them. It was found that the heat conducted through the common wall was sufficient to raise the temperature of the empty furnace sufficiently for the baking of oil sand cores, so the furnace is now used for this duty.

A second foundry, in Derbyshire, operating a number of producer-gas-fired annealing furnaces, uses the waste gases from these furnaces for the heating of all the drying stoves. The fuel consumption in these stoves would amount to about 400 tons a year if they were separately fired. This firm, incidentally, has also changed over from lump coal to producer gas for ladle drying with a net saving of at least 45 tons of coal a year, in addition to the improved working conditions resulting from smoke reduction.

FIRST REPORT ON THE BASIC CUPOLA BY THE MELTING FURNACES SUB-COMMITTEE*

Examination of results obtained in practice with basic-lined cupolas

The constitution of the Melting Furnaces Sub-Committee of the Technical Committee is as follows:—L. W. Bolton (convener), F. A. Rivett (secretary), P. A. Davenport, V. C. Faulkner, J. F. Gist, J. Jackson, E. Morgan, M.Sc., E. S. Renshaw and E. Shaw. Corresponding Members:—C. H. Kain, F. K. Neath, B.Sc., and H. H. Shepherd. J. W. Gardom (convener), Technical Committee. J. Bolton (acting secretary).

INTRODUCTION

One of the most serious restricting factors in the use of cupola melting for certain applications is the inability to reduce sulphur and phosphorus contents during the melting operation. In normal cupola practice, acid, *i.e.*, firebrick and ganister, linings have invariably been used, and with this type of lining it is not possible to obtain the basic slag necessary for desulphurisation and dephosphorisation. Recent improvements in basic refractories, and particularly the development of a basic patching material, have caused renewed interest in the possibilities of achieving these objects in a basic-lined cupola.

In the past the great disadvantage of burnt dolomite as a cupola lining material has been that on contact with atmospheric moisture it hydrates and disintegrates. This feature also precluded the use of a wet patching material for repairs. A new stabilised dolomite clinker has now been produced,[1] and is available both as a ramming material for the preparation of monolithic linings and also in the form of bricks. A stabilised dolomite cement has also been developed which can be mixed with water and applied as a patching material very much in the same way as ganister is used in an acid cupola. Some details of the properties of these materials are given in Table I. The patching can be successfully applied to other basic refractories such as magnesite and chrome magnesite bricks.

The first details of the use of these materials in a production cupola were published by Renshaw,[2] and dealt mainly with the opportunities for desulphurisation which a basic lining affords. The Melting Furnaces Sub-Committee in investigating this subject has had made available to it further information, which opens up other very interesting possibilities, particularly with regard to the question of dephosphorisation. While the Sub-Committee is still actively engaged in examining the results obtained in practice with basic-lined cupolas, it feels that the information at present available is of sufficient interest and importance to warrant the publication of this First Report, which gives an account of the work carried out to date. The thanks of the Sub-Committee are due particularly to Mr. E. S. Renshaw and to the management of the Ford Motor Company, Limited, Dagenham, Essex, for permission to publish the results of the preliminary experiments on dephosphorisation. The Sub-Committee wishes also to record its indebtedness to Mr. E. Shaw and the Refractory Brick Company of England, Limited, for data regarding the stabilised dolomite materials.

* Presented to the Forty-first Annual Meeting of the Institute of British Foundrymen.

Previous Work

Several references are made in the literature to the use of basic cupolas, but usually these were unsuccessful, partly because no satisfactory method of patching had been developed, and also because of the difficulty of keeping moisture from the sintered dolomite linings used. The most important published information is contained in a Paper by Heiken,[3] who used basic cupolas between 1905 and 1928, at first experimentally and later on a full production scale, for steel making by the converter process.

The main object in using a basic lining was to obtain metal of low sulphur content from the cupola, but other factors noted by this author are of interest. It is also of interest to note that the work on desulphurisation by Renshaw previously mentioned and also that on dephosphorisation, to be dealt with later in this report, was carried out without knowledge of the results of Heiken.

The first experiments reported by Heiken were carried out in a cupola of 20 in. diameter lined with magnesite bricks. A highly basic slag was produced by additions of dolomite and fluorspar. Using charges of 40-60 per cent. hematite pig-iron and 60-40 per cent. steel scrap, the average sulphur content of the molten metal was reduced to 0.017 per cent. This compared with an average figure of 0.077 per cent., using similar charges in a furnace with an acid lining. The carbon content increased from 2.85 per cent. average from the acid furnace to 3.69 per cent. with the basic lining. The phosphorus content of the metal fell from an average of 0.091 to 0.059 per cent. in the basic cupola, a phosphorus reduction of 35 per cent. simultaneously with the removal of sulphur. The average silicon content of the metal from the acid-lined cupola was 1.66 per cent., but the same charges yielded a silicon content of an average of 0.56 per cent. in the basic furnace.

In view of the success in obtaining desulphurisation, which on these figures was 78 per cent. effective, Heiken eventually changed over all the cupolas in the plant to basic linings, using, instead of magnesite bricks, a rammed lining of dolomite bonded with anhydrous tar. The results continued to be satisfactory, but with increased furnace output and with increasing steel scrap and decreasing hematite in the

Melting Furnaces Sub-Committee

charges, the sulphur content of the molten metal showed an increase, although it remained within permissible limits. Heiken noted that the increase in sulphur corresponded with a decrease in the amount of silicon charged (*i.e.*, with a reduced amount of hematite in the charges). The effect of adding silicon in the form of 12 per cent. silicon ferro-silicon was examined. Using charges of 88 per cent. steel scrap and 12 per cent. of ferro-silicon, a considerable increase in the sulphur content of the metal was found to occur. This was attributed to heavy oxidation of silicon when charged in this concentrated form, which caused a decrease in the basicity of the slag. When the required silicon content of the charges was obtained by the use of hematite there was less danger of oxidation taking place. To support the view that oxidation reduced the efficiency of the desulphurisation, Heiken showed that the sulphur content of the metal increased slightly during the blowing down period as the cupola emptied. This effect was noted even when using 50/50 mixtures of hematite and steel scrap.

The high pick up of carbon experienced in the experimental melts in the small cupola was confirmed in normal production and with charges containing 50 per cent. steel scrap, carbons of 3.85-4.37 per cent. were obtained. When charges containing no steel were melted large quantities of kish graphite were thrown out by the molten metal on cooling. The sulphur content of the metal produced from charges containing 50 per cent. steel scrap was generally below 0.02 per cent., rising to slightly over 0.03 per cent. in the last metal tapped. With a manganese content charged of 1.22 per cent., the molten metal contained about 1.0 per cent. manganese.

Heavy wear on the linings was experienced, but this was of assistance in maintaining a highly basic slag. By taking suitable precautions it was possible to prolong the life of linings in cupolas of 30-36 in. bore to enable melts of approximately 40 tons to be obtained. The lining had to be rammed to its original size after each day's melt. Because of the height of the cupolas, receivers could not be used, and the metal was collected in the well, each converter charge being tapped out in portions. It was considered that the use of a receiver would have enabled the metal to be held in contact with the slag for longer periods, and yielded more uniform and complete desulphurisation with a longer lining life.

Use of Stabilised Dolomite as a Lining and Patching Material

Experience has been obtained with monolithic linings prepared from dolomite clinker and using the special patching material for repairs. The main points arising in connection with the use of these materials are shown in Table I.

Installation of the Monolith

The basic lining should have a thickness of 9 in., and should extend from the bottom of the shell to a height of at least 4 ft. 6 in. above the tuyeres. If

TABLE I.—*Properties of Stabilised Dolomite Materials.*

A.—STABILISED DOLOMITE RAMMING MATERIAL.

SIEVE ANALYSIS.

B.S.S. screens	+ 7	−7 +25	−25 + 72	−72 +150	− 150
	Nil	30	30	15	25

CHEMICAL ANALYSIS (TYPICAL SAMPLE).

Loss on Ignition.	SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO
Nil	21.34	3.15	2.20	35.30	38.19

PACKING DENSITY.

(*a*) Dry.	(*b*) 6 per cent. Water.
2.45 gm. per ml. = 153 lb. per cu. ft.	2.35 gm. per ml. = 147 lb. per cu. ft.

Dried Strength (after 24 hr. air drying).—Circa. 150 lb. per sq. in.

Strength at Elevated Temperature.—Briquette held for 1 hr. at 1,100 deg. C. under load of 100 lb. per sq. in. is unaffected.

Thermal Expansion (20 to 1,000 deg. C.).—1.5 per cent.

Refractoriness.—1,800 deg. C.

Thermal Conductivity.—Mean Temperature, 700 deg. C. 7.5 B.Th.U. per sq. ft./in./hr./deg. F.

B.—STABILISED DOLOMITE PATCHING MATERIAL.

SIEVE ANALYSIS.

B.S.S. screens	− 25 + 72	−72 +150	− 150
	15	25	60

17 to 18 per cent. water necessary for plastic consistency.
Air setting period, 4 hr. Drying shrinkage, 1.0 per cent.
Refractoriness, 1,730 deg. C.

C.—STABILISED DOLOMITE BRICKS.

CHEMICAL ANALYSIS (TYPICAL SAMPLE).

SiO_2	Fe_2O_3	Al_2O_2	CaO	MgO
15.1	3.2	2.0	39.1	40.6

Hydration Resistance.—Withstands 24 hours' boiling in water.

Porosity.—20 per cent.

Bulk Density.—2.71 gm. per ml. (169 lb. per cu. ft.).

Specific Gravity.—3.39.

Cold Crushing Strength (Tested on end).—Over 8,000 lb. per sq. in.

Permeability.—0.10 cgs. units.

After Contraction (2 hours at 1,500 deg. C.).—0.4 per cent.

Refractoriness-Under-Load (25 lb. per sq. in. maintained 2 hours at 1,500 deg. C.).—5.0 per cent. subsidence.

Refractoriness-Under-Load (50 lb. per sq. in. Rising temperature).—Initial softening, 1,460 deg. C.; Rapid softening, 1,510 deg. C.; Failure, 1,650 deg. C.

Thermal Expansion (20—1,000 deg. C.).—1.3 per cent.

Thermal Conductivity (700 deg. C. mean).—15.2 B.Th.U. per sq. ft./in./hr./deg. F.

Specific Heat.—0.25.

the cupola is normally provided with a lining more than 9 in. thick, the additional thickness in excess of 12 in. may be made up with acid refractory.

The stabilised dolomite lining material is mixed with 6 per cent. water and 1 per cent. liquid sodium silicate in a small pan mill, the sodium silicate being previously dissolved in the water. The optimum charge is 4-5 cwts., and this takes about 5 min. to mix. In this way a suitable quantity of mix becomes available for ramming. It has been found convenient to add 8-9 per cent. water in the first instance, and to reduce to 7 per cent. by additions of the dry material. The actual ramming is then carried out at a moisture content of approximately 6 per cent. The lining former, which should preferably be sectional, is inserted, and a course of firebricks is placed inside the bottom plate round the bottom of the former to provide a solid foundation for the ramming. Pneumatic rammers with large flat heads appear to be best for carrying out the ramming. Small peg type rammers plough up the material, and leave a loose top layer of 3-4 in., which may dry out in the space of time elapsing between successive mixes, giving a danger of laminations or zones of weakness and high porosity in the lining.

An allowance of $\frac{1}{8}$ in. to the foot is made for expansion of the stabilised dolomite (the actual expansion is 1.5 per cent.) and an appropriate space is left between the ramming and the shell or the backing firebricks. Asbestos, slag wool and asbestos sheeting can be used for this purpose. The sheeting is used to hold the wool in position as ramming proceeds. No expansion allowance is made immediately above the tuyeres, and this space is rammed solid for a height of 12 in., then the expansion allowance is continued. If the expansion allowance were continued from the tuyere level, the air blast might circulate behind the lining and disintegrate it. The lining is taken to the top of the combustion zone, and no neutral course is necessary between the top of the lining and the firebricks of the shaft. The bottom is put in with sand, according to normal practice.

The time required for the installation of a lining depends on the facilities available, but the time required for a cupola of 36-in. bore is of the order of 10 hrs.

Drying

The cupolas in which the first monolithic basic linings were used have holes drilled into the shell to facilitate drying. As stabilised dolomite is air setting, a period of air drying is essential, so that the maximum strength may be developed. Experiments have shown that the air drying period should be of the order of 24 hrs. With a lining 9 in. thick, heating by coke or gas is then required for a further 24 hrs., following which the cupola is ready for service. One lining has actually been in use after a total of 12 hrs.' drying. Although no detrimental effects were observed, this practice is not considered advisable.

Patching

The stabilised dolomite material used for repairs to the lining is mixed in a pan mill with 18 per cent. water. It should be used as quickly as possible, since it also possesses hydraulic setting properties which are accentuated by the fineness of the material.

Lining Life

The life obtainable from a stabilised dolomite monolithic lining is important, because the cost of materials and installation is several times as great as that of a firebrick lining. The information so far available on lining life applies only to cupolas worked in such a way that desulphurisation is obtained, *i.e.*, with a minimum of oxidation. Under these conditions a cupola melting metal of ultimate composition T.C 2.80, Si 1.50 per cent. gave a lining life in the combustion and melting zones of 12 to 16 weeks, equivalent to a total metal throughput of 2,000 tons. The lining in the well withstood 26 weeks' operation, during which approximately 4,000 tons of metal were melted.

Under these conditions the consumption of patching material is similar to that of ganister in an acid cupola engaged on similar service, and is of the order of 60 lbs. per ton of metal melted. The consumption appears sensitive to the melting rate of the cupola, and it is inadvisable to operate at an output greater than 80 per cent. of the maximum obtainable from a given diameter and coke ratio.

Observations on stabilised dolomite linings have shown that in the combustion zone there is a cracking and "tendency to flake" of the working face. This may be due to shrinkage spalling or to inadequate expansion allowance, although it is felt that the latter is extremely unlikely. Due to the high refractoriness of the material, only a slight thickness of the lining sinters ($\frac{1}{4}$ to $\frac{1}{2}$ in.), and it is thought that the cracking phenomenon is due to differences in properties between the sintered working face and the back portion of the lining. The lining ultimately fails apparently due to lack of strength in the back portion of the monolith.

After a certain period of working, the material appears to lose its intergranular cohesion, particularly in the unsintered area approaching the shell. It is thought that this may be caused, in the first place, by contraction cracks which appear on the working face of the lining almost immediately the cupola is dropped after a day's run. Each crack may extend through the fused and sintered areas reaching the base material. After patching and subsequent operation, the cracks on the working face are able to fuse over with the patching material, but the cohesion between the grains may have been permanently impaired.

In the well, there is cracking of the working face, but to a less extent than in the combustion zone. It is thought that slag penetration and seasoning of the lining is responsible for this difference. The resistance of the lining to attack by basic cupola slag is very good.

Improving the Life of Stabilised Dolomite Linings

From the results available, it is believed that it will be possible to improve the life of these materials. An attempt is therefore being made to develop a more durable lining and a more efficient patching material.

Melting Furnaces Sub-Committee

It is felt that the difficulties encountered with the combustion zone could be overcome or minimised by attention to the following factors:—

(*a*) *Ramming Properties.*—The grain size is being investigated with a view to obtaining the maximum density, and hence the minimum porosity. A lining rammed with 6 per cent. water has a porosity of 27 to 30 per cent. It is thought that this could be reduced, in particular by investigation of grading technique.

The amount of water used for mixing is also important. It has been shown that the density increases with the amount of water used for mixing. The water content is limited by the efficiency of the drying-out process and the plasticity of the material. With proper facilities for drying out, *e.g.*, the use of vent rods through holes drilled into the cupola shell, the troublesome factor is the lack of plasticity, and for this reason the water content is at present limited to 6 per cent. It is suggested that attempts be made to improve the plasticity in order to obtain a more satisfactory ramming, and hence greater mechanical strength.

(*b*) *Physical Properties.*—Due to its high refractoriness and the comparatively low temperature of use, the greater part of the lining is not sintered and has little strength. It is thought that attempts should be made to improve the strength by the use of chemical bonds.

(*c*) *Methods of Allowing for Expansion.*—This matter is being investigated, as it is felt that the present method of expansion allowance is not entirely satisfactory.

(*d*) *Improvement in Resistance to Slag Attack.*—It is proposed to study the resistance of these materials to attack by basic slag, iron oxide, coke, ash, etc.

(*e*) *Improvement in Patching Materials.*—The life of a cupola lining is governed to a considerable degree by the general resistance of the patching material, and it may be that improved service will be obtained by improvements in the patching.

The properties of a satisfactory cupola patching material are:—(*a*) Low drying shrinkage; (*b*) low firing shrinkage; (*c*) adequate plasticity for application to the cupola walls; (*d*) refractoriness (although a high refractoriness is necessary, a wide fusion range is required to enable fritting to occur without danger of actual melting); and (*e*) high dry strength for resistance to abrasion before fritting takes place.

Stable dolomite materials have no natural plasticity and, consequently, must be finely ground so that the requisite plasticity may be obtained. Due to the fine grading, the material has a high firing shrinkage. Experiments are in progress to minimise the firing shrinkage without impairing the plasticity. Further experiments are in progress to improve the plasticity of suitably graded, high packing density material by the addition of plastic clay. Alternate patching

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materials may also be investigated, such as serpentine-stabilised dolomite, serpentine-magnesite mixtures, etc.

REFERENCES.

[1] Dolomite Bricks for use in Steel Works. T. Swinden and J. H. Chesters. *Journal Iron and Steel Institute*, 1941, No. 2, Vol. 144.

[2] Basic Cupola Process for Desulphurisation. FOUNDRY TRADE JOURNAL, Vol. 70, No. 1401, June 24, 1943.

[3] Production Results with a Basic Lined Cupola. *Die Giesserei*, No. 43 & 44, October 28, 1934. *See also* FOUNDRY TRADE JOURNAL, Vol. 72, No. 1437, March 2, 1944.

(*To be continued.*)

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

562,750 GLASNER, R. W. Presses for working metal and like operations.

562,776 GLEAVE, W. W., and IMPERIAL CHEMICAL INDUSTRIES, LIMITED. Production of metals.

562,777 GLEAVE, W. W., and IMPERIAL CHEMICAL INDUSTRIES, LIMITED. Production of rare earth metals.

562,788 CARBORUNDUM COMPANY. Refractory heat insulating material.

562,810 SPERRY PRODUCTS, INC., and STEVENS, A. H. (Sperry Products, Inc.). Device for indicating elastic deformation of the frame of a rolling-mill stand.

562,829 DOEHLER DIE CASTING COMPANY. Apparatus for handling continuously-cast rod.

562,883 BRASSERT & COMPANY, LIMITED, H. A., and MILES, J. Manufacture of steel by the basic Bessemer process.

562,891 CLIMAX MOLYBDENUM COMPANY. Production of tungsten containing ferrous alloys.

562,919 TAFT, T. H., HALLETT, H. A., and IDOSON MOTOR CYLINDER COMPANY, LIMITED, Cupolas or the like.

562,998 WOODALL-DUCKHAM (1920), LIMITED, and WORTH, F. C. Construction of retorts for the heat-treatment of materials, furnaces, kilns, and the like apparatus.

563,025 FORD MOTOR COMPANY, LIMITED. Surface treatment of zinc or cadmium or metals coated therewith.

563,061 AKTIEBOLAGET INDUSTRIMETODER. Process for treatment of chromium ores.

563,087 PESCARA, R. P. Air-compressing plant.

563,101 MOND NICKEL COMPANY, LIMITED (International Nickel Company, Inc.). Electrodeposited nickel.

563,117-8-9 BIRMINGHAM ALUMINIUM CASTING (1903) COMPANY, LIMITED, FAIRBAIRN, H., and PETERS, H. Apparatus for casting metals.

563,145 UDY, M. J. Production of metals and alloys.

563,225 MOORE, B. J., and MOORE, B. C. Industrial kilns and ovens.

563,249 ELECTRO METALLURGICAL COMPANY. Chromium steels.

A NEW PRINCIPLE IN GAS-FIRED FURNACES

The discovery of a new principle in furnace design is a rare occurrence. A furnace heated by the combustion of gases has always been held to comprise a combustion chamber, a chamber in which the goods are heated, and a flue through which the products of combustion are removed from the furnace; some or all of these functions may be performed by the same chamber, but in general these functions are clearly defined. The last occasion when a new technique was introduced was in 1906-10, when Prof. W. A. Bone and C. D. M'Court developed the technique of surface combustion.

A new principle has lately been described by Mr. R. H. Anderson, Mr. D. C. Gunn and Dr. A. L. Roberts, involving the use of permeable refractories through which furnace gases are withdrawn from the furnace chamber. This has been worked out by the Department of Coal Gas and Fuel Industries at Leeds University, the Yorkshire Industrial Gas Development Centres, the Bradford Gas Department, and certain manufacturers, including a prominent manufacturer of insulating firebricks. The new furnace can be applied to many types of heating operation and several units have been in operation for considerable periods. It has been developed primarily with town gas as the fuel, but could be used on other fuel gases provided that they are free from dust.

Porous Refractories Replace Flues

Among the characteristics of the newer insulating refractories that are now employed in hot face insulation is that of high permeability to gas flow. This has been regarded hitherto as a difficulty overcome by backing the insulating refractory with a normal refractory of low permeability. The authors, however, conceived the idea that the gases could be withdrawn from the furnace chamber through the pores of the refractory, if it was made sufficiently permeable, and that considerable benefits would result. Initial trials suggested that a permeability at room temperature of 4 to 5 cub. ft. per hr. per sq. in. of material 1 in. thick would be satisfactory. Owing to the increase in the viscosity of gases with temperature, these figures would be reduced to 1 to 1.5 at 1,200 deg. C. Data obtained in industrial installations showed, as was to be expected, that the permeability of the structure as a whole was some three times greater than that of the material.

The method of construction is that the furnace chamber is built of permeable refractories, *i.e.*, of open-textured insulating firebricks, behind which is a space, which in turn is backed by a normal firebrick wall. If the pressure on the furnace side of the wall is sufficiently greater than on the side farther from the furnace, the products of combustion will pass through the wall; consequently, there is no flue leading from the furnace chamber in the ordinary way. The difficulty of keeping sufficient positive pressure within the furnace chamber when the door is opened periodically, has led to a suction being maintained in the annulus into which the products are withdrawn.

It appeared likely that this design of furnace would achieve notable savings in fuel. The cellular nature of the material, of the order of 1,000 sq. ft. per cub. ft. of material, presents a vast surface area over which heat transfer can take place. Thus the temperature of the outgoing gases at any point in the wall is likely to be the same as that of the material of the wall. Major heat losses are (1) the loss of heat in the products of combustion leaving the furnace, and (2) the heat conducted away through the furnace wall. Considering in what may be called the "conventional" furnace, a chamber with an internal wall temperature of t_1 deg., the gases will leave at or above t_1 deg., and this temperature governs the heat lost in the flue gases. In the permeable refractory furnace, the gases escape at a lower temperature, t_2 deg. (which is that of the outer side of the permeable furnace lining), due to having given up additional heat to the brick while passing through the wall. Thus the loss of heat due to the temperature of the products of combustion is reduced.

Where Heat Losses Occur

The second source of heat loss is by conduction through the furnace wall. Again, the temperature of the outside of the wall will be t_2 deg. for the permeable furnace, and this will be higher than the temperature, t_3 deg., with the conventional furnace; thus less heat is lost by conduction through the furnace wall.

In addition to its possibilities in saving fuel, this new design offers important possibilities in the uniform heating of furnace chambers. There must be inequalities in temperature in the conventional furnace where gases are burnt at one place and the products of combustion leave at another. It is, moreover, often difficult to avoid dead spots where the gases do not circulate freely and the temperature is consequently lower than elsewhere. This furnace makes it possible to operate with a positive pressure throughout the furnace chamber and to withdraw the gases uniformly over the whole surface, so that the furnace chamber can be filled with flame. With the normal flue construction it is difficult to work furnaces under pressure.

Application to Crucible Practice

Several of these furnaces described by the authors have been in industrial operation for some considerable time. The results fully bear out the deductions drawn from theoretical considerations, and the behaviour of the furnaces has been highly satisfactory. A small crucible metal melting furnace working at low temperatures, for example, showed over an extended period of fuel saving of 15 per cent. over an orthodox furnace used for the same purpose. In the same pair of furnaces a no-load test showed a saving in fuel of 58 per cent. with the permeable wall furnace. Another successful application has been for heating galvanising baths.

A New Principle in Gas-Fired Furnaces

Reheating Steel Castings

A mechanically-charged furnace for reheating steel castings which has been in continuous operation for over 12 months measures 7 ft. 6 in. back to front, 3 ft. 9 in. wide, and 22 in. to the crown of the arch. The waste gases are withdrawn through the walls, back, arch, and a portion of the hearth, the necessary suction being applied by an exhaust fan. Records kept during 57 consecutive runs showed an average fuel consumption of 1.25 cub. ft. of town gas per lb., which included all gas used on the furnace—a thermal efficiency of 44 per cent., the best run showing 56 per cent. No clogging of the refractories has been observed, and in spite of the severe conditions to which the furnace is subjected, there has been no spalling and very little cracking of the lining. These conditions involved rapid heating up from a cold start with no load on the furnace; the castings were then charged and brought up to 900 to 950 deg. C. and soaked; they were then withdrawn and a fresh charge immediately inserted. An interesting feature is the speed with which these furnaces can be heated up. After a week-end shut-down, *i.e.*, with a cold start, this furnace is ready for charging after gas has been on for 17 min. only; the same condition can be obtained in 7 min. after an overnight shut-down.

A bogie hearth annealing furnace due for rebuilding was adapted to permeable linings. This furnace was of the single door type, having two bogies for alternative charges, each having an effective area of 5 ft. by 3 ft. wide. In this furnace permeable tubular blocks were used to give a mechanically stable structure while avoiding joints that might cause short-circuiting. This furnace was designed to anneal miscellaneous steel castings, each bogie load weighing 30 cwts. The castings were to be heated to 920 to 950 deg. C., held there for 5 hrs., cooled in the furnace to 600 deg. C., and then withdrawn, after which a new charge was inserted. After over six months in operation it can be said that this furnace is entirely successful, and shows a thermal economy over the individual consumptions of other bogie hearth furnaces in the same works of 35 per cent., these figures being based in each instance on the performance of the comparison furnaces *when new*.

Other furnaces and applications were described in the Paper, but to sum up the conclusions so far reached as the result of considerable experience, it would seem that with lower furnace temperatures such as 500 deg. C., the permeable wall construction will save about 10 per cent. of the fuel. With higher temperatures of 1,400 deg. C., the savings are likely to be about 40 per cent. In general the maximum suitable temperature at present is about 1,300 deg. C., on account of the limitations of the refractories. The principle is not of universal application, again because of the properties of permeable refractories. These refractories are not resistant to fluxes, and could

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(*Continued from previous column.*)

not be used for direct melting. They would not be recommended for forging furnaces since the iron oxide scale would soon cause trouble for the same reason. There are, however, a large number of processes conducted between 500 and 1,300 deg. C., which appear to offer a wide field for immediate development. It is a recognised principle of the industrial utilisation of town's gas that the greater the thermal efficiency of the process, the greater is the scope for gas. In this new principle the gas industry appears to have made a long step forward towards the better utilisation of gas.

THE DEVELOPMENT AND PRODUCTION OF INOCULATED CAST IRON

(*Continued from page* 35.)

found on machining that distortion took place, so the runners were moved on to the ends of the casting and run in flat on the table, with the object of equalising the distribution of the metal and counteracting the variable rates of cooling. At this there was a slight improvement in the distortion, but the best results were obtained when the process of inoculation was adopted with similar running arrangements.

The whole of the castings illustrated, with the exception of the heaviest of pulleys, are made in green sand. Figs. 27 and 28 give some indication of the type and variety of castings produced, inoculated iron being used in manufacture. This investigation and development has been made possible through the intimate liaison existing between the technical and practical departments connected with the foundry. As a concluding note, the Authors have been greatly encouraged by the first-hand reports from the machine shop of the merits of inoculated irons.

For permission to publish this Paper thanks are due to the directors and management of Thomas Robinson & Son, Limited, Rochdale, and also for their co-operation in assisting the investigation.

NEW TRADE MARKS

The following applications to register trade marks appear in the "Trade Marks Journal":—

"Holsimco"—Machine tools and parts. Holland & Simmons, Norman Works, Paddockhall Road, Haywards Heath, Sussex.

"Acrow"—Articles made from common metals or their alloys. Acrow (Engineers), Limited, 33, Catherine Place, London, S.W.1.

Hand (Device)—Domestic hollow-ware of common metal. Trustwell Bros., Limited, Wheatsheaf Works, John Street, Sheffield, 2.

"Crypton"—Pumps, and electrical instruments and apparatus. Crypton Equipment, Limited, George Street, Bridgwater, Somerset.

"Ermaloy"—Alloys composed mainly of non-ferrous metals. Enfield Rolling Mills, Limited, Millmarsh Lane, Brimsdown, Enfield, Middlesex.

THE DEVELOPMENT AND PRODUCTION OF INOCULATED CAST IRON

Experiments to overcome some current difficulties of the ironfounder

By H. P. HUGHES and W. SPENCELEY

(*Continued from page* 7.)

Underlying Theories

There are a number of theories abroad as to the process of inoculation. It is, therefore, with a measure of reserve and timidity that the Authors intend to put forward some of the findings arrived at during this investigation. They are based not on any laboratory experiments or thermal analysis, but on practical conclusions made as a result of inoculated metal showing properties so different from ordinary metal, and have been arrived at after an extensive search of available literature to determine and explain these effects.

the Authors to draw sucn conclusions. During the casting of grids normally cast with small quantities of metal left in a ladle—this in ordinary metal was quite satisfactory—however, adopting a similar procedure with inoculated metal it was found that the metal had lost fluidity and would not run. No difference in temperature could be noticed, and it is contended that the reduction in carbon from 3.5 to 3.25 per cent. could not have shown so great a difference.

Another outstanding illustration that was quickly noted was, that, while heating up a cold shank with

FIG. 21.—INOCULATED IRON CAST SHORTLY AFTER FERRO-SILICON ADDITION × 75.

FIG. 22.—INOCULATED IRON CAST 15 MINS. AFTER FERRO-SILICON ADDITION × 75.

It is proposed that the graphite in random formation produced by inoculation is the result of graphitisation taking place in the melt previous to eutectic temperature, in other words there is produced proeutectic graphite. This is contrary to the findings of some, *e.g.*, Flynn and Reese say that graphite is formed between 1,040 to 1,150 deg. C. On the other hand, Massari and Lindsay have shown that high carbon, low silicon irons cooled exceedingly rapidly, show graphite present, and assume that it is present at temperatures well above eutectic.

It would be well to mention the facts that caused

metal and allowing it to cool somewhat so that it adhered to the sides of the shank, in the case of ordinary metal when this occurred a considerable time elapsed during the use of it before the metal was removed. On the other hand, the inoculated metal melted very readily when hot metal was poured in.

It is suggested that this proeutectic graphite causes the pasty condition to develop so quickly in this type of iron, and it is further assumed that inoculated irons show the combined characteristics of low and high carbon irons. In other words, the graphitisation produced by inoculation is similar to the graphitisa-

Inoculated Cast Iron

tion produced in high carbon irons through the solubility of the carbon being exceeded, and that as a result of this carbon being precipitated as graphite, it leaves a carbon weak austenite with a higher point of solidification characteristic of low carbon irons.

The graphitisation taking place at temperatures above the solidification temperature render the iron stiff and pasty and reduce its fluidity, but this stiffness as shown by the metal adhering to the shank, is the result of graphitisation previous to the eutectic temperature, and resolution can be easily obtained with higher temperature metal. It is possible that the graphite precipitated in the liquid is the basis for rapid growth at the eutectic temperature to give random flake distribution.

During the cooling of cast iron, solidification begins with the formation of dentrites of primary austenite which continues to grow till the eutectic temperature is reached. It is suggested that random graphite forms at the higher temperatures, that is, when the dentrites allow greater freedom of growth. The rosette formation, on the other hand, is formed at lower temperatures, since it is confined to the interstices of the dentritic and less liberty has given the smaller irregular distribution.

This was the structure predominating in the ordinary iron in the castings, giving trouble during machining, and it was found that the trouble was practically overcome by inoculated iron. It was often necessary, when machining such a casting as shown in Fig. 26, to take as many as six cuts to produce a true surface table. With the introduction of the inoculated irons, two and occasionally three have been found sufficient to obtain the required results. A full report of these tests has not yet been obtained from the machine shop, but there is every reason to believe, as a result of the information already obtained, that satisfaction will be shown.

It is suggested that the rosette formation, which is the product of the decomposition of austenite below the eutectic temperature, is accompanied with certain weaknesses due to the continuous nature of the graphite, and the graphite formed through decomposi-

FIG. 23.—1, 2 & 3 SECTIONED TEST BLOCKS CAST AT DIFFERENT TEMPERATURES. A. CASTING FROM ORDINARY IRON SHOWING INTERNAL SHRINKAGE. B. CASTING FROM INOCULATED METAL SHOWING EXTERNAL SHRINKAGE. C. SHOWING FEEDER HEAD ARRANGEMENTS.

tion from the solid metal causes certain stresses to occur because of the expansion associated with its formation. When the surface of the casting was machined, the rosette graphite predominating there was removed, so releasing some stresses. On the other hand, the graphite structure in the inoculated irons

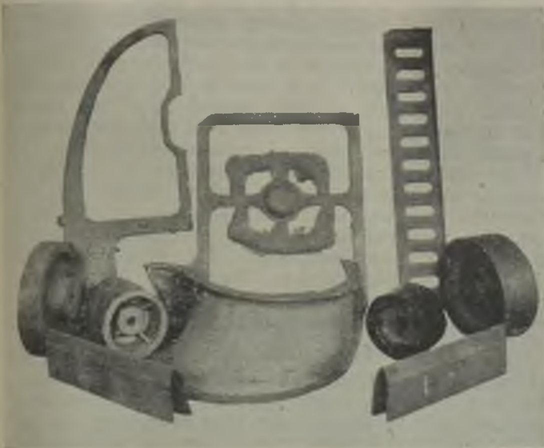

FIG. 24.—ILLUSTRATING THE WIDE VARIATION IN THE SECTION THICKNESS OF CASTINGS PRODUCED.

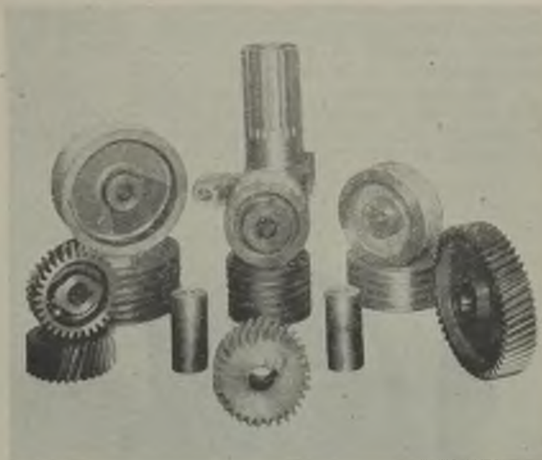

FIG. 25.—CASTINGS AFTER MACHINING.

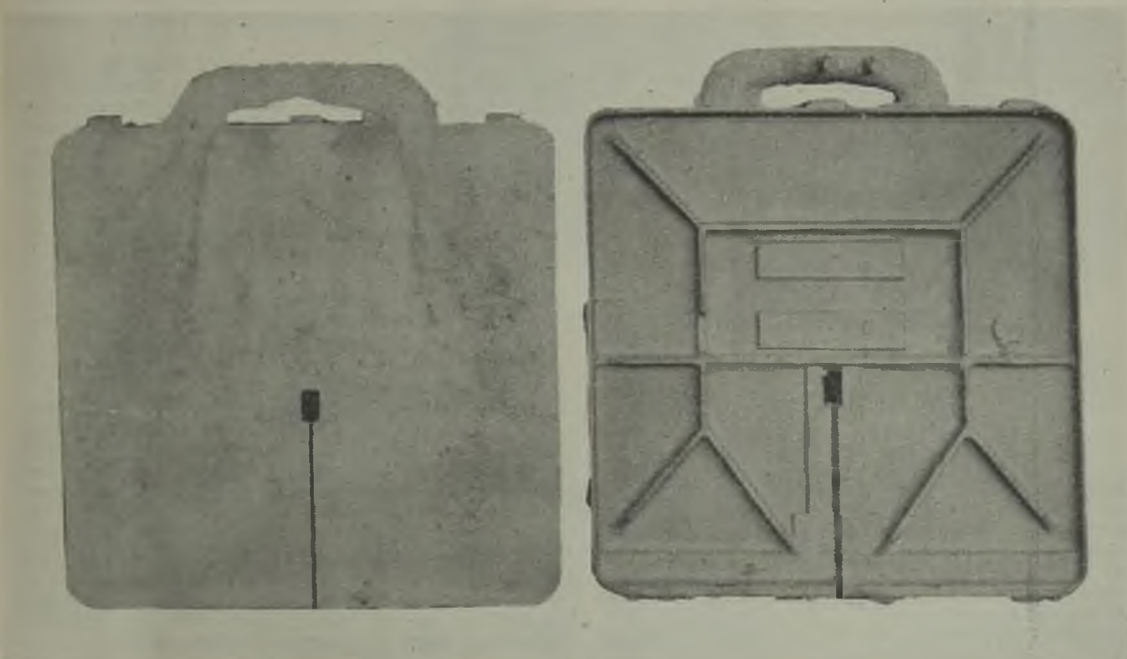

FIG. 26.—ONE TYPE OF TABLE GIVING TROUBLE DUE TO DISTORTION. IT IS 30 INS. SQUARE × $\frac{5}{8}$ IN. THICK.

Inoculated Cast Iron

was all of the random form, giving a more homogenous effect, with graphite forming before complete solidification, allowing it greater liberty to expand, and less opportunity to break up the structure.

It has been often stated that the effects of inoculation wear off after an interval of 10 to 20 min. The Authors have found such to be the case, only it does not appear to predominate to the same degree in the medium carbon irons as in the low carbon irons. Fig. 21 shows the structure of a casting iron immediately after inoculation, and Fig. 22 shows a similar casting run 15 min. after inoculation, where the structure would indicate a tendency to resort to the rosette formation, although not quite so obviously as shown with ordinary iron.

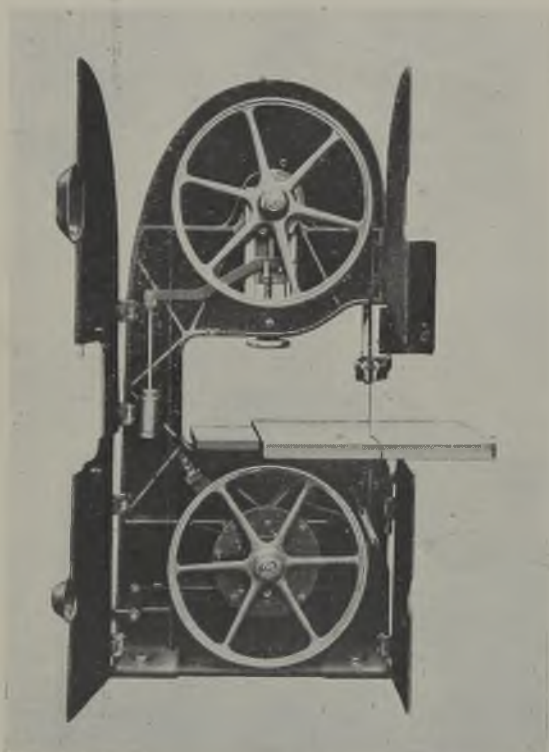

FIG. 27.—30 IN. BAND SAW.

It is proposed to recount some of the more obscure problems and to give some experiences which arose from the authors' efforts in the production of what is considered a physically and mechanically superior casting to the ordinary grey iron. The effect of the addition of special elements to grey cast iron has received a fair amount of attention during recent years. This has been due to the demands made upon the ironfounders in common with other manufacturers to produce a high-quality casting to meet the requirements of machine engineering practice.

Soundness of castings is the primary aim of all foundries, and soundness is governed by a number of factors. To discuss all these would entail too much time and space, so in the main it is desirable to deal in detail with the results of personal experience. It will be realised from the earlier portion of the Paper, when it was stated that the carbon content of the inoculated iron was slightly lower than ordinary cast iron, that it might be necessary to modify to some extent the moulding technique. This proved so, and when it was considered that 75 per cent. of the castings were being made on a production basis, it was decided to tread this new ground with some reserve.

Early Difficulties

It will be noted that one of the major problems. like that of other foundries, was to avoid internal shrinkage and to obviate the after-machining distortion of some particular castings. Shrinkage does not normally become apparent until a large amount of machining time has been spent. As the authors' foundry was in this respect no exception to the rule, this trouble was sometimes evident, even when the casting had what was considered adequate feeding arrangements.

When the alteration to inoculated metal was made. the Authors thought for a few days that they had fallen from the frying-pan into the fire. Some of the heavier section castings showed an obvious external shrinkage, and Fig. 23B illustrates this. This caused some headaches, as it will be realised that a casting externally sound does at least get the trouble out of the foundry for the time being, but one not so is an immediate problem to the foundry personnel. However, it soon became apparent that this trouble was of advantage, since, on sectioning some of these castings, they were found to be internally sound. Here was something really beneficial, it being contended that. if it was possible to remove the visible or external shrinkage—and this would make itself apparent—it would ensure a satisfactory casting.

In Fig. 23, the casting marked "A," cast in ordinary iron and having what was thought sufficient feeding, shows some internal shrinkage. On the other hand, casting "B," in inoculated iron with similar feeding facilities, shows an external shrinkage with internal soundness. These results called for a complete. and what proved extensive investigation of all production castings, but the benefits and satisfaction derived have been well worth the painstaking efforts. As far as possible, feeding arrangements and method of running is laid out on the pattern plate, after the necessary tests have given the most satisfactory results.

Influence of Casting Temperature

Temperature has been suggested as a means to assist homogeneity, high temperature tending towards slower cooling with greater graphitisation and less shrinkage. With metal, poured cold, there is greater chilling propensity, less graphitisation and more shrinkage. The test blocks shown in Fig. 23 illustrate this point.

These blocks of 4 in. square section are cast with a ½-in. diameter runner on the top and in the centre of the block. These tests are, of course, made as severe as possible to show maximum effects. The three blocks were cast from inoculated metal at widely different temperatures. No. 1 could be correctly termed very high, No. 2 normal casting temperature, and No. 3 low. The No. 1 block shows the most desirable results with little variation in structure from edge to centre.

It was realised that all possible means should be taken as far as distribution, type and shape of runner are concerned, to ensure progressive solidification, the difference in rate of cooling between thin and thick sections should be equalised as near as possible. This can be achieved by superheating the particular part of the mould which forms the thin sections, and so directing the metal which is losing temperature to the heavier sections, the combination of suitable runners and feeding heads to ensure progressive solidification from the bottom upwards. This method is illustrated in Fig. 23C, although the ingate to the casting is of such a size that, if the casting was poured in the same proportion, progressive solidification would not function. This is controlled by the size of the downgate, which is placed directly into the feeding head, thus achieving a dual purpose, that of assisting progressive solidification by its slow rate of pour, and, secondly, attaining the so desired hot metal in the feeding head.

It was quickly realised in the initial experiments that the fluidity of this metal was of a much lower order at a given temperature than the ordinary grey irons, but above this temperature fluidity was equally as good; this can be substantiated in Fig. 24, which depicts a number of the thinner section castings made in this material. The method of running these particular castings has not been altered from the ordinary grey-iron practice. Fig. 24 also shows some of the heavy section castings, and the extensive machining necessary is illustrated in Fig. 25.

In the case of the heavy vee-rope pulleys, the normal practice was to insert a taper chill suitably coated through the centre of the boss, and run by means of pencil runners on this boss, with a large feeding head on the rim, but it was invariably found that, after the vees were machined, at some place at the root of the vees, and in the vicinity of the centre place, there were areas of porosity. This was attributed to a hot spot due to the mould not being perfectly level, and the slow speed of run from pencil runners, allowing the metal to run over this particular area for the longest time possible, with the result that the runners were moved, and on the rim experiments were made with the type of runner at present in use. The ingate was on top of the rim with a large feeding head attached in as close proximity as possible to the casting, as shown in Fig. 23C. Here again the speed of pouring can be determined by the size of downgate, which is again directly into the feeding head. This method showed a slight improvement over the pencil runner

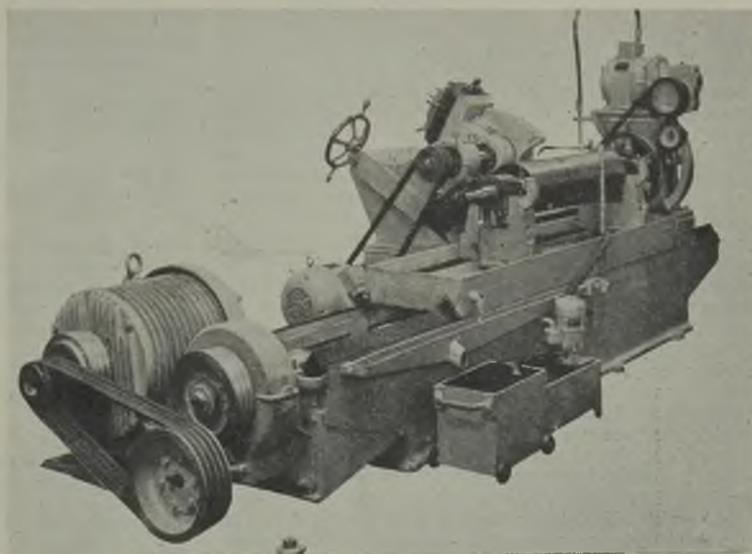

Fig. 28.—Roll Grinding and Fluting Machine.

method even in the ordinary iron, but the most marked improvement came when used in connection with the lower carbon inoculated iron. At this period it was noticed that the feeding heads previously applied had never done the work expected of them, that is, feed the casting, as will be appreciated from Fig. 23C. Note the deep cavity in the head indicating absorption of the head metal into the casting. This method of running, and the type of iron used, enabled the authors to eliminate the centre chill, obtain a sound bore, obviate the porosity in the vees, and give a casting with a much closer structure.

In the past the tables illustrated in Fig. 26 were run on the top with four ⅝-in. dia. runners, but, unless these castings had a long weathering period, it was

(*Continued on page* 30, *col.* 2.)

THE CONTROL OF COMPOSITION AND HEAT-TREATMENT IN 0.25 PER CENT. C AND 1.5 PER CENT. MN STEEL CASTINGS

By T. W. RUFFLE

Discussion on a Paper presented at the annual conference of the Institute of British Foundrymen. Mr. Daniel Sharpe, the retiring President, occupied the chair. Mr. Ruffle's Paper was printed in our issue of July 13.

MR. S. T. JAZWINSKI (Member) commented on the fact that the Paper gave the percentage of yield point to maximum stress as being from 65.6 to 68.2, but work he had carried out gave figures of from 62 to 72.2 per cent. He did not agree with the final conclusion and failed to see how it was possible to make comparisons between the physical properties of electric and converter steel unless the converter process was under expert supervision. Experience in the last three years had shown that, with the use of new devices and application of fresh ideas, conditions of oxidation and deoxidation were obtainable in the converter process which were comparable with those in the electric furnace. Obviously, then, a comparison should be made between both processes only when both were under adequate control. The differences shown in the Paper indicated that in the Author's case the converter was not under ideal supervision.

Another point upon which he would like further explanation was the suggestion in the Paper that a more drastic heat-treatment was necessary with converter steel. If one made an experiment at the same casting temperature with electric and converter steel, it would be found that it was not necessary to apply a more drastic heat-treatment to obtain similar properties. The Author's supposition was, he thought, based on the idea that converter steel was usually cast at a higher temperature, and that for the same composition a higher heat-treatment temperature was necessary with converter steel than with electric steel. This was not the case, as, due to the greater fluidity of converter steel, it appeared hotter than it actually was. The impact figures for carbon-manganese steels had not been given in the Paper, and without them it was impossible to compare fully, electric with converter steel.

Relative Heat-treatments

The AUTHOR, replying with regard to the different yield ratios of electric and converter steel, said he could give some figures on that point. Converter steel had a lower yield ratio. He had compared some 40 heats of the same carbon and manganese content and having the same normalising heat-treatment. The yield ratio for the converter steel averaged out at 0.64 and for electric steel the figure was 0.67. That made a difference of 1.2 tons in the yield point with an ultimate stress of 40 tons per sq. in. The ultimate stress of converter steel was 6 per cent. higher, on the average, than with electric steel, for the same carbon and manganese content, and the elongation averaged 19 per cent., as against 25 per cent. He could not agree that his firm's converter practice was not under good supervision. Last year Kain and Sanders presented a Paper which dealt fairly thoroughly with his firm's practice, and he did not see, at the moment, how it could be improved upon. If Mr. Jazwinski was getting, consistently, results equal to the figures quoted in the Paper for basic electric work, he could only congratulate him and say that his own firm could not do that. Perhaps they would, one day. He certainly would like to know how it could be done.

As to the question of converter steel being harder to break down under heat-treatment, he had satisfied himself about that several times and had always explained it by the higher content of phosphorus. The phosphorus content resisted the homogenisation of the structure, and the more phosphorus there was, the more difficult was it to bring this about. That seemed to be the reason why there was more difficulty in breaking down converter steel. It had been necessary to go to higher temperatures than with electric steel to get equivalent results.

Izod Test Values

He was sorry he had omitted figures for impact tests of normalised carbon-manganese steel. He had quite a number of test results and, speaking on the conservative side, they averaged 45 ft.-lbs. He considered this an excellent impact value for a straightforward steel and heat-treatment. The point with regard to lower carbon steels was an interesting one. Mr. Jazwinski had claimed that converter steels with lower carbon content could not be compared with those of higher carbon content because of the difference in methods of manufacture. He himself had found that converter steels with a lower ultimate stress had far better ductility in proportion than those with a higher ultimate stress. There seemed to be a point at which the ductility of converter steel fell off rapidly, whereas that of electric steel did not. Whilst he would not like to be precise about where that point was, it appeared to be in the region of 35 tons per sq. in. ultimate stress, but it was not known why. Indeed, there were many things which were not yet known about converter steel and, although it had been suggested that converter steel in almost all respects was the equal of electric steel, his own experience did not confirm that.

MR. JAZWINSKI said that the results obtained from considerable work on converter steels in which his firm had participated would be published, and they would be found to confirm his argument.

The AUTHOR said he would be very pleased to see these results.

Grain Size Control

MR. H. T. ANGUS, Ph.D., M.Sc. (Member), said there was one point which appeared to be interesting. The Author stated in his Conclusion 5 that the greater resistance to breaking down necessitated a higher temperature, and this in turn led to some coarsening of the grain. Was the Author quite satisfied that an increase of temperature, say from 950 to 980 deg. C., would affect the final grain size? Personally he rather doubted whether a higher normalising temperature would affect the final grain size of the steel.

The AUTHOR replied that, whereas with their electric steel it was possible to take the temperature up to 980 deg. C., in most cases without serious grain coarsening, with converter steel or any other steel which was inherently a fine grain steel, there was a coarsening of the grain when a certain limiting temperature was exceeded. Even if the steel was inherently fine grain, it would coarsen very rapidly when this limiting temperature was exceeded. Their converter steel seemed to be prone to partial coarsening in some areas, but not in others, and that was sufficient to affect the properties quite appreciably. He had obtained figures which showed there was a considerable growth of grain with converter steel when it was heat-treated in the 950 to 980 deg. C. region, and the poor results he had obtained were attributed partly to that. Therefore, he had repeated the normalising at 850 deg. C. for a short time, long enough to take everything into solution. In this way a finer grain was produced with a considerable improvement in properties.

DR. ANGUS: Are you referring to the austenitic grain size or the final grain size?

The AUTHOR: The final grain size, which was definitely affected by the heat-treatment, as it is inherently dependent on the austenitic grain size developed during the heat-treatment.

Value of Izod Tests

MR. C. LASHLY, M.C. (Associate Member), said the Author had given figures of Izod impact tests of 45 ft.-lbs. and had also stressed the question of high ultimate yield. Did the Author think that the Izod impact test had a greater value than a plain stress test in this particular type of steel?

The AUTHOR replied that he did not think he would. When one discussed what the Izod meant, it was possible to get into the most involved arguments, and such arguments had gone on for many years. Although he regarded it as a most important test, the fact remained that many steels and other materials having extremely low impact values were doing tough jobs in various parts of the world. That had been demonstrated on a number of occasions. It was necessary to have a yield which would meet the stresses imposed on the part in question, but just how to make a direct correlation between service requirements and impact testing had baffled most people. The Izod was a valuable test, but served mainly as a check on the quality of the steel in its less tangible aspects—the sort of thing that could not be got down to numerical definition very readily. It was quite easy to have two steels of largely identical properties except for the impact, and it was difficult to find out why. That was what he meant by saying the Izod was a check on the less tangible aspects in steel. Definitely, he would say that the yield point took considerable precedence over impact, although it was quite nice if one could get, say, 50 ft.-lbs. impact as well as a satisfactory yield.

MR. LASHLY said the reason he raised the point was that nobody seemed to have got down to a correlation, and therefore the Izod impact test seemed to him of real value.

The AUTHOR said he had never been able to find any correlation.

MR. J. G. BAILES (Member) said the Izod test was really a rough-and-ready method, because he had never seen any attempt microscopically to measure the depth or width of the notch. The method was adopted of putting a gauge into the notch which might be ten-thousandths out. Nor had he seen any tests to correlate the depth and shape with the foot-pound figures obtained. Therefore, he contended that at the present stage the Izod test was a very rough-and-ready one. A microscope could be provided to measure the depth of the remaining cross-section, and also to prove that the shape and size of the base of the notch is correct.

Notch Contour Unimportant

The AUTHOR agreed that one had to be very particular about the test-pieces, but he did not think it could be described as a rough-and-ready test. Quite recently he had had one or two test-pieces with quite badly milled notches. He had been surprised that there had been so little difference in the results; it was much less than he had expected and, if it had not been noticed in one case that the notch was faulty, he would have passed all the results as showing the normal variation. The variation was well within 10 ft.-lbs., although the notch was quite faulty. The point was that, if one wanted to work to very fine limits, the test was a rough-and-ready one, but, generally speaking, the results were either very good or very bad, and that was what one wanted to know. Nobody could explain what the difference was between, say, 20 and 25 ft.-lbs. in practical terms, but the difference between 20 and 60 ft.-lbs. was fairly obvious.

Furnace Temperature Readings

MR. J. F. GIST (Associate Member), referring to the statement in the Paper that a soaking temperature of between 940 and 980 deg. C. should be used for converter steel, asked the Author in what part of the furnace he placed the thermocouples to ensure that the charge actually reached this temperature. His experience with basic electric steel heated to this temperature and maintained showed a definite coarsening of the grain, and he suggested that, instead of placing the thermocouples at points in the furnace where they would be subjected to the heating gases and therefore give an untrue and high reading, they should be more or less buried in the charge of castings on the bogie, otherwise there would be difficulty in obtaining a true reading of the temperature obtaining throughout the charge. In this connection he personally favoured

Control of Composition

the use of search contact couples. He had obtained good results by heating to a temperature of 880 deg. C. soaking 1 hr. per in. sectional thickness of castings to be annealed, withdrawing from furnace at 880 deg. C., cooled in air to 660 deg. C., recharged into the furnace, and cooled down to 300 deg. C. before final discharge. A typical heat-treatment cycle in a modern gas-fired furnace operated as above and annealing 10-ton charges of castings of 2-in. sectional thickness is as follows:—

Time taken to bring charge up to 880 deg. C.	7 hours
2-in. sectional thickness, 2 hrs.' soak ...	2 hours
Bogie withdrawn at 880 deg. C. after 2 hrs.' soak and cooled in air to approximately 660 deg. C., recharged in furnace and cooled down to 300 deg. C. before final discharge	9 hours
Complete cycle	18 hours

The AUTHOR agreed it was both very difficult and very important to know what the temperature of the charge was. Where his experimental work had been carried out in the laboratory, muffles had been used with very accurate control. In the works' furnaces, which were of the bogie type, fired with pulverised coal, he uses two thermocouples. One was suspended through the roof with the hot junction about 6 in. above the top of the load; the other was inserted through the side with the junction well within the load of castings and about 2 in. above the bogie. The chief purpose of the top couple was to prevent premature or over-heating of the top of the load. The bottom couple was the controlling couple and various checks had shown that this system gave an accurate guide to the true temperature conditions of the work.

Results from Acid Electric Steel

MR. C. J. DADSWELL, Ph.D., B.Sc. (Member), said the Author had done a good service in presenting this Paper, because carbon-manganese steel was such an important class of steel. It was not much more expensive to make than carbon steel and, by giving it a little more complicated heat-treatment than carbon steel, there was available a steel which could help the steelfoundry industry to supply the needs of the engineering world in a way which sometimes carbon steel was not able to fulfil. It was used before the war as a rolled product and made into forgings by those who wanted a reasonably priced steel for fairly high duty; for example, the motor-car industry. The effective hardening brought about by water quenching, as stated in the Paper, gave a steel with excellent properties.

On the comparison of converter and electric steel, he did not know very much about the former, but a few years ago he had experience of the acid arc furnace. It was found that the cleanliness of the steel in the way of inclusions was less evident with acid steel than with basic steel, and that cleanliness had an effect on both the impact and elongation values.

As regards impact, he thought that electric steel gave higher values, usually because the inherent grain size was smaller than in the case of Tropenas converter steel. At the same time, the grain size could be improved in converter steel. The late Mr. Deschamps had worked his converter in such a way that he obtained values for impact which compared very favourably with many electric steels, as shown from figures given by him to the Steel Castings Committee of the Institute.

One further point on the question of impact was that foundrymen were rather wary of the impact test because the results were so erratic. This was because there was difficulty of making sound test blocks; if there was any microscopic discontinuity, there was a notch effect which destroyed the value of the test. Perhaps, with Mr. Kain's clover-leaf test-piece, sounder test-pieces were obtained, and therefore more consistent results. He felt that the value of the Izod test was not so much in worrying about 35 ft.-lbs. against 50 ft.-lbs., but in comparing classes of steel and showing whether they were sensitive to the notch effect. It was possible to have steels which showed almost identical properties in the way of tensile values and elongation values, but for which the impact value was very low. Such steels were not good for stressed parts which were subjected to shock.

The AUTHOR said there was one interesting practical point about carbon-manganese steel. It often happened in the foundry that just a few cwts. were required to a fairly high specification, and that could be obtained using carbon-manganese steel by the adoption of a water quenching treatment. At the same time, the remainder of the metal could be used for ordinary castings, and very satisfactory results obtained with straightforward normalising. If alloy steel was used, it would probably be necessary to give a more complicated heat-treatment to all the castings made from the heat. The best properties of carbon-manganese steel were obtained with full heat-treatment.

He had recently read with interest a Paper which dealt with temper brittleness, and the Author was not satisfied to get satisfactory impact values at room temperature. He took impact values at low temperatures and differentiated still further by noting the temperature at which the impact value fell off. By this method it was possible to take two steels which were alike in all properties at normal temperatures, but a steel the impact value of which fell off most rapidly at lower temperatures was then ranked as a poorer shock-resisting steel. That seemed to be a rather interesting development.

Mr. W. A. Turner has relinquished his position as sales manager with Kent Alloys, Limited, and has been appointed general manager of the Coleman Foundry Equipment Company, Limited, Stotfold, Beds.


The High-Quality Iron for High-Duty Castings.
DALE
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Made in seven standard grades or to individual requirements, this iron has a close grain structure and fine graphitic carbon content. It replaces Hematite, and tones up high phosphorus irons.
We also make Dale Refined Malleable Iron to any required specification.
STANTON
DALE Refined PIG IRON
THE STANTON IRONWORKS COMPANY LIMITED
NEAR NOTTINGHAM

NEWS IN BRIEF

The address of the Keighley Association of Engineers is now Devonshire Buildings, Devonshire Street, Keighley.

According to the bulletin of the Tin Producers' Association, there is a possibility that the United States will participate in the international tin agreement after the war.

At a conference at Cardiff, recently, assurance was secured that the Blaenavon Steelworks would be permitted to continue in operation. The works were at one time threatened with closure and requisitioning by the Government for storage purposes.

Four M.P.s for Cornish divisions—Com. P. G. Agnew, Mrs. Beatrice Wright, Capt. N. A. Beecham, and Major Maurice Petherick—have agreed to bring before the appropriate Minister a suggestion that a Commission be set up to consider all forms of metallic mining throughout Britain.

The receiving order dated January 16, 1941, and the order of adjudication dated February 10, 1941, in connection with the affairs of Mr. Walter Arnold Blackburn, 29, Broadway North, Walsall, retired ironfounder, have been rescinded and annulled, debtor having paid his debts in full.

It is now possible to release natural calcined magnesite for laying and maintaining magnesium oxychloride floors in factories, hospitals, etc., and for other work of approved importance. Applications for licences to acquire calcined magnesite should be made to the Ministry of Supply, Chrome Ore, Magnesite and Wolfram Control, Broadway Court, London, S.W.1.

Representatives of six South of England industrial firms visited Newcastle-upon-Tyne last week to inspect sites where factories for production of their manufactures might be erected. They were introduced to the Lord Mayor by Mr. Alfred Denville, M.P. for Newcastle Central. It was stated that should the visitors decide that the sites are suitable, factories might be built by the Corporation and let to the firms.

Shipbuilding employers have under consideration a scheme, drawn up and recommended by the North-East Coast Institution of Engineers and Shipbuilders, to encourage the entry of university trained men into the shipbuilding industry. One suggestion is that salaries paid to university-trained employees between, say, 21 and 25, should be not less than £1 a week more than the customary wage paid to an employee not so trained.

Notice No. 78, the main public notice relating to the liability of goods to purchase tax, has been revised. In the course of the next few days copies of the notice will be posted to all traders registered for purchase-tax purposes. Other persons interested will be able to obtain copies from local officers of Customs and Excise or from the Secretaries' Office, Customs and Excise, City Gate House Finsbury Square, London, E.C.2.

More Clyde shipbuilders will be recruited for work overseas at the suggestion of the Admiralty. Repairs will have to be carried out on the Mediterranean seaboard, and especially in the South of France, and in the East as the war increases in intensity against Japan. Clyde shipbuilders are already operating in Normandy and Britanny, Gibraltar and Malta, along with fellow-craftsmen from the Tyne and the North. The last time an appeal was made for shipbuilders to go overseas the response was 100 per cent. greater than the number required.

The following resolution has been passed by the Industrial Research Committee of the Federation of British Industries:—"This committee notes with the greatest satisfaction the generous and inspiring example created by I.C.I., Limited, in providing 80 post-graduate research fellowships tenable at the principal universities, and expresses the hope that this example will be followed by all the major industries as one of the most effective means of providing research facilities and staff, on which the future well-being of British industry so largely depends."

Associated British Engineering, Limited, has entered into a conditional agreement for the purchase of the goodwill (including the name) and assets of the Diesel-engine business of Mirrlees, Bickerton & Day, Limited. It is proposed to form a new company to continue the business under the old name, all the shares being held by the Associated Company. If the agreement is approved, Mirrlees, Bickerton & Day will still own the Glasgow factory and operate it as it has done for the past 40 years under the name of the Mirrlees Watson Company, and will continue the manufacture of sugar machinery and other specialities previously produced.

The National Arbitration Tribunal has granted an increase of wages for male workers in certain foundries in the Walsall area. The decision is that the present inclusive rates of adult male day workers shall be increased by a war advance of 4s. a week or less, as the case may be, so as to provide that no adult male day worker shall receive less than an inclusive rate of 75s. 6d. a week. For the lowest-paid junior male day workers the minimum inclusive weekly rates are to be increased by war advances in proportion, ranging from age fourteen, 17½ per cent. of 4s. a week, to age twenty, 62½ per cent. of 4s. a week.

A call for a "charter of health" in the foundry industry was made in a resolution passed at the conference of the National Union of Foundry Workers at Morecambe last week. Mr. J. Gardner, of Falkirk, said the time was overdue when the union should formulate a policy in respect of foundry structure, equipment and materials, and enforce methods and facilities for the prevention of sickness and premature death among foundry workers. The conference decided to apply for 12 days' holidays with pay for all foundry workers, a 48-hour week, equal pay for equal work for women workers, and an immediate application for an increase in wages. The acceptance of the principle of women members in the union was agreed upon.

PERSONAL

MR. GEORGE HUTTON, of Stenhousemuir, has clocked in at a Larbert foundry for over 48 years, and has always been on time.

STAFF-SERGT. OAKLEY, of Broseley, Salop, son of Mr. Edwin Oakley, iron and steel merchant, Broseley, who is with the Royal Artillery, has been awarded the B.E.M. Before the war he was associated with his father in the business.

MR. GEORGE J. WELLS, superintendent of ship and tank armour production and of the heat-treatment of guns and general forgings at the English Steel Corporation, Limited, Sheffield, has retired. He joined the original Vickers firm in January, 1896.

MR. F. R. STAGG, assistant managing director of Thos. W. Ward, Limited, since 1938, has been appointed a joint managing director of the company. MR. H. W. SECKER, who has been a director of the company since 1938, has been appointed an assistant managing director.

Wills

TANQUERAY, D. Y. B., a director of Baker, Perkins, Limited, engineers	£18,408
EVANS, W. P., founder of W. P. Evans & Son, Limited, engineers, Salford	£11,849
NEILSON, H., of Stewarton, chairman of the Summerlee Iron Company, Limited	£173,510
FAWCETT, D. L., of Leeds, late chairman of T. C. Fawcett, Limited, engineers and ironfounders...	£10,390
RUSSELL, DAVID, of Rotherham, engineer on the staff of the United Steel Companies, Limited, Sheffield, and formerly with Steel, Peech & Tozer, Rotherham	£5,131
NEEDHAM, SIR CHRISTOPHER T., of Manchester, late chairman of John Needham & Sons (Manchester), Limited, iron and steel merchants, and the National Boiler & General Insurance Company...	£366,281

OBITUARY

MR. GEOFFREY MARRIOTT LE TALL, a director of Watson, Saville & Company, Limited, steelmakers, of Sheffield, died at Fort William, Scotland, recently.

MR. WALTER ROWLETT HAWKINS, of Ivy House Lane, Coseley, Bilston, died recently at the age of 74. He held an important position with Cannon Iron Foundries, Limited, Deepfields, Bilston, with whom he had been associated for nearly 60 years.

MR. JOHN HUTCHINSON, of Cardiff, for many years an iron merchant and engineers' agent and secretary of the Glamorgan Hematite Iron Ore Company, Limited, died recently, aged 88. Previously he was secretary of the Ebbw Vale Steel, Iron & Coal Company, Limited, and the Darlington Steel & Iron Company, and also held a commercial appointment with the Barrow Hematite Company. Born of yeoman stock at Hutton Rudby, Cleveland, Yorks, Mr. Hutchinson commenced his business career in Middlesbrough at a time when the iron trade was generally conducted by private ironmasters, several of whom he served. In one instance he maintained intimate and friendly business relations throughout his long life with the sons and the grandson of one of his earliest employers.

COMPANY RESULTS

(Figures for previous year in brackets)

Breedon & Cloud Hill Lime Works—Interim dividend of 7½% (same).

A. C. Wickman—Final ordinary dividend of 3% (7½%), making 8% (12½%) for 1943.

Baldwins—Half-yearly dividends to June 30, 1944, on the 6% "A" cumulative preference and on the 7% "B" non-cumulative preference shares.

Metal Traders—Net profit for the year ended March 31 last, after providing for taxation, £6,545 (£4,622); dividend of 25% (same); forward, £103,786 (£102,438).

A. & J. Main—Trading profit, after tax, for 1943, £50,605 (£44,552); depreciation, £8,000 (£7,000); interest, £4,651 (£1,625); net profit, £31,277 (£30,884); to general reserve, £20,000 (£17,500); dividend of 10% (same); forward, £9,066 (£8,735).

W. H. Dorman & Company—Net profit to March 31 last, after charging depreciation, £123,637 (£78,347); to general reserve, £5,516 (nil); taxation, £109,000 (£69,000); dividend of 16⅔% on the ordinary shares (same); forward, after preference dividend, £7,226 (£7,428).

Davey Paxman—Profit for year to March 31 last, after E.P.T., £56,903 (£45,933); debenture interest, £2,789 (£2,869); income-tax, £32,500 (£27,289); debenture redemption, £1,500 (same); to general reserve, £10,000 (£5,000); to reserve for post-war contingencies, £5,000 (same); ordinary dividend of 7½%, £3,188 (same); forward, £8,968 (£8,042).

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Diacut (Leicester)—Steel hardeners and processors. £2,000. D. McPherson and H. Daft, 30, Overdale Road, Leicester.

F. M. Bell & Company, Trumpet Street, Gaythorne, Manchester—Engineers. £3,000. R. M. and H. J. Bell and L. Ethell.

Phillips & Rabone, Imperial Works, Lombard Street, Birmingham—Brassfounders. £6,000. S. E. White and J. W. Bedford.

W. P. Wakefield, 680, Lea Bridge Road, London, E.10—Manufacturers of abrasives, etc. £100. M. Bond and J. Atkins.

T. W. Holmes, 22, Charing Cross Road, London, W.C.2—Manufacturers of steel and non-ferrous products, etc. £1,000.

Washington Refractories, Percy Chambers, 34, Grainger Street, Newcastle-upon-Tyne—£1,000. G. Blair and S. Hunter.

H. Doel & Sons, 43, Haviland Road, Boscombe, Hants—Dealers in metals, minerals, etc. £900. H. E., M. J., and L. H. Doel.

Leonard Coleman, 14, Belvoir Road, Coalville, Leics—Agricultural and general engineers, etc. £5,000. C. L. and H. Coleman.

Raw Material Markets

IRON AND STEEL

The call for most grades of pig-iron is on a reduced scale. No revival in the light-castings trade is anticipated until the building industry is free to embark upon the post-war housing programme. Moreover, the Government have cancelled or suspended many contracts for speciality and engineering castings. Production of pig-iron has recently been reduced, but it is still probably in excess of current needs, and there are now substantial stocks of all descriptions—except hematite—which are available for use in an emergency.

In regard to scrap, the position is better than it has been recently, but supplies of some grades are still none too easy to obtain. Makers would welcome larger tonnages of heavy melting scrap suitable for cupola work. There is a steady demand for cast-iron scrap and heavy machinery metal in foundry sizes. Pressure for wrought-iron scrap has eased slightly of late. Short heavy steel is generally finding good outlets, but business in lighter grades is falling off.

Although, at the moment, coke is available in adequate quantities to meet works' requirements, it is expected that this fuel will soon become much scarcer. For this reason, wherever possible, foundries are laying in as large stocks as they can secure under the present relatively favourable circumstances.

Possibly due to the steep rise in the price of bar iron, business in this department has not gained much impetus since the holidays, although a reasonable measure of support is forthcoming from the shipbuilding industry. The strongest demand seems to be for the best grades of iron. A limited but regular trade is being done in crown bars, while makers of No. 3 and No. 4 bar are fairly well placed for work. The smaller sizes of most grades of bar continue to be readily absorbed. Business in iron strip and sheets is at present very slow.

The brightest feature of the steel trade is the sustained demand for re-rolled products. Most of the mills have several months' work in hand, and the consequently inflated consumption of steel semis calls for substantial deliveries of billets, blooms and sheet bars, and also of other forms of re-rolling material, such as defective billets, double-sawn crops, etc.

The plate makers are somewhat busier than they have been for the last few weeks, although they can still take on additional specifications for early rolling. Some of them have recently received orders for plates to be shipped to America, and this has helped the position to some extent. In general it is the lighter sizes that are called for in connection with the present orders.

On the whole, the sheet-makers continue to be well engaged. There are many uses at the present time for heavy gauges of sheets, but the volume of orders received week by week is not so substantial as it was. As it is, the mills have several weeks' work ahead of them.

The position in regard to sections is unchanged for light and medium sizes. There continues to be a heavy demand in many directions, all for Government requirements, and both re-rollers and steelworks are turning out all they can of light structural sizes. There are opportunities for prompt rollings of large sizes of joists and structural sizes; in fact, the mills could do with considerably more business, but this is not likely to eventuate for some time in the absence of any ordinary building construction.

NON-FERROUS METALS

Although on a somewhat reduced scale, war demands for copper still account for a considerable tonnage of metal. As it now seems unlikely that there will be a revival in the demand for munition manufacture, there are much brighter prospects of an early return to the execution of civilian orders. From the extremely tight supply position which existed in America earlier in the year it is reported that the situation has changed to such an extent that there has been a further slight easing of the restrictions on the non-military uses of copper.

Tin supplies are reasonably satisfactory—taking into account the fact that such a large proportion of the world's tin-producing area is still enemy-occupied territory. With the encouraging progress of operations in the Pacific and the probability of increased pressure being brought to bear on the Japanese in the near future, much thought is now being given to the future of the tin industry. While for the past few years the Allies have been quite well supplied from South American and African sources, there is no doubt that when supplies from South-East Asia are again available there will be a strong demand for this higher-grade ore.

Consumption of lead seems to have receded from the peak level. At the same time, there is still a fairly heavy demand, mainly from the battery and cable trades.

REFINED FERRO-MANGANESE

The Iron and Steel Control announces that the prices for refined ferro-manganese have been reduced as follows:—

Maximum 0.5 per cent. carbon, £60 per ton, scale 16s.; maximum 1.0 per cent. carbon, £58 10s. per ton, scale 15s. 6d.; maximum 1.5 per cent. carbon, £57 15s. per ton, scale, 15s.; maximum 2.0 per cent. carbon, £57 per ton, scale 14s. 6d.; maximum 3.0 per cent. carbon, £55 10s. per ton, scale 14s.—all 78 per cent. Mn basis.

These prices apply only to material despatched from producers' works or from stock in the United Kingdom when delivered to buyers in minimum 5-ton lots. For smaller lots extra carriage over the 5-ton rate may be charged by producers. Extras and stockholding merchants' terms remain the same.

CURRENT PRICES OF IRON, STEEL AND NON-FERROUS METALS

(Delivered, unless otherwise stated)

Wednesday, September 13, 1944

PIG-IRON

Foundry Iron.—Cleveland No. 3: Middlesbrough, 128s.; Birmingham, 130s.; Falkirk, 128s.; Glasgow, 131s.; Manchester, 133s. Derbyshire No. 3: Birmingham, 130s.; Manchester, 133s.; Sheffield, 127s. 6d. Northants No. 3: Birmingham, 127s. 6d.; Manchester, 131s. 6d. Staffs No. 3: Birmingham, 130s.; Manchester, 133s. Lincolnshire No. 3: Sheffield, 127s. 6d.; Birmingham, 130s.

(*No. 1 foundry 3s. above No. 3. No. 4 forge 1s. below No. 3 for foundries, 3s. below for ironworks.*)

Hematite.—Si up to 3.00 per cent., S & P 0.03 to 0.05 per cent.; Scotland, N.-E.Coast and West Coast of England, 138s. 6d.; Sheffield, 144s.; Birmingham, 150s.; Wales (Welsh iron), 134s. East Coast No. 3 at Birmingham, 149s.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, 140s. 6d., delivered Birmingham.

Scotch Iron.—No. 3 foundry, 124s. 9d.; No. 1 foundry, 127s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, 174s.; South Zone, 176s. 6d.

Refined Malleable.—North Zone, 184s.; South Zone, 186s. 6d.

Cold Blast.—South Staffs, 227s. 6d.

(Note.—*Prices of hematite pig-iron, and of foundry and forge iron with a phosphoric content of not less than* 0.75 *per cent., are subject to a rebate of 5s. per ton.*)

FERRO-ALLOYS

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

Ferro-silicon (5-ton lots).—25 per cent., £21 5s.; 45 per cent., £25 10s.; 75 per cent., £39 10s. Briquettes, £30 per ton.

Ferro-vanadium.—35/50 per cent., 15s. 6d. per lb. of V.

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

Ferro-titanium.—20/25 per cent., carbon-free, 1s. 3½d. lb.

Ferro-tungsten.—80/85 per cent., 9s. 8d. lb.

Tungsten Metal Powder.—98/99 per cent., 9s. 9½d. lb.

Ferro-chrome.—4/8 per cent. C, £46 10s.; max. 2 per cent. C, 1s. 3¾d. lb.; max. 1 per cent. C, 1s. 4¼d. lb.; max. 0.5 per cent. C, 1s. 6d. lb.

Cobalt.—98/99 per cent., 8s. 9d. lb.

Metallic Chromium.—96/98 per cent., 4s. 9d. lb.

Ferro-manganese.—78/98 per cent., £18 10s.

Metallic Manganese.—94/96 per cent., carb.-free, 1s. 9d. lb.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.—Basic: Soft, u.t., 100-ton lots, £12 5s.; tested, up to 0.25 per cent. C, £12 10s.; hard (0.42 to 0.60 per cent. C), £13 17s. 6d.; silico-manganese, £17 5s.; free-cutting, £14 10s. Siemens Martin Acid: Up to 0.25 per cent. C, £15 15s.; case-hardening, £16 12s. 6d.; silico-manganese, £17 5s.

Billets, Blooms and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £13 17s. 6d.; basic hard, 0.42 to 0.60 per cent. C, £14 10s.; acid, up to 0.25 per cent. C, £16 5s.

Sheet and Tinplate Bars.—£12 2s. 6d. 6-ton lots.

FINISHED STEEL

[*A rebate of 15s. per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.*]

Plates and Sections.—Plates, ship (N.-E. Coast), £16 3s.; boiler plates (N.-E. Coast), £17 0s. 6d.; chequer plates (N.-E. Coast), £17 13s.; angles, over 4 un. ins., £15 8s.; tees, over 4 un. ins., £16 8s.; joists, 3 in. × 3 in. and up, £15 8s.

Bars, Sheets, etc.—Rounds and squares, 3 in. to 5½ in., £16 18s.; rounds, under 3 in. to ⅜ in. (untested), £17 12s.; flats, over 5 in. wide, £15 13s.; flats, 5 in. wide and under, £17 12s.; rails, heavy, f.o.t., £14 10s. 6d.; hoops, £18 7s.; black sheets, 24 g. (4-ton lots), £22 15s.; galvanised corrugated sheets (4-ton lots), £26 2s. 6d.; galvanised fencing wire, 8 g. plain, £26 17s. 6d.

Tinplates.—I.C. cokes, 20 × 14 per box, 29s. 9d. f.o.t. makers' works, 30s. 9d., f.o.b.; C.W., 20×14, 27s. 9d., f.o.t., 28s. 6d., f.o.b.

NON-FERROUS METALS

Copper.—Electrolytic, £62; high-grade fire-refined, £61 10s.; fire-refined of not less than 99.7 per cent., £61; ditto, 99.2 per cent., £60 10s.; black hot-rolled wire rods, £65 15s.

Tin.—99 to under 99.75 per cent., £300; 99.75 to under 99.9 per cent., £301 10s.; min. 99.9 per cent., £303 10s.

Spelter.—G.O.B. (foreign) (duty paid), £25 15s.; ditto (domestic), £26 10s.; "Prime Western," £26 10s.; refined and electrolytic, £27 5s.; not less than 99.99 per cent., £28 15s.

Lead.—Good soft pig-lead (foreign) (duty paid), £25; ditto (Empire and domestic), £25; English, £26 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, ex works, £37 12s. 6d.; rolled zinc (boiler plates), ex works, £35 12s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £30 10s.

Other Metals.—Aluminium, ingots, £110; antimony, English, 99 per cent., £120; quicksilver, ex warehouse, £68 10s. to £69 15s.; nickel, £190 to £195.

Brass.—Solid-drawn tubes, 14d. per lb.; brazed tubes, 16s.; rods, drawn, 11⅜d.; rods, extruded or rolled, 9d.; sheets to 10 w.g., 11⅛d.; wire, 10⅞d.; rolled metal, 10½d.; yellow metal rods, 9d.

Copper Tubes, etc.—Solid-drawn tubes, 15¼d. per lb.; brazed tubes, 15¼d.; wire, 10d.

Phosphor Bronze.—Strip, 14¼d. per lb.; sheets to 10 w.g.; 15¾d.; wire, 16¼d.; rods, 16½d.; tubes, 21½d.; castings, 20d., delivery 3 cwt. free. 10 per cent. phos. cop. £35 above B.S.; 15 per cent. phos. cop. £43 above B.S.; phosphor tin (5 per cent.) £40 above price of English ingots. (C. Clifford & Son, Limited.)

Nickel Silver, etc.—Ingots for raising, 10d. to 1s. 4d. per lb.; rolled to 9 in. wide, 1s. 4d. to 1s. 10d.; to 12 in. wide, 1s. 4½d. to 1s. 10½d.; to 15 in. wide, 1s. 4¾d. to 1s. 10¾d.; to 18 in. wide, 1s. 5d. to 1s. 11d.; to 21 in. wide, 1s. 5¼d. to 1s. 11¼d.; to 25 in. wide, 1s. 6d. to 2s. Ingots for spoons and forks, 10d. to 1s. 6½d. Ingots rolled to spoon size, 1s. 1d. to 1s. 9½d. Wire, round, to 10g., 1s. 7½d. to 2s. 2½d. with extras according to gauge. Special 5ths quality turning rods in straight lengths, 1s. 6½d. upwards.

NON-FERROUS SCRAP

Controlled Maximum Prices.—Bright untinned copper wire, in crucible form or in hanks, £57 10s.; No. 1 copper wire, £57; No. 2 copper wire, £55 10s.; copper firebox plates, cut up, £57 10s.; clean untinned copper, cut up, £56 10s.; braziery copper, £53 10s.; Q.F. process and shell-case brass, 70/30 quality, free from primers, £49; clean fired 303 S.A. cartridge cases, £47; 70/30 turnings, clean and baled, £43; brass swarf, clean, free from iron and commercially dry, £34 10s.; new brass rod ends, 60/40 quality, £38 10s.; hot stampings and fuse metal, 60/40 quality, £38 10s.; Admiralty gunmetal, 88-10-2, containing not more than ½ per cent. lead or 3 per cent. zinc, or less than 9½ per cent. tin, £77, all per ton, ex works.

Returned Process Scrap.—(Issued by the N.F.M.C. as the basis of settlement for returned process scrap, week ended Sept. 9, where buyer and seller have not mutually agreed a price; net, per ton, ex-sellers' works, suitably packed):—

Brass.—S.A.A. webbing, £48 10s.; S.A.A. defective cups and cases, £47 10s.; S.A.A. cut-offs and trimmings, £42 10s.; S.A.A. turnings (loose), £37; S.A.A. turnings (baled), £42 10s.; S.A.A. turnings (masticated), £42; Q.F. webbing, £49; defective Q.F. cups and cases, £49; Q.F. cut-offs, £47 10s.; Q.F. turnings, £38; other 70/30 process and manufacturing scrap, £46 10s.; process and manufacturing scrap containing over 62 per cent. and up to 68 per cent. Cu, £43 10s.; ditto, over 58 per cent. to 62 per cent. Cu, £38 10s.; 85/15 gilding metal webbing, £52 10s.; 85/15 gilding defective cups and envelopes before filling, £50 10s.; cap metal webbing, £54 10s.; 90/10 gilding webbing, £53 10s.; 90/10 gilding defective cups and envelopes before filling, £51 10s.

Cupro Nickel.—80/20 cupro-nickel webbing, £75 10s.; 80/20 defective cups and envelopes before filling, £70 10s.

Nickel Silver.—Process and manufacturing scrap; 10 per cent. nickel, £50; 15 per cent. nickel, £56; 18 per cent. nickel, £60; 20 per cent. nickel, £63.

Copper.—Sheet cuttings and webbing, untinned, £54; shell-band plate scrap, £56 10s.; copper turnings, £48.

IRON AND STEEL SCRAP

(*Delivered free to consumers' works. Plus 3¾ per cent. dealers' remuneration.* 50 *tons and upwards over three months, 2s. 6d. extra.*)

South Wales.—Short heavy steel, not ex. 24-in. lengths, 82s. to 84s. 6d.; heavy machinery cast iron, 87s.; ordinary heavy cast iron, 82s.; cast-iron railway chairs, 87s.; medium cast iron, 78s. 3d.; light cast iron, 73s. 6d.

Middlesbrough.—Short heavy steel, 79s. 9d. to 82s. 3d.; heavy machinery cast iron, 91s. 9d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 89s. 3d.; medium cast iron, 79s. 6d.; light cast iron, 74s. 6d.

Birmingham District.—Short heavy steel, 74s. 9d. to 77s. 3d.; heavy machinery cast iron, 92s. 3d.; ordinary heavy cast iron, 87s. 6d.; cast-iron railway chairs, 87s. 6d.; medium cast iron, 80s. 3d.; light cast iron, 75s. 3d.

Scotland.—Short heavy steel, 79s. 6d. to 82s.; heavy machinery cast iron, 94s. 3d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 94s. 3d.; medium cast iron, 77s. 3d.; light cast iron, 72s. 3d.

(Note.—*For deliveries of cast-iron scrap free to consumers, works in Scotland, the above prices less 3s. per ton, but plus actual cost of transport or 6s. per ton, whichever is the less.*)

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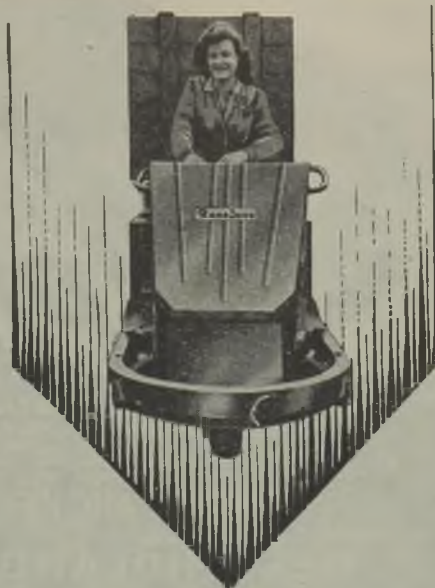

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