FOUNDRY TRADE JOURNAL

EST. 1902

VOL. 95
No. 1944

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DECEMBER 3, 1953

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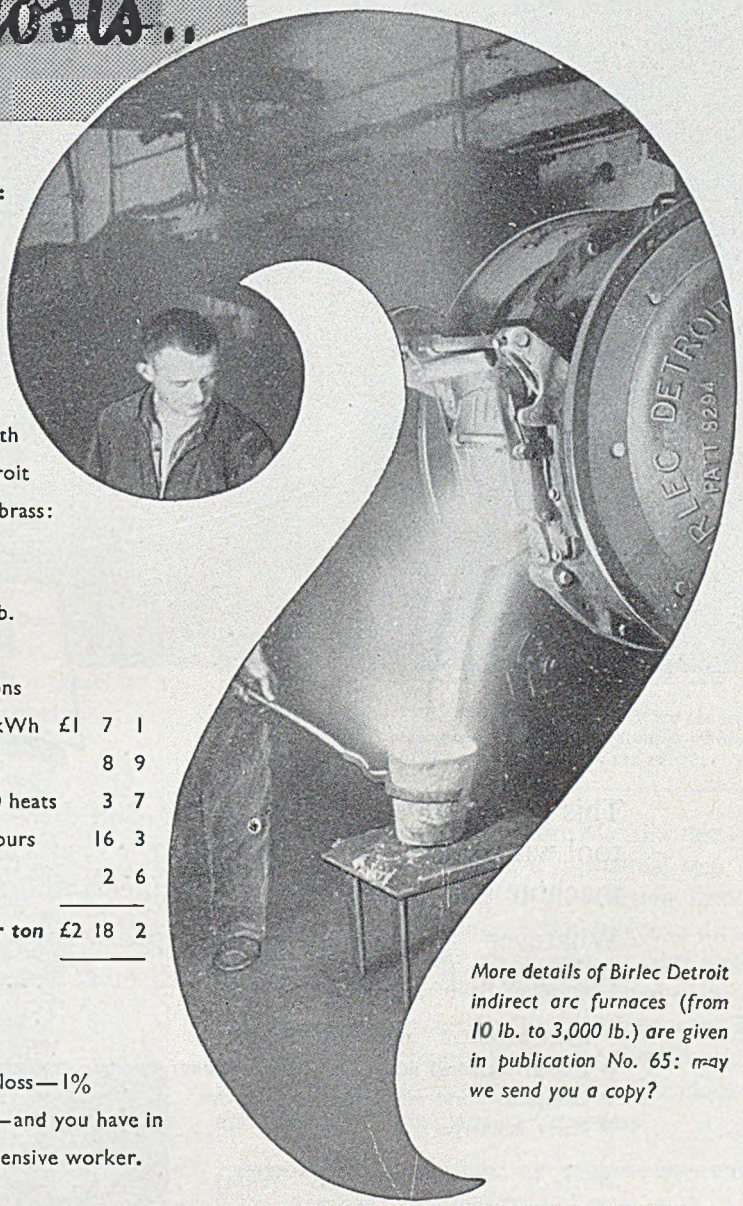
Offices: 49, Wellington Street, Strand, London, W.C.2

Single Copy, 9d. By Post 11d. Annual Subscription, Home 40/-, Abroad 45/- (Prepaid)

What are your melting costs..



Some metal founders never find out: too few know in advance. BIRLEC DETROITS, however, give reliable, predictable melting performances, producing sound metal at low operating costs.

Compare your present melting figures with these typical costs on a 500 lb. Birlec Detroit furnace (model LFY), working on 70/30 brass:

Average size of heat	500 lb.		
Heats per 8 hours	11		
Average output per 8 hours ...	2½ tons		
Electricity per ton @ 1d. per kWh	325 kWh	£1	7 1
Electrodes per ton @ 1/9d. per lb.	5 lb.		8 9
Refractories per ton	1,500 heats		3 7
Labour per ton @ 5/- per hour	3¼ hours		16 3
Water and miscellaneous ...			2 6
Direct operating cost per ton		**£2**	**18 2**

More details of Birlec Detroit indirect arc furnaces (from 10 lb. to 3,000 lb.) are given in publication No. 65: may we send you a copy?

Also reckon the advantage of low metal loss—1% can be assumed for budgeting purposes—and you have in the Birlec Detroit a hard, reliable, inexpensive worker.

BIRLEC LIMITED

ERDINGTON · BIRMINGHAM 24

Sales and service offices in LONDON, SHEFFIELD *and* GLASGOW

BIRLEC

sm/B. 948. 53b.

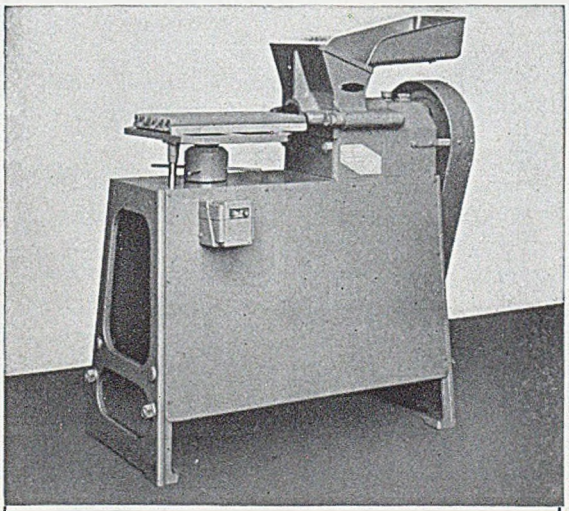
A.

TWO FOUNDRY MACHINES OF EXCEPTIONAL MERIT

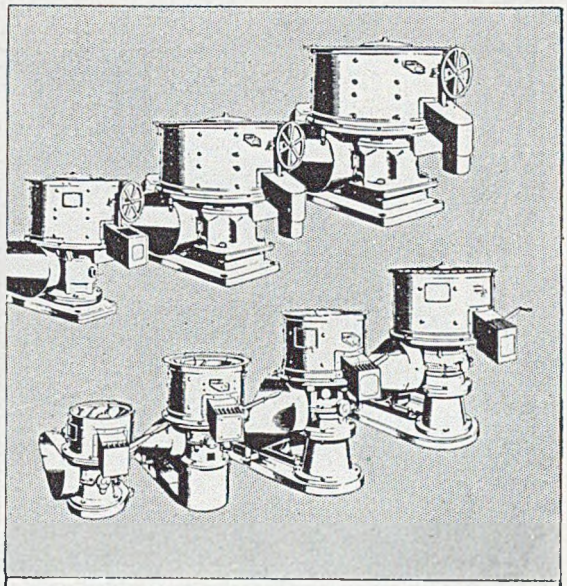
Sand/Binder Mixing without crushing

ACCURATE CORE EXTRUSION WITH ANY GRADE SANDS

The Fordath 'New Type' Mixer, in seven sizes with capacities from 20 lbs. to 1 ton, mixes foundry silica sands with core bonding compounds without crushing. It mixes and discharges in 2 to 3 minutes a well aerated homogeneous mix. Stiff compounds as low as 1% can be completely dispersed through the sand. Fordath Mixing Machines are hard at work, day after day, in foundries everywhere. It is therefore a simple matter to arrange to see one in operation.



The FORDATH MULTIPLUNGER CORE MACHINE *admirably exemplifies the success of equipment designed by foundrymen for foundrymen.*



FORDATH 'NEW TYPE' MIXING MACHINES *use the well known Fordath principle of rubbing and folding without crushing in each of the seven models in the range.*

The Fordath Multiplunger Core Machine takes the extrusion of accurate cores a substantial step forward. The positive thrust of the core-mix through the multiple die by plunger action produces dimensionally accurate cores when sands of poor quality have to be utilised; even facing sand or plain red moulding sand can be extruded satisfactorily. The appeal of this machine to costing-conscious foundrymen was immediate from the day of its introduction, and there have been many repeat orders.

Arrange to see these machines at work

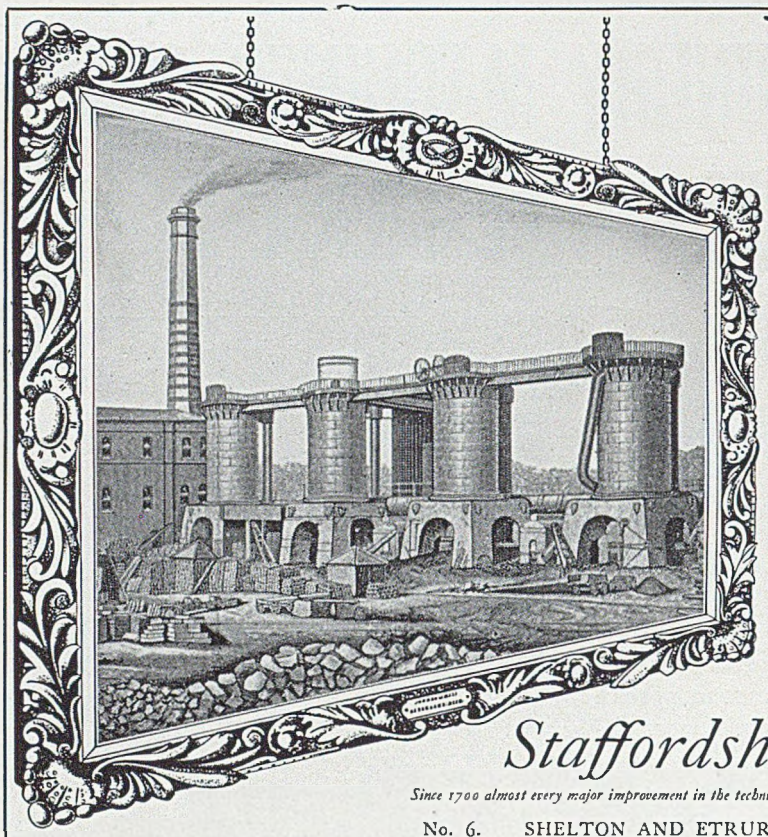
Full details from :

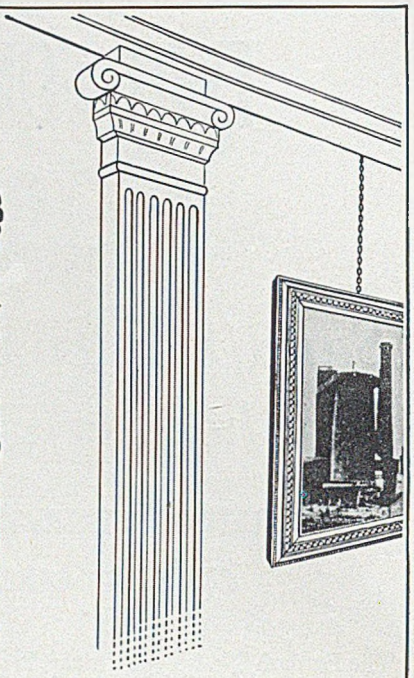
THE FORDATH ENGINEERING CO. LTD.

HAMBLET WORKS, WEST BROMWICH, STAFFS.

PHONE: West Bromwich 0549, 0540, 1692

GRAMS: Metallical, West Bromwich





Staffordshire Ancestry

Since 1700 almost every major improvement in the technique of iron founding has originated in Staffordshire.

No. 6. SHELTON AND ETRURIA, HANLEY, NORTH STAFFS

Samuel Griffiths, in his "Guide to the Iron Trade," writes of the Etruria Works: "The Great Shelton Bar and Iron Company is situated at Hanley and is the property of the Right Honourable the Earl Granville. The works were laid down in 1857 under the direction of first class engineers and erected with assiduous care, quite regardless of expense . . .

. . . This firm has succeeded in making a quality of malleable iron, not in the least red short, a beautiful light colour in the fracture, with a rich fibre, and which will stand a tensile strain in a much higher degree than that of many other Staffordshire houses."

• *Pictorial reference is reproduced by courtesy of the publishers of Samuel Griffiths' "Guide to the Iron Trade of Great Britain" to whom grateful acknowledgment is made.*

For the past 136 years Pig Iron has been manufactured at Bradley & Foster's Darlaston Iron Works. Today, Bradley & Foster's spectrographic control of raw material and finished product enables them to supply pig iron of consistent uniformity to the most exacting specification.

FOR QUALITY CONTROLLED
REFINED PIG IRON

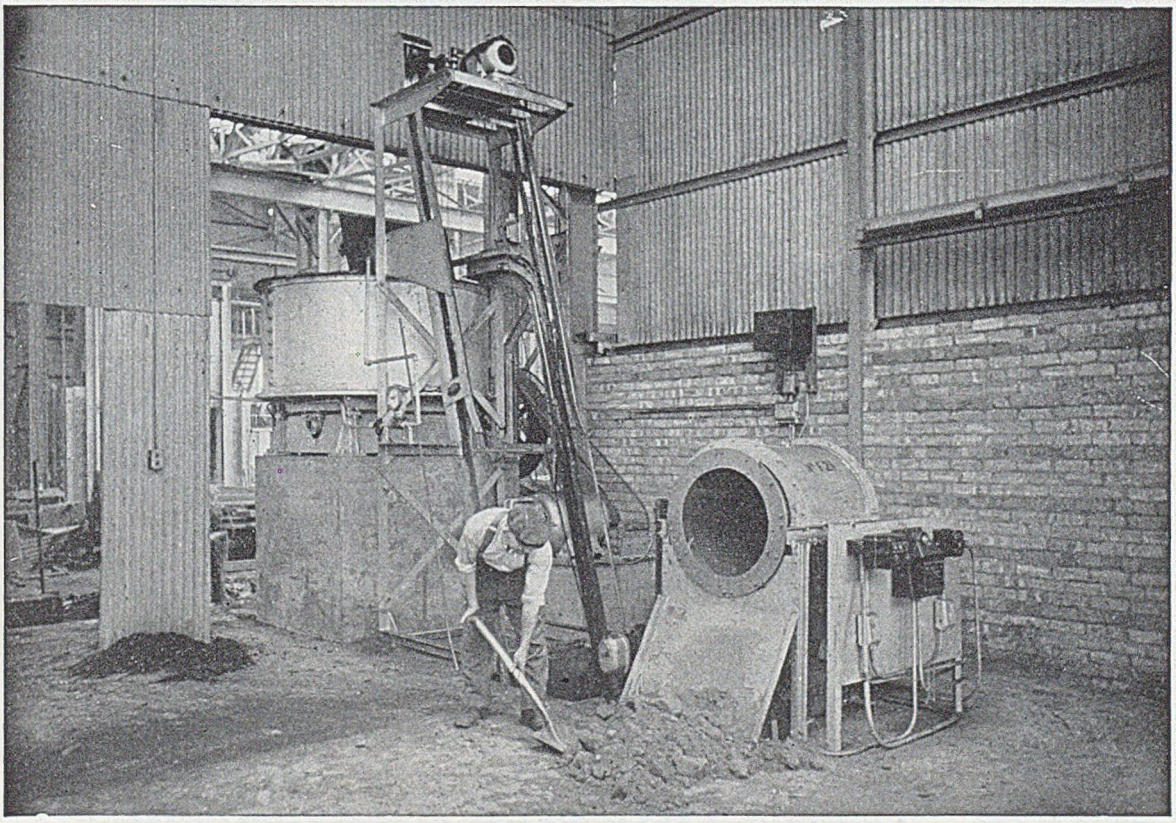
Bradley & Foster
LIMITED

DARLASTON · STAFFORDSHIRE

L.G.B.

PNEULEC *facing sand plant unit*

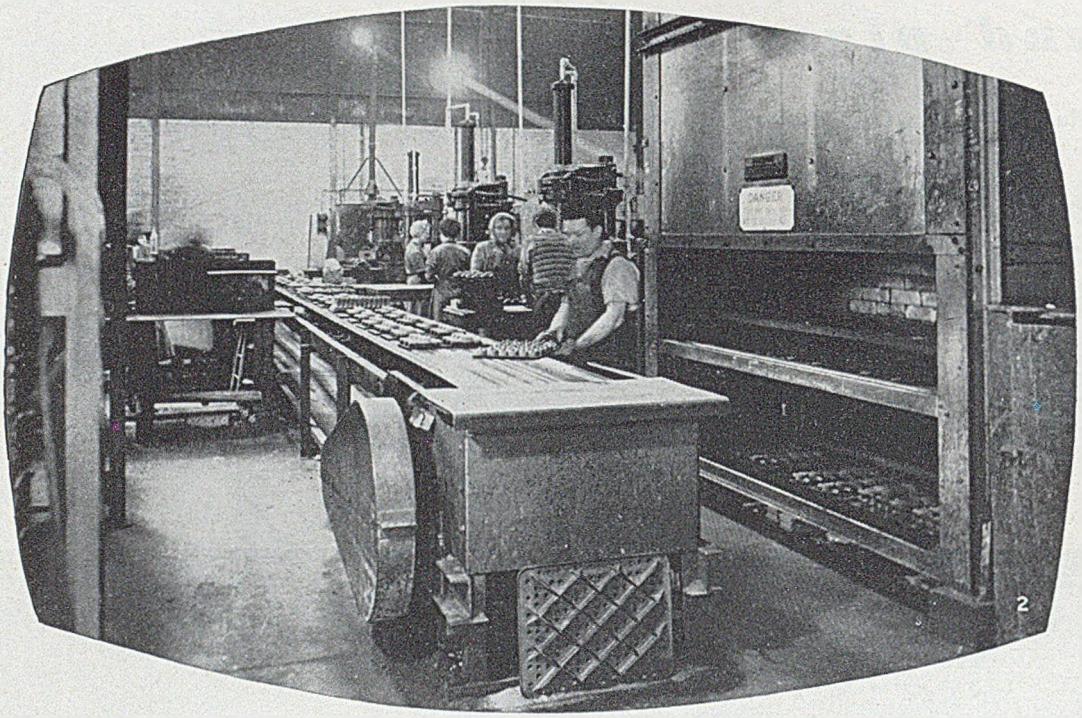
The illustration shows our facing sand plant unit which includes shovel fed rotary screen, collecting belt conveyor, magnetic pulley, loader and 6ft. 0in. diameter mill with disintegrator. The recommended batch capacity of the plant for facing is 6 cwts. and the normal batch cycle 6 minutes. This is a standard layout and there are many successful installations operating in all parts of the world. Further information will be gladly supplied on request.



Built in England by

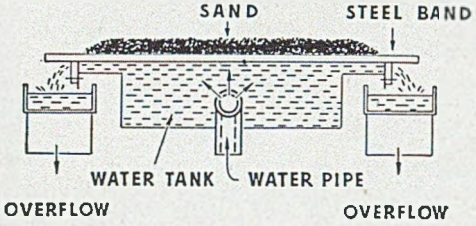
PNEULEC LIMITED, SMETHWICK, Nr. BIRMINGHAM

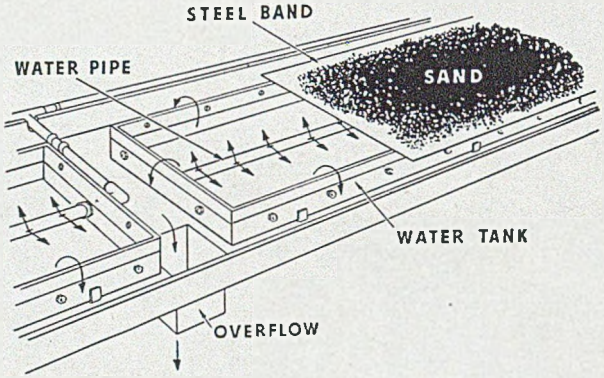
MODERNISE YOUR CORE SHOP . . .



This photograph shows one of our many conveyors conveying cores from the benches to the drying stove.

WITH STEEL BAND CONVEYORS





If you have difficulty with your warm sand adhering to patterns why not cool it on our patented water-cooled steel band conveyor as illustrated by diagrams above and on right.

SSBC

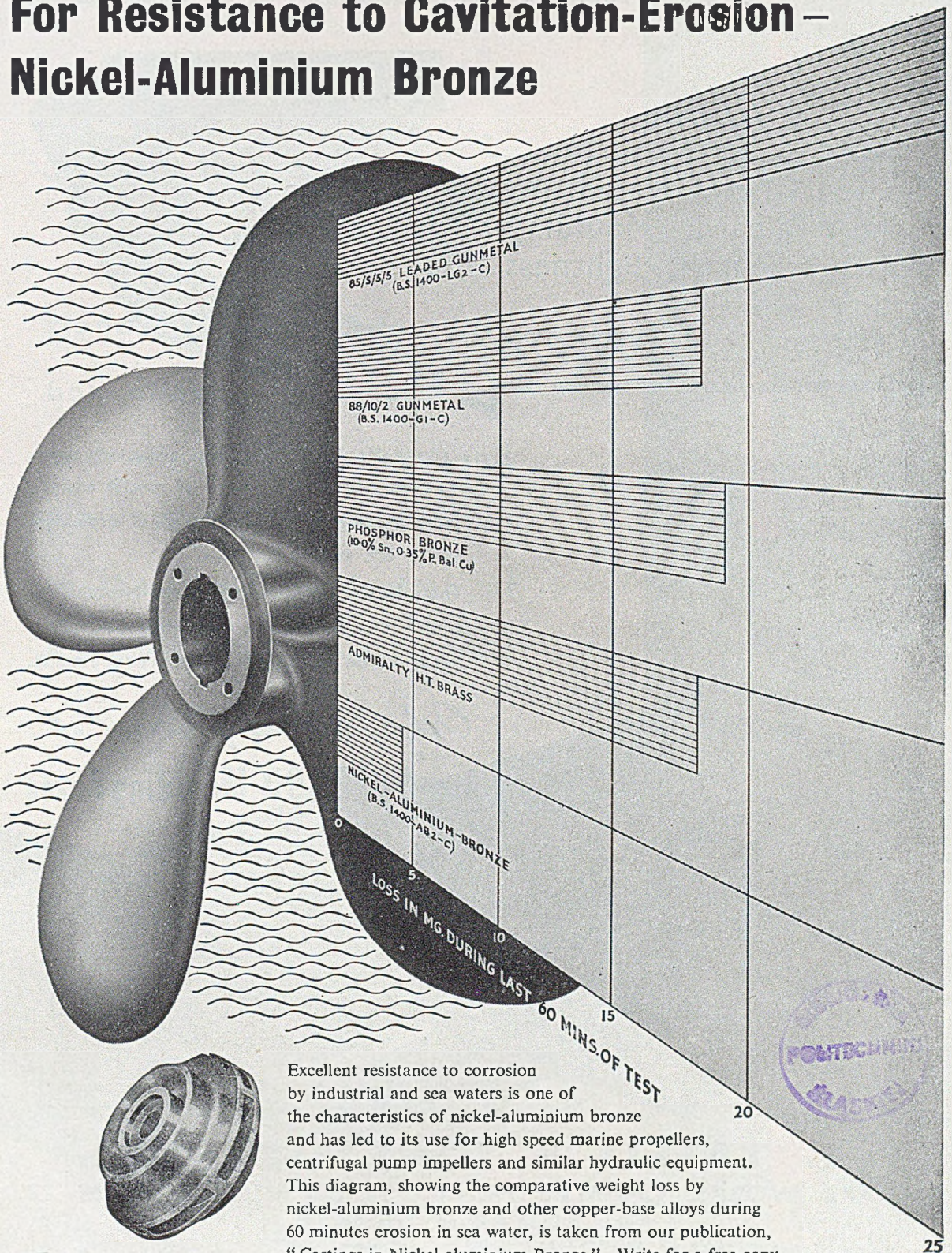
SANDVIK STEEL BAND CONVEYORS LTD

B.F.T. Division

DAWLISH ROAD, SELLY OAK, BIRMINGHAM, 29

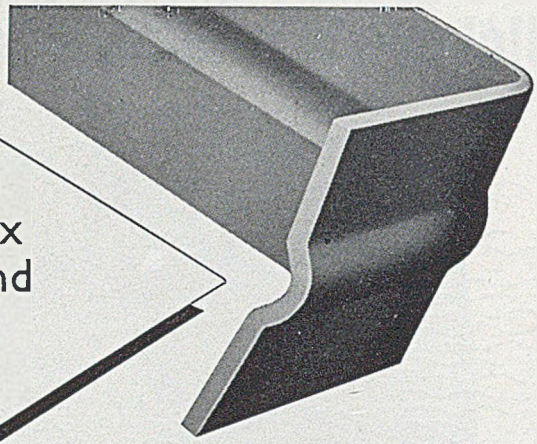
Telephone: SELly Oak 1113-4-5 *Telegrams: Simplicity, Birmingham*

For Resistance to Cavitation-Erosion — Nickel-Aluminium Bronze



Excellent resistance to corrosion by industrial and sea waters is one of the characteristics of nickel-aluminium bronze and has led to its use for high speed marine propellers, centrifugal pump impellers and similar hydraulic equipment. This diagram, showing the comparative weight loss by nickel-aluminium bronze and other copper-base alloys during 60 minutes erosion in sea water, is taken from our publication, "Castings in Nickel-aluminium Bronze". Write for a free copy.

THE MOND NICKEL COMPANY LIMITED · SUNDERLAND HOUSE · CURZON ST · LONDON · W.1.

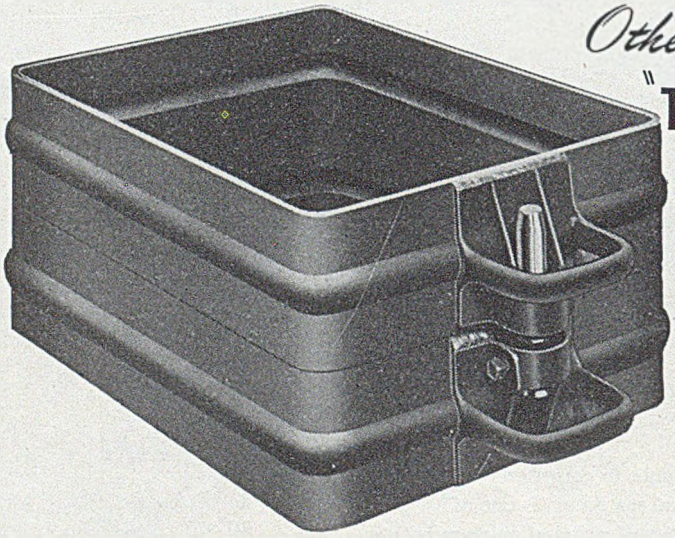


This special corrugated section of the "Talbard" Moulding Box affords strength, lightness and rigidity *with*

MAXIMUM SAND RETENTION

Talbard Moulding Boxes are precision manufactured from rolled steel of special analysis and are available in a full range of sizes from 8in. by 6in. to 48in. by 30in.

These boxes are standardised for interchangeability of moulding-box equipment but special boxes can be made for individual requirements.



Other special features of

"TALBARD" Moulding Boxes

- Cast malleable lugs and fittings
- Accurately ground box faces
- Precision ground pins adjustable for length
- Full range of loose pin and multi part boxes
- Accurate pin centres and guaranteed interchangeability
- Renewable steel bushes, round or elongated
- Straight lifting handles optional
- Special brassfounders boxes
- Range of bars, clamps, etc., as required
- Specially finished and packed for export

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LESS SCRAP!

Sterling

standards of precision in box dimensions, accuracy and alignment of lugs and pins, are major contributions to the rapid production of

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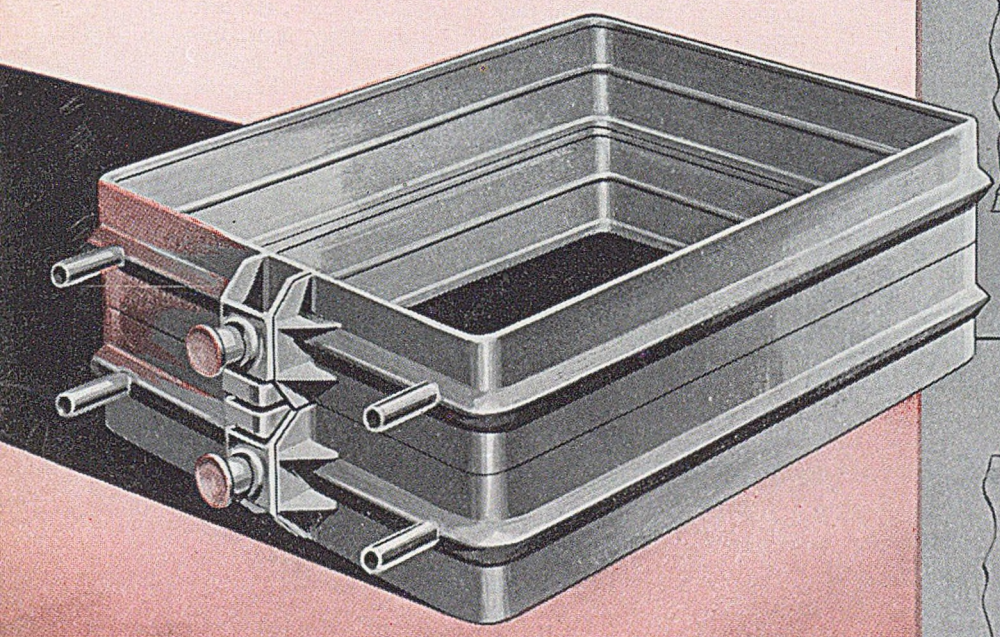

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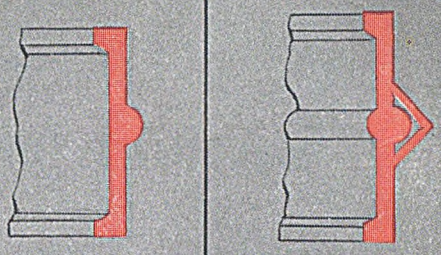
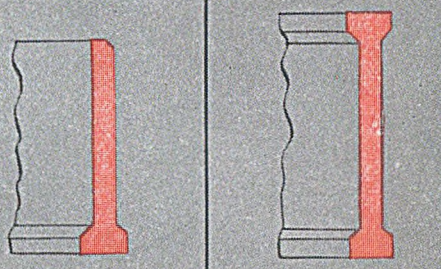


STANDARD



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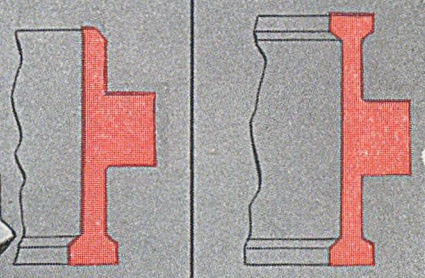
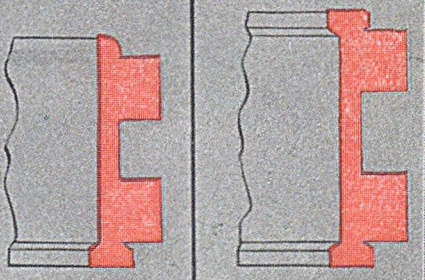
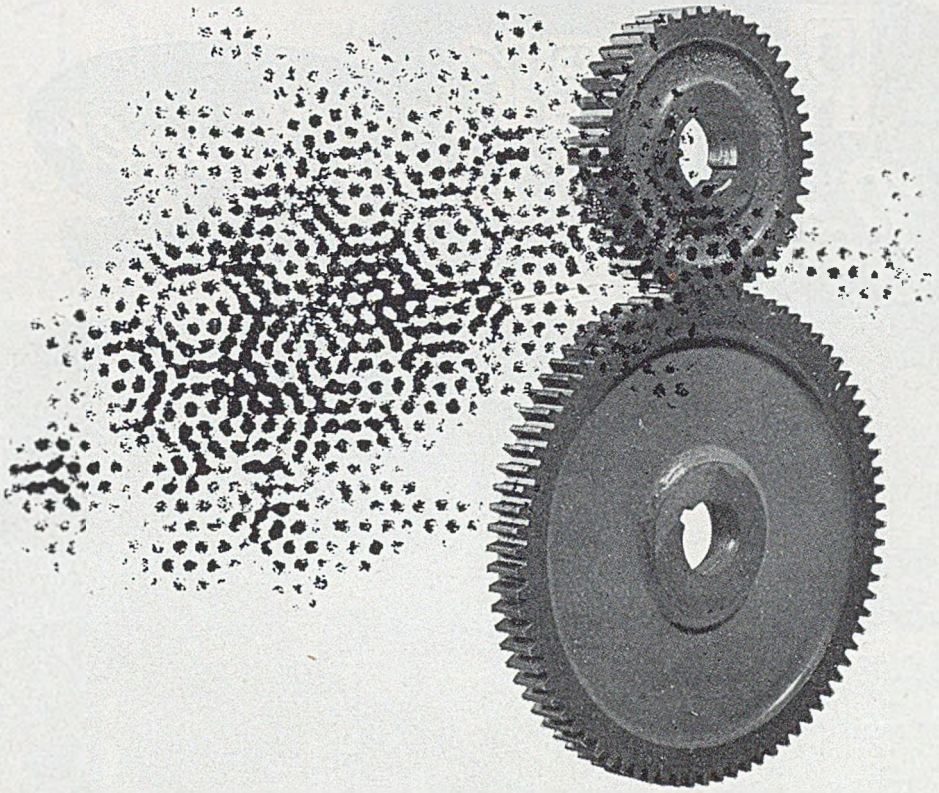


ALL FOUNDRY



CONDITIONS



Dust means trouble—

and you can't make a thing without making dust

Dust and swarf are highly dangerous things to have around. Between them they can ruin the bearings and cogs of delicate machines — and dust alone can cause havoc in the throats and lungs of your work-people. There's only one place for dust and swarf — the dustbin. Call us in to help you put them there. We've been handling tricky dust control problems for a long time now.

see us for dust

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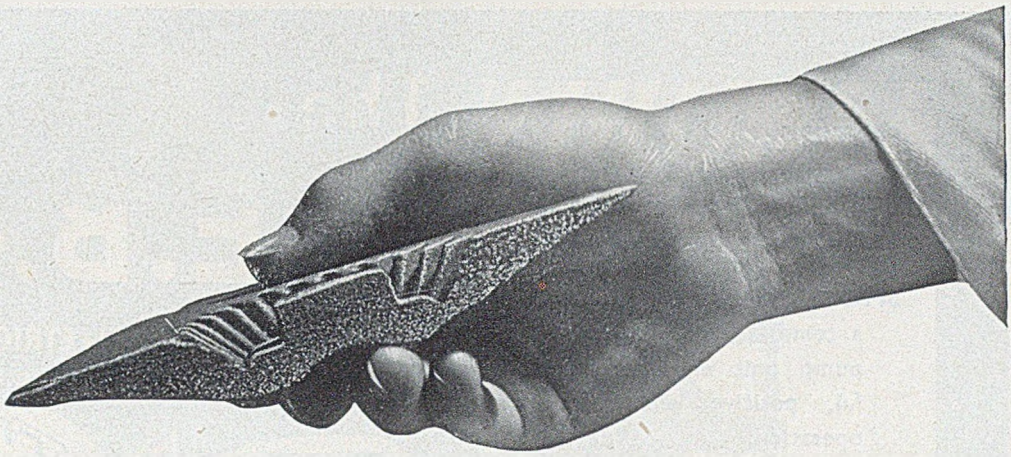
CRC 37



FOR THE SAND-SHELL MOULDING PROCESS—

—a complete resin service from I.C.I.

PRODUCTS 'Mouldrite' PF 422 Resin Binder, Silicone-oil mould lubricant and resin-base wetting agent.

SERVICE based on practical experience with the Sand-shell process over a wide range of metal casting at an I.C.I. foundry, which is carrying out extensive research on shell moulding.

INFORMATION on the uses of synthetic resins in the foundry from the Technical Service and Development Department of I.C.I. Plastics Division.

Send for 'Synthetic Resins for the Foundry'

'Mouldrite' is the registered trade mark of the thermosetting resins manufactured by I.C.I.

IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.1 ICI

P.541

Campanological Casting...

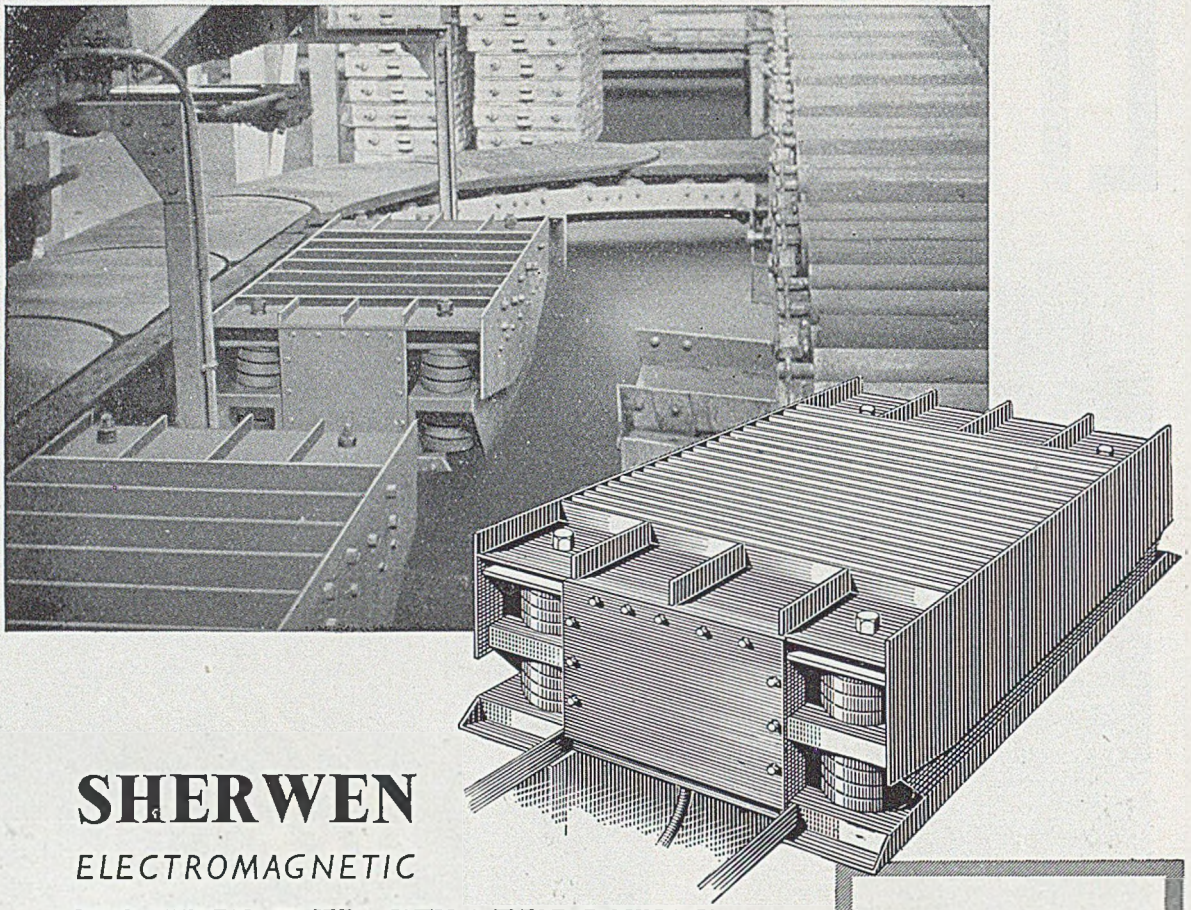
with the better quality metal and negligible metal loss from Morgan CRUCIBLE furnaces.

Church bells are but one of the multitudinous products which last well because they are made well—and made well because someone knew the value of "CRUCIBLE MELTING... the Morgan way". Please write for literature.

With acknowledgements to Messrs. Gillett & Johnston Ltd.

CRUCIBLE MELTING ... the Morgan way

THE MORGAN CRUCIBLE COMPANY LTD., BATTERSEA CHURCH RD., LONDON, S.W.11 BAT 8822



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ELECTROMAGNETIC

FOUNDRY SHAKEOUTS

Wear and tear on foundry boxes is considerably reduced by installing Sherwen vibratory shakeouts as the intensity of vibration can be instantaneously controlled to suit light or heavy boxes. The shake out action, which is a straight line movement at right angles to the bottom of the box, quickly breaks up and screens most difficult dry sand.

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- ★ *NO FOUNDATIONS REQUIRED*
- ★ *CONTROLLED VIBRATION INTENSITY*
- ★ *NO LUBRICATION*

FRASER & CHALMERS

FRASER & CHALMERS ENGINEERING WORKS
ERITH · KENT

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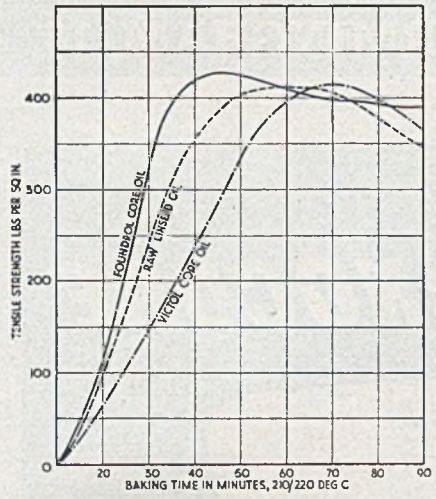
VICTOL & FOUNDROL Core Oils



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Do you require High-Grade Core-Oils with properties excelling Linseed Oils or Low Priced Core-Oils which still produce excellent cores ?

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Metals & Methods, Ltd.	—
Metronic Instrument Co., Ltd.	66
Midgley & Son, Ltd.	—
Midland Tar Distillers, The, Ltd.	65
Mining & Chemical Products, Ltd.	65
Mitchell's Emery Wheel Co., Ltd.	—
Modern Furnaces & Stoves, Ltd.	47 & 55
Mole, S., & Sons (Green Lane Foundry), Ltd.	—
Molineux Foundry Equipment, Ltd.	—
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Monometer Manufacturing Co., Ltd.	—
Monsanto Chemicals, Ltd.	—
Morgan Crucible Co., Ltd.	25
Morris, Herbert, Ltd.	—
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Neville, T. C., & Sons, Ltd.	—
New Conveyor Co., Ltd.	—
Nitralloy, Ltd.	44
Norton Aluminium Products, Ltd.	—
Norton Grinding Wheel Co., Ltd.	—
Ormerod, R. E., Ltd.	—
Paget Engineering Co. (London), Ltd.	—
Palmer Tyre, Ltd.	—
Pantin, W. & Co., Ltd.	—
Parish, J., & Co.	—
Pascall Engineering Co., Ltd.	67
Passe, J. F., & Co.	—
Paterson Hughes Engineering Co., Ltd.	—
Pattern Equipment Co. (Leicester), Ltd.	—
Patterns (Derby) Ltd.	—
Perry, G., & Sons, Ltd.	43
Phillips Electrical, Ltd.	24
Phillips, J. W. & C. J., Ltd.	62
Pickerings, Ltd.	64
Pickford, Holland & Co., Ltd.	—
Pneulec, Ltd.	7
Pope's Electric Lamp Co., Ltd.	—
Portway, C., & Son, Ltd.	—
Potclays, Ltd.	40
Premo Pattern Co., Ltd.	—
Precision Presswork Co., Ltd.	—
Price, J. T., & Co. (Brass & Aluminium Founders), Ltd.	—
Price, J. T., & Co., Ltd.	—
Reavell & Co., Ltd.	—
Refractory Mouldings & Castings, Ltd.	—
Richardson Engineering (B'ham), Ltd.	34
Richardson, R. J., & Sons, Ltd.	—
Risdale & Co., Ltd.	—
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Sarginson Bros., Ltd.	—
St. George's Engineers, Ltd.	—
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Sklenar Furnaces, Ltd.	—
Slough Metals, Ltd.	—
Smedley Bros., Ltd.	60
Smeeton, John A., Ltd.	—
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Smith, John (Keighley), Ltd.	—
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Solus-Schall, Ltd.	—
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Ward, Thos. W., Ltd.	1
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Warner & Co., Ltd.	68
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Webster & Co. (Sheffield), Ltd.	—
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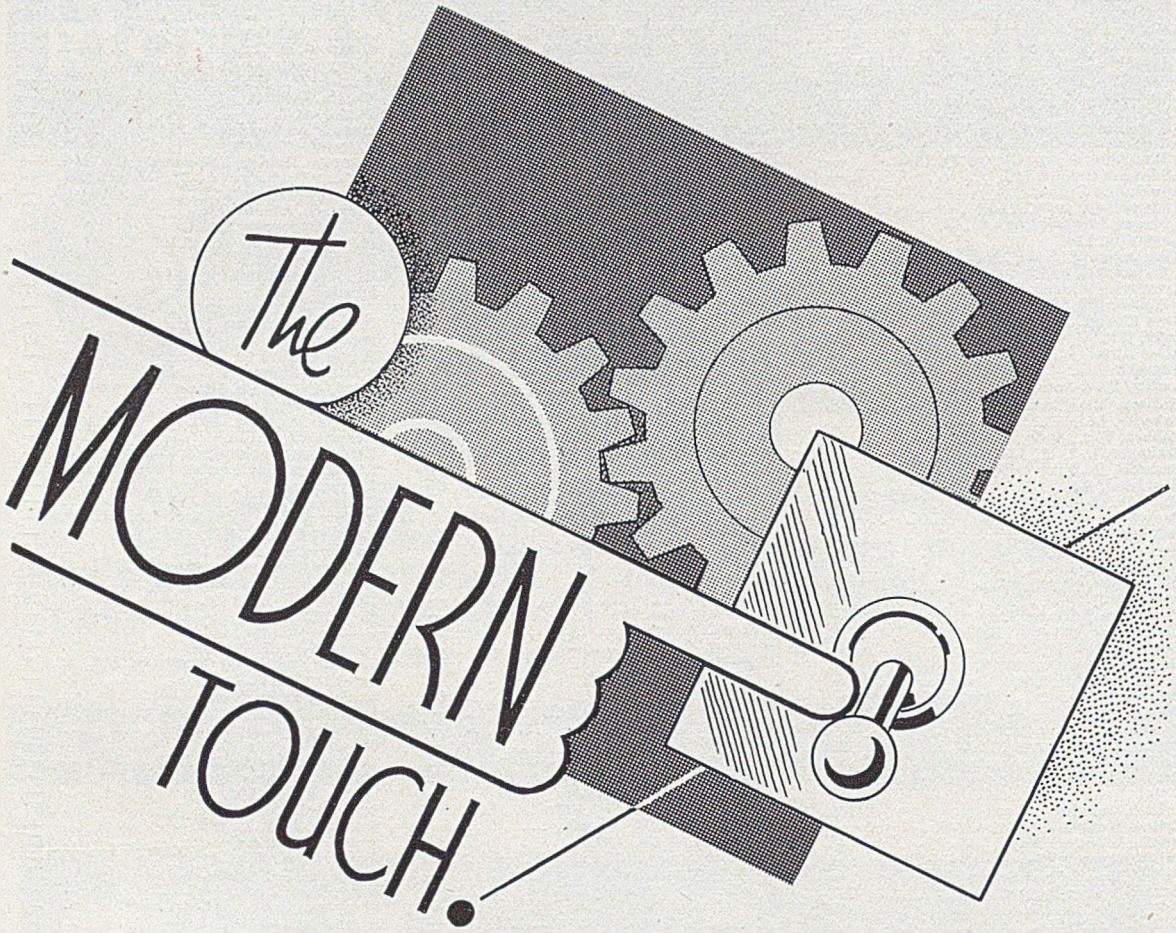

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FOUNDRY TRADE JOURNAL

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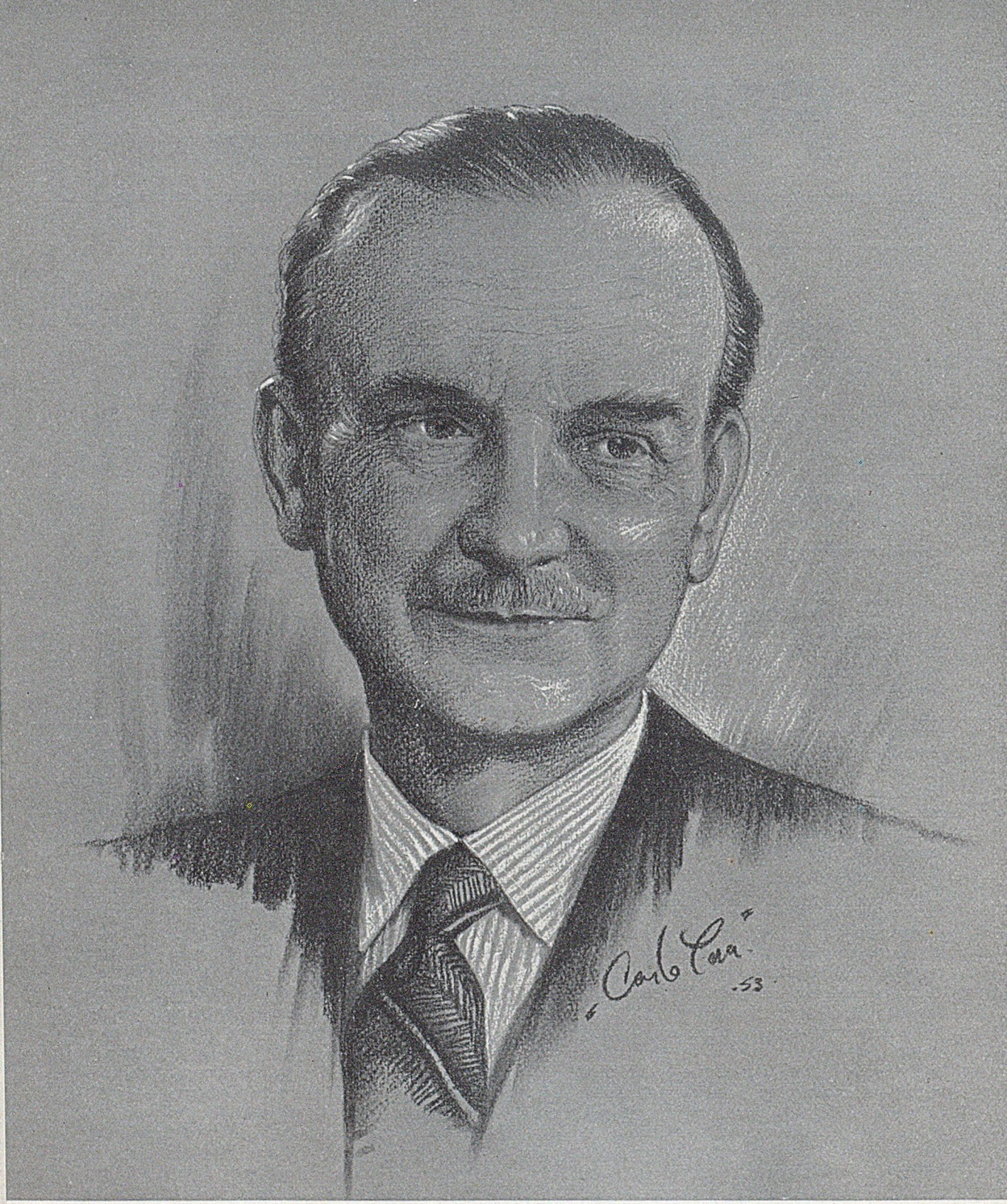
Rationalization

Last week, we attended a conference organized by the British Cast Iron Research Association and the Council of Ironfoundry Associations on "Simplifying Foundry Operations." In many cases, however, the simplification needed a quite complex organization. Sometimes it involved the use of methods engineering, work and motion study, or the imposition of high-grade technical control, but in all cases a mental attitude directed towards the better and more intelligent use of labour is fundamental. No participant can have failed to have learnt the lesson for the need and value of a logical and inquisitive mind directed towards the better utilization of human effort. The revival of the word "rationalization" would seem to fit these circumstances. Whilst the conference initially impressed upon the audience this essential attitude, it lost its sense of logic by the early recital of the benefits before the basic principles had been sufficiently assimilated. Early in the proceedings there should have been the lecture—an exceedingly interesting one—which suggested the posing of twenty questions or more as to why, where, how, and when a job should be done—much on the lines we set out in this column a few months ago.

In one of the extraneous yet interesting lectures, it was authoritatively stated that a quite high percentage of the founders fail to weigh their cupola charges. Such a non-existent process cannot very well be simplified, but the application of the "how, when and where" questions would soon show up the need for its institution. A similar state of affairs apparently exists in the core-shop, where additions of quite expensive materials are made by guesswork. Still not quite germane to the subject was an interesting case history of scrap reduction. A pair of moulding machines forming part of a large unit was regularly producing, yet from its moulds was made a much higher percentage of wasters than the rest. All were using exactly the same controlled sand and poured with the same type of metal. The cause of the trouble was the difference in hardness of defective mould faces, and the problem was solved by the introduction into the air system at the machine of a pressure-reducing valve together with a suitable meter, enabling lighter ramming to be effected.

The actual work-simplification methods were impressively illustrated by films, and their study must have been beneficial to those operating quantity production foundries, but for the small foundry owner the best advice was that the man in charge should plan each job before production was started, communicate his methods to those who had to carry out the work—preferably on Saturday mornings at a short conference—and finally engage a night shift to knock out the moulds and prepare for a good start each morning. For all foundries the lessons were:—Use the best pattern the worth of the job will stand, meticulously designed and maintained boxes, and insist upon careful and intelligent workmanship. Then perhaps thinking around the idiotic question that if there is a 10-ton wagon absolutely full of loose pins, could it be made to carry an extra one? It is such a study applied to the numerous problems in workaday life which will evolve better methods and produce good commercial results.



E. LONGDEN, M.I.Mech.E.

President of the Institute of British Foundrymen 1953/1954

Leaders of the Industry

E. LONGDEN, M.I.Mech.E.

E. LONGDEN comes of foundry stock as his father was a craftsman in the industry. Thus it was only natural that he should become an apprentice moulder, and he "served his time" with the British Westinghouse Company, Limited—now Metropolitan-Vickers, Limited. Like most of the progressive youths of that period, his evenings were spent in gaining knowledge of theoretical subjects and for a number of years he studied metallurgy, engineering and economics at Manchester College of Technology. His desire to impart knowledge to others was shown early in life and he was a valued contributor to the columns of this JOURNAL. A little later, he became well known as a popular lecturer on technology to national and local meetings of the Institute of British Foundrymen. During his long career, Longden has been manager of the foundries of Tangyes, Limited; John Heatherington & Sons, Limited; Craven Brothers Limited, and engineering and foundry works manager for David Brown-Jackson & Company, Limited. From this last post he retired to practise as a foundry consultant. In this capacity he was last year asked by the United Nations Technical Aid Mission to visit Yugoslavia to advise on foundry processes.

For his research and technological work, especially that devoted to liquid shrinkage and solid contraction and related subjects, Mr. Longden has been awarded both the Oliver Stubbs and the British Foundry Medals—both well-deserved honours. He has presented the official British exchange papers at both Paris and Philadelphia. He joined the Institute of British Foundrymen in 1921, and by 1928 he was president of its Lancashire branch. After very long service on the Council, he was elected president last June. His detailed knowledge of cast iron, steel and non-ferrous foundry technology, together with his logical approach to subjects well qualifies him for the high office he now holds.

Recent times have found his leisure time taken up with gardening and the writing of a book, now due for publication, on "Densening and Chilling in Foundrywork," whilst he confesses to the liking of detective thriller stories for light recreation.

London Branch Ladies' Evening

Nearly 300 members, their ladies and guests, assembled at the Café Royal last Friday for the annual dinner/dance and cabaret show of the London branch of the Institute of British Foundrymen. At this premier social event of their year, the branch had the Institute's national president, Mr. E. Longden (and Mrs. Longden) as well as the secretary, Mr. T. Makemson, among the guests. Mr. B. Levy, branch president, supported by Mrs. Levy, received the company. The toast of the London branch was given by Mr. Longden and replied to by Mr. Levy, who added a special welcome to the ladies and other guests. Mr. A. R. Wizard was the indefatigable M.C. and the cabaret turns, "The Courtneys" and "Ravic and Babs," were voted a huge success. Organization of the function was handled by Mr. A. R. Parkes.

Luncheon

FOUNDRY TRADE JOURNAL

Mr. V. C. Faulkner, the Editor, presided over a luncheon at a London club last Tuesday, which preceded an informal meeting of patternmakers. This had the object of ascertaining the views of master patternmakers as to the desirability of forming a trade association. A "steering committee" was formed, which is to meet very shortly in Birmingham. Mr. B. Levy, of 3 to 5, Osbert Street, London, S.W.1, is the convener. Other guests were:—Mr. A. Whitehouse; Mr. J. F. Bowers; Mr. R. J. Seymour; Mr. N. Gott; Mr. N. C. Fisher; Mr. F. W. Evans; Mr. R. Sarginson; and Mr. L. Brown, with Miss Doctors acting as secretary.

Latest Foundry Statistics

According to the Ministry of Supply, the output of aluminium castings during September was 1,761 tons for those sand cast; 3,323 tons made by the gravity-die and 1,122 by pressure-die-casting processes. As magnesium castings, 350 tons were produced.

Notes from the Branches

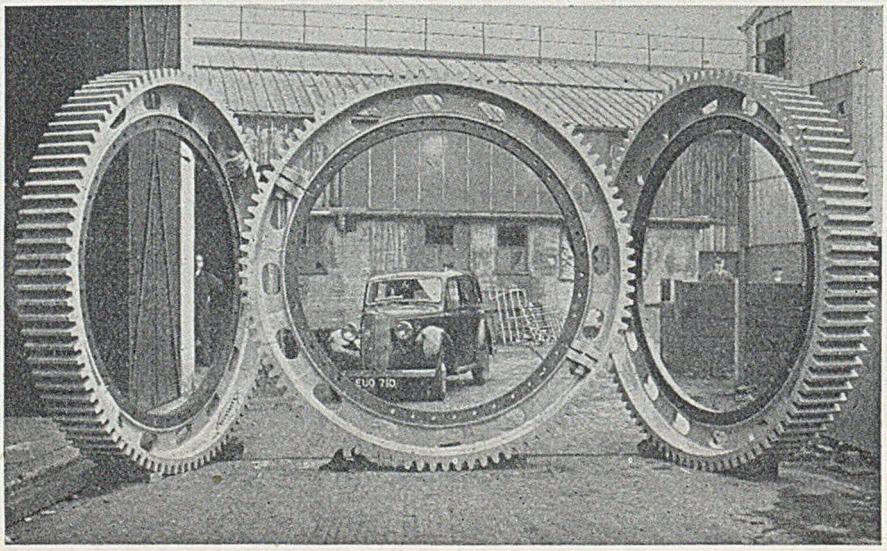
Bristol and West of England

The second meeting of the session of the Bristol and West of England branch of the Institute of British Foundrymen took place on October 24, when a visit to T. H. & J. Daniels' works preceded a very successful lecture presented by Mr. C. R. van der Ben and Mr. H. Haynes. Seventy-two members were conducted around the works and foundry, and after the meeting were entertained to tea by the management.

Mr. H. Haynes opened the meeting with a paper entitled "A Comparison of Two Moulding Methods used for producing the Same Castings," and Mr. C. R. van der Ben followed with a paper entitled "Some Aspects of High-duty Irons." The papers were then followed by a film depicting a visit to the works of the National Gas and Oil Engine Company, Limited. The members found much to interest them in both papers and the film, the practical nature of Mr. Haynes' remarks creating much enthusiasm, as was evidenced from the discussion. Mr. van der Ben's paper was the more technical, but those present of a metallurgical turn of mind enjoyed a very informative and thought-provoking discourse.

In replying to the many questions, the speakers emphasized the following points:—The drying time for moulds in a stove can be accelerated where it is possible to use some form of radiation heating of the moulds; where it is desired to make small melts of special high-duty irons, this can normally be most successfully done in a crucible furnace; cupola charges high in steel were not recommended for making castings in the ordinary way, it being considered better to "pig" the first melt and then analyse the iron so obtained—by this means a more accurate check could be maintained over the raw materials forming the subsequent charges. The speakers were thanked by Mr. H. Balme, seconded by Mr. Holladay.

A.B.B.F., London-area Meeting. An informal meeting of London-area members of the Association of Bronze and Brass Founders will be held on Wednesday, December 10, at the Clarenden Restaurant, Hammersmith, preceded by luncheon at 12.30 p.m.



*Three of a Consignment of Four Gear Wheels, each 9 ft. dia. and weighing 3 tons, sent to Canada by Garton & King, Limited, of Exeter. The Wheels were cast in Halves and subsequently bolted together. Each Wheel carries 96 teeth. [This report and illustration, which were reproduced in the local Press, form a good example of the type of publicity which it is very desirable for founders to encourage. The prestige not only of the foundry concerned, but of the whole industry is thus enhanced, and recruitment schemes are furthered.—*EDITOR.]

Vitreous Enamelling in Sweden, Denmark and Finland*

By J. H. Gray, A.I.Mech.E.

Having recently visited enamelling plants in Sweden, Denmark and Finland, and having on other occasions made many visits to enamellers in Denmark and Sweden, the Author was asked by the I.V.E. Library and Publications Committee to prepare this Paper outlining his experiences and giving a general picture of the enamelling industry as it exists to-day in those three countries.

SWEDEN

Dealing first with vitreous enamelling activities in Sweden; in that country there are 22 enamelling plants. Of these, six enamel both steel and cast iron, eight enamel cast iron only, and eight enamel steel only. Three plants embody horizontal continuous furnaces, and one plant a vertical-type continuous furnace; the remainder are batch-type furnaces. The average box-type furnace is smaller than that generally adopted in Britain, the size being 1,000 cm. wide by 2,500 cm. back to front, and 750 cm. high (3 ft. 3 in. by 8 ft. 2 in. by 2 ft. 5 in.).

Electricity is by far the most popular fuel (this no doubt due to the abundance of hydro-electric power and the comparatively low cost at which this fuel can be purchased; also the shortage of coal and the high cost of fuel oil). Fuel oil is probably the second choice, and coal third. Apart from the comparatively low cost of electricity, it is realized that a cleaner atmosphere is obtainable when using it, and the furnace is probably more easily controlled. There is a further point that perhaps could be mentioned in connection with electricity as a fuel, and that is that this fuel could in all probability be available without a great deal of difficulty even in the event of war. To give an indication of comparative cost, it is of interest to know the average prices of the various fuels.

	Sweden.	Britain.	
Electricity	1d.	1.34d.	per kwh.
Oil†	1s. 0d.	9.75d.	,, gallon
Coal	£9	£4	,, ton

† The oil referred to is No. 3 oil, which has a specific gravity of 0.98 at 60 deg. F.

It is the considered opinion of those in the industry that of the total enamelware, *i.e.*, number of pieces, produced in Sweden, approximately 65 per cent. is steel and 35 per cent., cast iron. The articles enamelled in Sweden are very similar to the type of ware enamelled in this country, with one or two exceptions. In Sweden a large number of pressed-steel bath tubs is produced in white and colours; the company producing these can correctly say they have the largest plant for enamelled steel bath tubs in Europe. At the present moment there is no enamelling of pressed-steel sink units. These are produced in stainless steel or in cast iron finished by the dry process. There is a large quantity of cast-iron hollow-ware enamelled in Sweden, such as stewpans, casseroles, frying pans, and large boilers used for the washing of clothes. Another market which is probably new to this country is the enamelling of cast-iron troughs used on farms for animal drinking water.

Finishes in Vogue

The cast-iron hollow-ware is nearly all finished in cream or silver grey inside and the outside in orange shaded with red, although a fairly recent introduction for the finish of casseroles in particular is a covering both inside and outside of what can be termed a blue/white, and on the outside is decorative work such as birds, flowers, etc. These decorations are applied on the cover-coat (while in "biscuit" form) by hand with the use of an ordinary oil-paint brush; they are usually dark blue, being made with equal proportions of clear frit and oxide and milled to zero with water and 1 per cent. clay. This particular finish, however, is produced mainly for export to America and Canada. There is a large quantity of solid-fuel (mainly wood-fired) cooking and heating stoves which are made in cast iron and finished in cream, with the exception of the hob, which is usually finished in chrome green. Only a very low percentage of ware is produced with a mottle finish.

In connection with cast iron, opinions vary in different plants, depending on the type of product, as to the most suitable cast iron for enamelling, and for general interest hereunder are quoted a number of compositions, which have been given as being suitable for producing a cast iron to give good enamelling results:—

General cooker castings:

		percentage
C	.. ..	3.5
Si	.. ..	2.5
P	.. .. .. max.	1.0
Mn	.. ..	0.5
S	.. .. .. max.	0.07

* Paper presented to the Institute of Vitreous Enamellers at the annual conference in Cheltenham. The Author is attached to Stewart & Gray Limited.

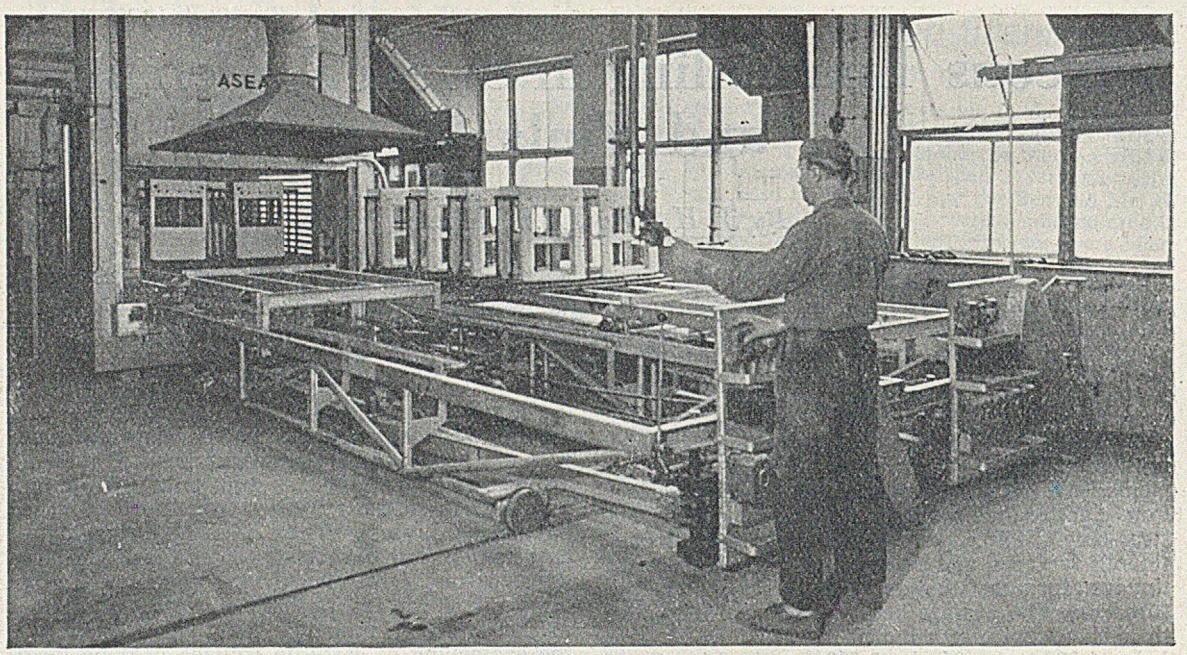


FIG. 1—*Typical Box-type Furnace, showing the Ware being hung and a Heat Extractor above the Furnace Charging Machine.*

Cast-iron hollow-ware:	percentage
C	3.8 to 4.0
Si	2.5 to 3.0
P	0.6
Mn	0.6
S	0.03

*Heavy castings for solid-fuel-fired stoves, etc.:**	
C	3.4
Si	2.8
P	0.9
Mn	0.5
S	0.1

Electric cookers and hollow-ware:	
C	3.45
Si	2.75
P	0.6
Mn	0.5
S	0.1

Castings which are enamelled direct to the iron or over ground-coat are not usually annealed, and very high-class finishes are obtainable. For white and pastel shade acid-resisting finishes, a rather high percentage of matt ground-coat or annealing ground-coat is used, particularly in the production of heavy solid-fuel fires and sanitary equipment, such as cast-iron flush bends, heavy boilers, etc.

General Trends

There has been in recent years in Sweden a great swing-over from cast iron to steel in the production of gas and electric cookers and other commodities which the finished in vitreous enamel, where this is practicable, and it is felt that the tendency in this direction is continuing.

Although it is true to say that one or two of the larger plants use a steel of enamelling quality, this is not the case generally, as good-quality steel has been, and to the best of the Author's knowledge, still is, difficult to obtain in quantities to meet all requirements. The most commonly used is probably a once-pickled steel to the following composition:—

	percentage
C	0.07
Si	0.10 to 0.14
P	max. 0.03
Mn	0.25 to 0.35
S	max. 0.04

Generally speaking, the thicknesses of steel used are the same as in this country. For example, 14 s.w.g. for bath tubs, 19 and 20 s.w.g. for refrigerator linings, 18, 19 and 20 s.w.g. for gas- and electric-cooker appliances, and steel of lighter gauge for sheet-iron hollow-ware.

In many cases the steel is degreased by trichlorethylene or an aqueous degreaser, or a combination of both, although it can be stated with confidence that 50 per cent. of the steel enamellers are degreasing with an aqueous degreaser only. Hydrochloric acid is by far the most popular; only one or two plants use sulphuric acid.

In the majority of cases castings are sandblasted with silica sand. There are no restrictions on the use of this as prevail in this country. It is, however, necessary for the operators to be examined periodically by a physician, and periodical examination of the factory is made by Government inspectors

* In connection with this composition it has been mentioned that a small amount of Ti (about 0.1 per cent.) produces a better quality enamelling iron.

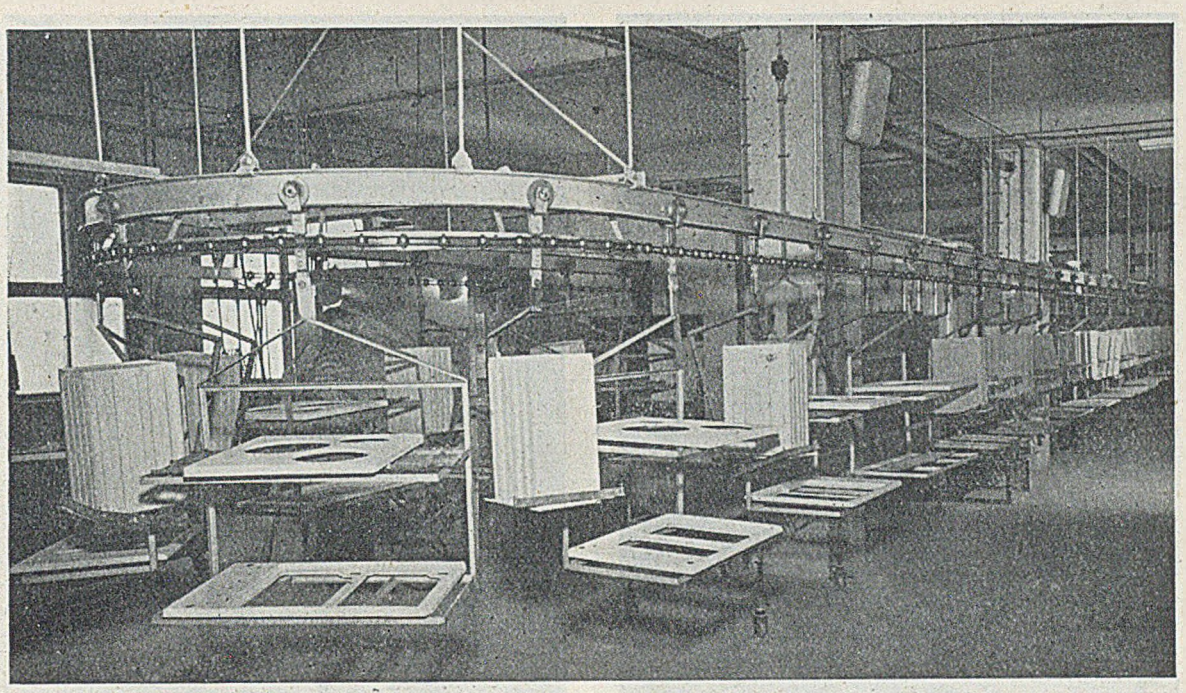


FIG. 2.—*Monorail Grip-coat Drier.*

to ensure that the exhaust system is working efficiently. Several plants use steel grit or a mixture of grit and silica sand, due to the fact that this is cheaper and the dust hazard is not so great.

Enamels in Use

It is almost certainly correct to say that no lead-bearing enamels are used in Sweden for the enamelling of the usual type of ware. In the case of hollow-ware, acid-resistance and thermal shock resistance are usually insisted upon, and the majority of enamellers work to American specifications in this connection. There is no prohibition on the use of antimony-bearing enamels in hollow-ware, and the majority of enamellers are using enamels containing this element. In connection with the enamelling of gas and electric cookers, although there is no definite request to enamel these in acid-resisting finishes, the majority of plants making cast-iron cookers prefer to produce these with acid-resisting-enamel top bars and cornices or hob tops. In the case of steel, it is the general endeavour to produce the outside of the cookers in acid-resisting finishes, but in almost every case the oven linings are finished only in a non-acid-resisting ground-coat mottled white.

Low-firing ground-coats, fusing between 810 and 830 deg. C., are now becoming popular, but in this direction it is considered that the enamellers in Sweden are rather behind the British industry, no doubt because they have not yet decided whether low-firing ground-coats are economical in use, bearing in mind the rather low grade of enamelling iron that is available.

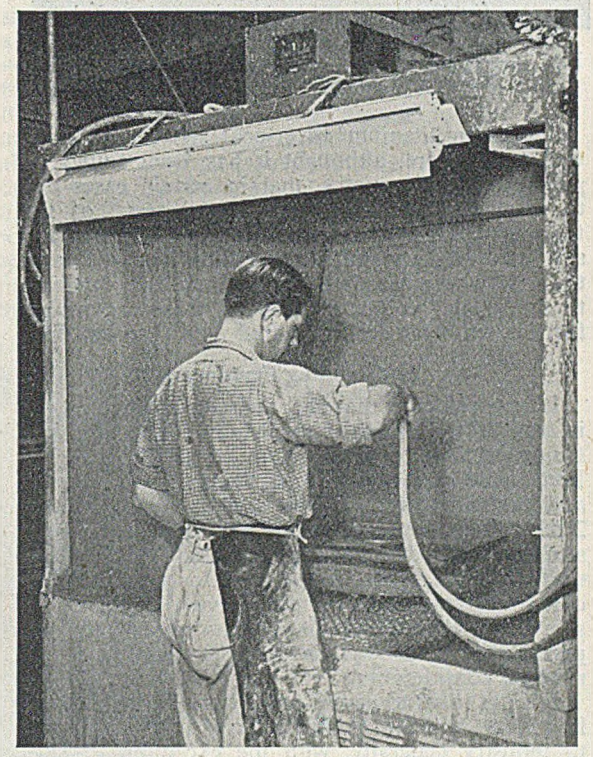


FIG. 3.—*Water-washed Spray Booth of the Latest Type. These Booths are believed to be very efficient, and the Absolute Minimum of Enamel Dust is exhausted to the Atmosphere.*

FIG. 4.—*Portable Gas Rings being dipped in an Annealing-type Ground-coat by the use of Tongs.*

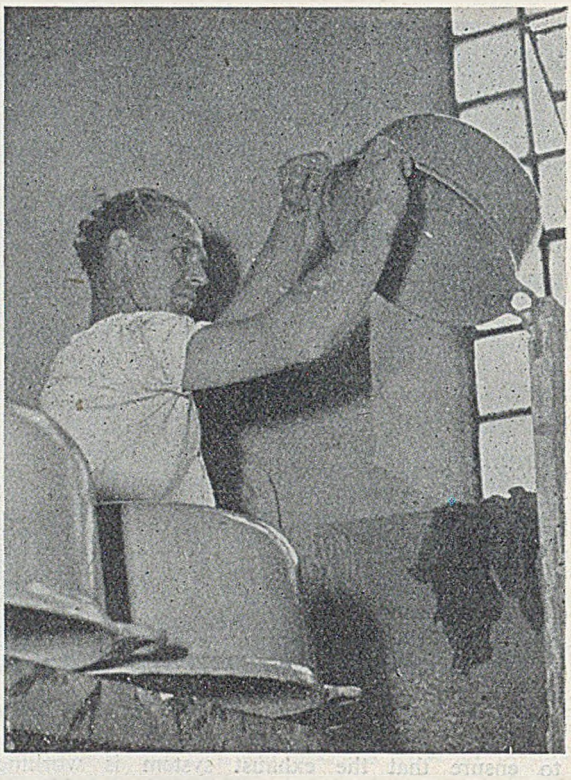


FIG. 5.—*Dipping of Large Cast-iron Pots in Annealing Ground-coat.*

Sheet-iron titanium cover-coat frits are coming well to the fore, althought it has been found, as perhaps in this country, that in certain cases due to what can be termed the "brittleness" of the titanium cover-coats, zircon and antimony frits are still used in large quantities. This is particularly the case where pastel shades are required, due also to the greater colour stability of these at varying furnace temperatures, compared with titanium frits.

Outstanding Features

It is considered that the Swedish enamellers are in front of the British enamellers in connection with fusing perrits and tools. A much greater use has been made of nickel-chrome steels in flat, angular, and tubular forms. This steel is approximately 2 mm. thick, but, due to the way in which perrits and tools are designed, great rigidity is obtained, enabling such perrits to be used for the fusing of cast iron as well as steel, and in view of their considerably reduced weight as compared with cast perrits, the unproductive load in the furnace is reduced considerably.

It is not usual to permit night work in any enamelling plant, and the Author believes that this applies to industry generally, with the exception of steel works and similar industries where continuous processes are considered essential. This is a very controversial point with most plant managements, as they realize that in order to reduce working costs plants should operate 24 hours per day. The average operator works an 8-hr. shift, and it is usual to run two shifts only. Women are not permitted to work on night shifts in any industry except by special permits, which are usually only given to food industries at peak periods. All labour in enamelling plants is considered as semi-skilled, and

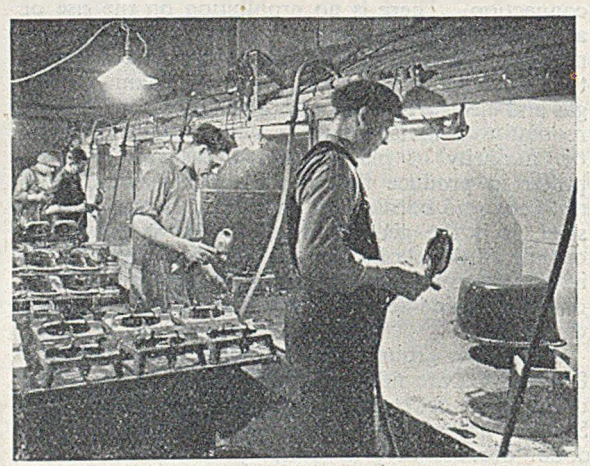


FIG. 6.—*Spraying of Cover-coat on Hollow-ware and Gas Appliances.*

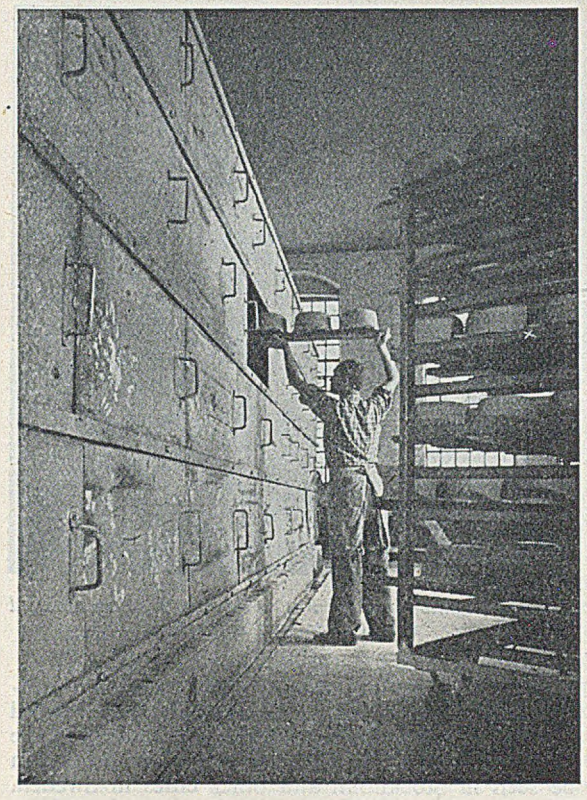


FIG. 7.—*Steam-heated Drier.*

wherever possible, every operation is paid for by individual piecework price. Plants normally operate for 5½ days per week. Enamel-shop employees, in common with those of other industries in Sweden, are now entitled to three weeks' holiday with pay each year. It is considered that the earned income of the operators is between 30 and 40 per cent. higher than in this country, and when the cost of living in Sweden is compared, it appears that the average operator is a little better off financially than his counterpart in Britain. Staff in Sweden generally work approximately the same number of hours as in this country, but they normally start at 7.30 a.m. and finish at 4.30 p.m. with a 1-hr. break for lunch from 11 a.m. to 12 noon.

Although it would appear that no architectural enamelling is carried out in Sweden, one company in particular has spent a great deal of time and money in using vitreous enamels for artistic and decorative finishes in the form of paintings, plaques, and murals, etc.

With a few exceptions, mainly in the larger plants, it is considered that the standard of sheet-iron enamelling is higher in this country than in Sweden, but for cast iron the position is reversed—the Swedish enamelling industry seems to have overcome many of the difficulties in the production of cast-iron acid-resisting finishes in pastel shades, in advance of this country. This is probably due to the fact that the demand for self-colours has been prevailing in Sweden longer than in this country, and also it is considered that, generally speaking, the average casting produced in Sweden is rather superior to those obtainable by the industry in Britain.

Plant

Fig. 1 represents a typical box-type furnace, showing the ware being hung and a heat extractor above the furnace charging machine, the heat from which is used for "boosting" the temperature in the enamel-shop drier. It is also interesting to note that the furnace is electrically heated, and the furnace door and charging machine are also electrically operated. Fig. 2 shows a monorail grip-coat drier, which has been in use for some considerable time, giving complete satisfaction. Fig. 3 is a water-washed spray booth of the latest type. These spray booths are believed to be very efficient, and a minimum amount of enamel dust is exhausted to the atmosphere.

As a matter of general interest, industrial enamelling on cast iron commenced in Sweden around 1880. It was introduced into one company by Germans and into another by Frenchmen. In 1889, three Germans started the enamelling of sheet-iron signs in what is now a very large plant in southern Sweden. The same company started, in 1911, the production of enamelled sheet-iron cooking utensils, and lamp reflectors, the latter for use out of doors.

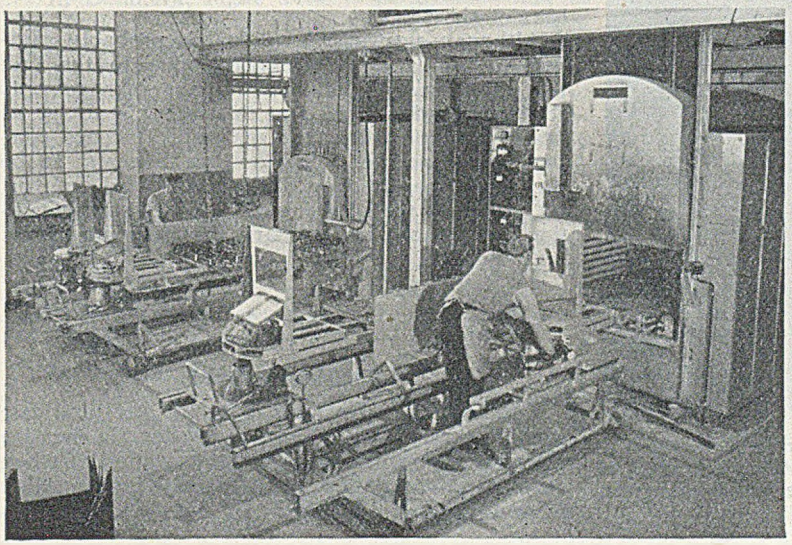


FIG. 8.—*Batch of Two Small Electric Furnaces. These have Double Charging Machines, which are hand operated.*

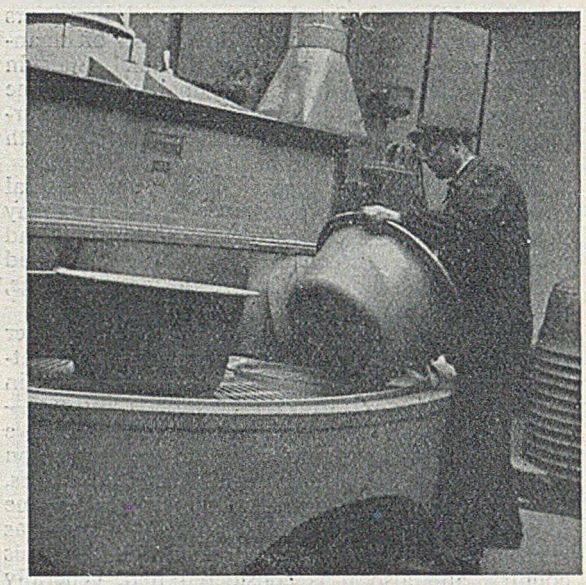


FIG. 9.—*Large Cast-iron Pots for subsequent enamelling in White Finishes over Matt Ground-coat after being cleaned by Sandblasting.*

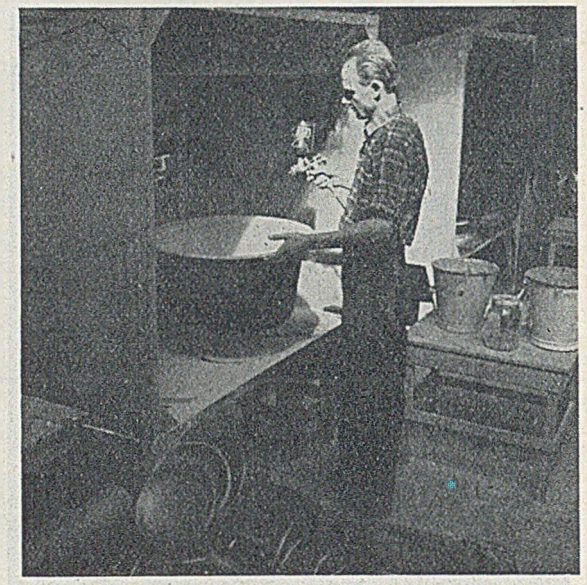


FIG. 10.—*Same Type of Pot as in Fig. 9 being sprayed with Cover-coat Enamel.*

DENMARK

Vitreous enamelling in Denmark is definitely a growing industry. The type of production is rather similar to that produced in Sweden, with one or two exceptions. In Denmark there are no pressed-steel bath tubs being produced, but one company in particular specialize in vitreous enamelling for the architectural field, and some excellent work has been carried out by them—very large buildings in Copenhagen can to-day be seen with vitreous-enamelled facings. The same company have carried out quite a lot of work in this field also for the Swedish market, and the results of their work can be seen in Stockholm and other cities in Sweden. The enamelling of 24-s.w.g. steel car number plates is also carried out on a large scale; these are usually finished with a yellow background and black lettering.

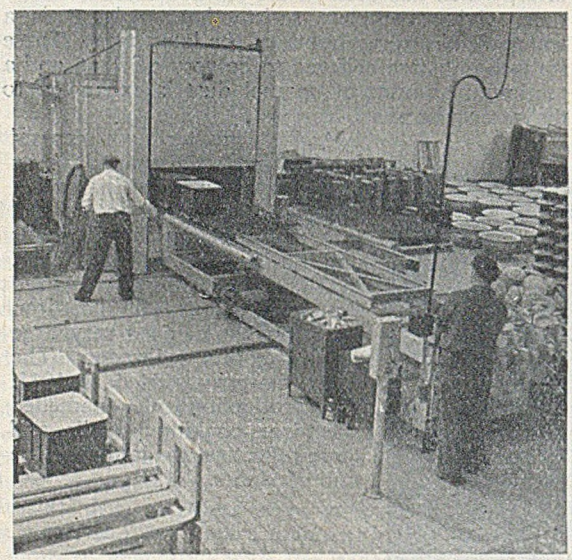


FIG. 11.—*General View of a One-furnace Plant, showing Large Pots and General Hollow-ware as well as Refrigerator Linings, which are processed in this Department.*

In Denmark there are eight enamelling plants. Of these only one houses a continuous furnace. Three plants are engaged on steel only, four on cast and steel, and one on cast only. The production of enamelled iron and steel per year cannot be stated with certainty but it is considered to be approximately 2,500 tons of cast iron and 2,000 tons of sheet iron.

Although electricity as a fuel is probably gaining in popularity in Denmark, due to the fact that the majority of enamel-plant managements realize the advantages that this offers in so far as uniform temperatures and maximum furnace control are concerned, development appears to be moving in the direction of the use of coal and fuel oil, owing to their lower costs. To give an indication of fuel costs in Denmark, the following figures are representative:—

Electricity	1.2d. per kwh.
Fuel oil	1s. per gallon
Coal	£6 8s. 0d. per ton

Finishes Selected

The finishes in Denmark both for steel and cast iron are very similar to those in Sweden. In the case of cast-iron enamelling, with the exception of when ground-coats are used, most castings are annealed prior to blasting. It may be of interest to note that

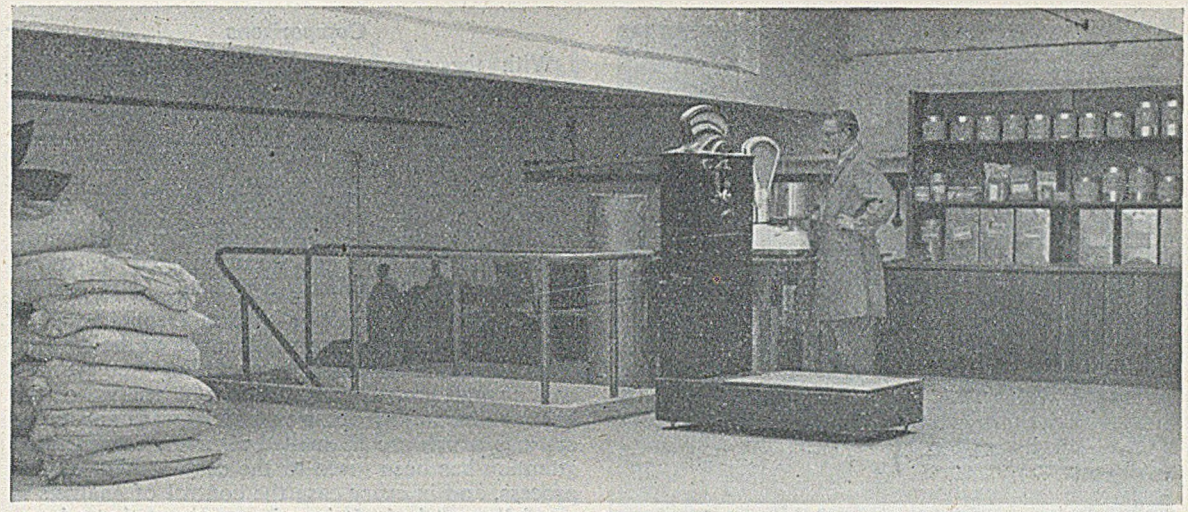


FIG. 12.—*Frit Storage and Weighing-out Department.*

in Denmark a much greater use is made of the vitreous or annealing type of ground-coat than in Finland, Sweden or Britain.

There is no restriction on the use of silica sand for sandblasting, and the majority of cast-iron enamellers are employing sand, as in Sweden. To get what are probably better results than with steel grit and to reduce material costs, some enamellers are mixing steel grit and sand in equal proportions, although steel grit only is also being used in some plants.

Self-colour finishes for cast iron are by far the most popular; mottle finishes are rarely seen, except on the inside of some cast-iron hollow-ware and cooker-oven linings. Perhaps the most popular colours on cast iron, with the exception of hollow-ware, are white and cream. For hollow-ware, white and cream inside with orange/red outside, or self-colour blue or brown outside are used.

In Denmark, night work is permissible, and in the majority of cases, plants are operated on three eight-hour shifts. It is permissible for women to be employed on night work, although there must be a foreman also employed on the night shift in those cases. The average operator in the enamelling department is considered to be semi-skilled, and every operation, wherever possible, is paid for as individual piecework. These would include sandblasting, spraying, brushing, sheet-iron ground-coat dipping, and fusing, bearing in mind that the furnaces are small and only one operator is required to handle a furnace. The size of the average furnace is 2,500 cm. long by 1,200 cm. wide by 1,000 cm. high (approx. 8 ft. long by 4 ft. wide by 3 ft. 3 in. high).

In the case of cooker production, gas, electric and solid-fuel, it appears that acid-resisting finishes are not demanded, although the majority of enamellers make every effort to produce cookers having acid-resisting finish on the outside, but in almost every case the oven linings are enamelled in a non-acid-resisting ground-coat mottled white. In the case of steel cookers, the enamelling of the outside in acid-resisting finishes does not present a difficult problem where titanium enamels are used. In the case of cast iron where difficulty is encountered, normally a non-acid-resisting finish is applied with the probable exception of the top bars and cornice in the case of a gas cooker, and the hob in the case of an electric cooker. These are finished in acid-resisting enamels. Cast-iron hollow-ware is always produced in an acid-resisting finish, and it should be mentioned here that in most plants enamellers work to American specifications for acid and alkali resistance, and thermal-shock tests.

Materials in Use

As may be expected, the various gauge sizes of steel used in the enamelling department depend on the type of ware being produced, similar to this country and Sweden. Wherever possible, an enamelling-quality steel is used, and large quantities of steel are purchased from Britain; it is understood that more will be used as this becomes available. As, however, very-low-quality steel also has to be enamelled, when enamelling grade is not available, the enamellers are not inclined to use low-firing ground-coats. They feel that those having a temperature range of 850 to 870 deg. C. are a safer proposition.

It appears that the self-opacifying sheet-iron titanium frits for white and cream finishes have already become very popular; the majority of plants realize the advantages, such as acid-resisting finishes and thin coatings that can be applied with this type of frit, although it is generally considered that these frits are more difficult to operate than the antimony/zirconium type and call for much closer control in the enamelling shop generally.

Hydrochloric acid is most commonly used for cleaning sheets, and grease burning in the furnace is the method most usually adopted for degreasing,

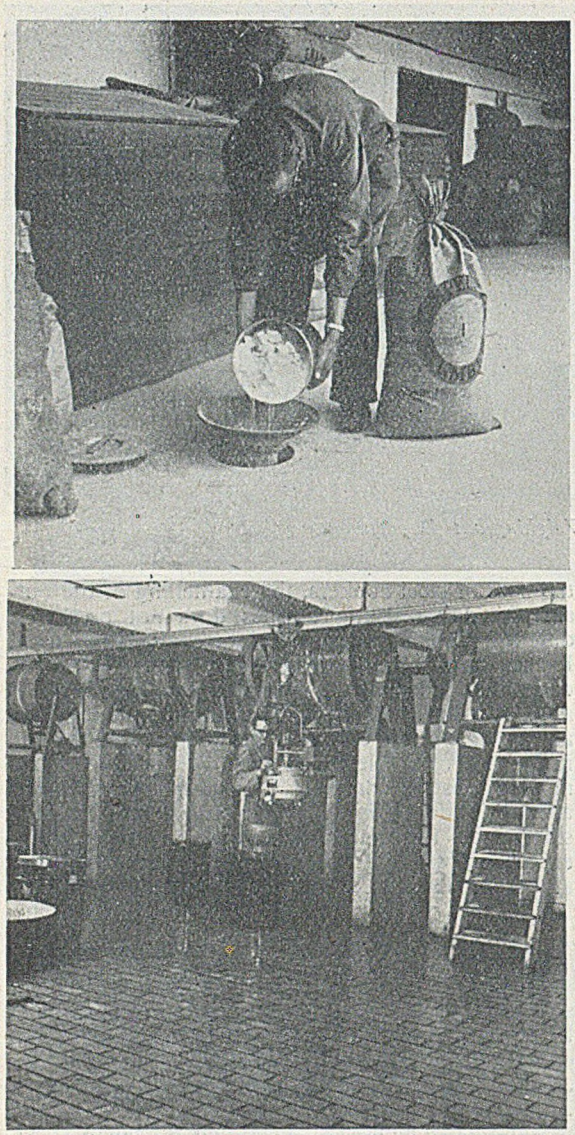


FIG. 13.—*Loading, from the First Floor, of Mills situated on the Ground Floor, and* FIG. 13 (A).—*Mills on Ground Floor, which are Loaded as shown above.*

although a few plants have aqueous degreasing equipment, and this is used wherever possible. Degreasing by grease burning is most popular, because when enamelling-grade iron is not available, the type of iron used is of a very inferior quality, and most enamellers like to adopt a standard method, rather than be changing continually.

Most plants operate 5½ days per week, and the rates of pay for the various operators compare very favourably with those in this country, and this is a point of interest, particularly bearing in mind that the cost of living in Denmark is very much on a par with that in this country.

Comparisons

With the exception of hollow-ware and other specialities it is considered that sheet-iron enamelling in Britain is of a slightly higher quality than that in Denmark, but in cast iron the reverse is probably the case. Once again this is no doubt due to the fact that for many years the enamelling industry has had to produce high-quality self-colour pastel shades, as against the high production of cast-iron mottle finishes that has been enjoyed by many enamellers in this country for such a long period.

It should be mentioned that in Denmark, as in Sweden, very much more use is made of the dipping of cast-iron ware in both the annealing-type ground-coat or matt ground-coat. No doubt because of the high production of cast-iron hollow-ware and other castings which are enamelled all over, considerable attention has been given to the development of this process, and in every case the control of enamels is carefully watched. It is quite apparent that wherever this method of processing is applied, a finish at least equal if not better than by spraying can be obtained, and furthermore, the cost of production is reduced considerably, due to the speed of the operator when dipping as compared with spraying; also the consumption of enamel is reduced.

Typical Illustrations

Fig. 4 shows portable gas rings being dipped in an annealing-type ground-coat by the use of tongs; Fig. 5 the dipping of large cast-iron pots in annealing ground-coat. Fig. 6 shows the spraying of cover-coat on hollow-ware and gas-cooker appliances, and Fig. 7 illustrates a drier which is heated by steam. The articles are loaded into individual compartments on racks, and when dry they are withdrawn and a new load inserted. This method operates very satisfactorily in this plant, and the doors of each compartment being so small, the maximum amount of heat is retained in the drier.

Fig. 8 shows a batch of two small electric furnaces. These have double charging machines which are hand operated. It is of interest to note that in the operation of these, protection is given to the operator when withdrawing the load by a shield which has a heat-resisting glass front. The doors of these furnaces are also electrically operated.

The enamelling of cast-iron cooking utensils was introduced into Denmark in 1842. Prior to that all enamelled cast-iron hollow-ware was imported from Germany. The vitreous enamelling of sheet iron was introduced from Germany around 1890. Dry-process cast-iron enamelling in Denmark was also started by the Germans about the same time as sheet-iron enamelling was introduced, or perhaps but a few years later.

[The concluding section of this Paper, shortly to be printed, describes conditions obtaining in the Finnish vitreous-enamelling industry, and Figs. 9 to 13 (A) included in the foregoing may be taken as illustrating plant and practice in that connection. —EDITOR.]

Shell Moulding of Cylinder Castings*

By A. Emmerson

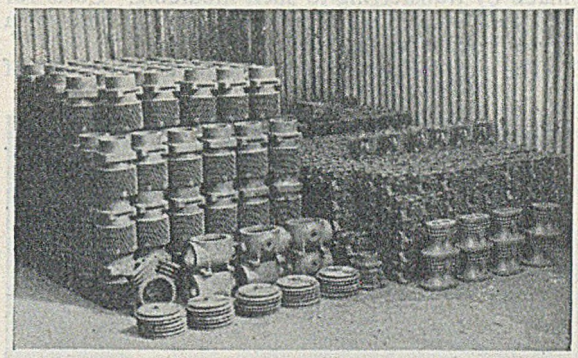
After first explaining the type of castings undertaken in his foundry, where the shell moulding has been carried on, the Author surveys briefly the normally accepted routine for the production of shells. Then he gives details of the processes he has developed and the refinements and precautionary measures introduced. The making of a wide range of automobile components, up to 200 lb. weight, with shell moulds and some with shell cores, is next described and numerous practical hints are quoted. Finally, an appreciation of the applicability of the process is given in the light of the Author's experience, and possible lines for future developments are envizaged. At the meeting, a number of shells and shell-moulded castings were exhibited.

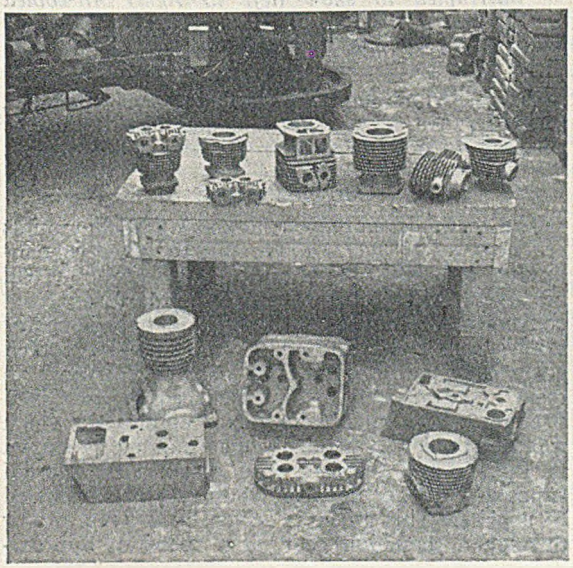
Since shell moulding was introduced into the foundry, of which the Author is co-manager, more than 20,000 castings have been poured in moulds of this type. All the castings, made in shell moulds, some examples of which are shown in Figs. 1 to 3, are made from high-grade cylinder iron. This material usually contains hematite iron, refined iron, steel cylinder-block scrap and refining agents, and has a low phosphorus content. Additions of nickel or chromium are made to the ladle prior to pouring, and the resultant castings have tensile strengths ranging up to 23 tons per sq. in. A fully-equipped laboratory ensures that consistent quality is maintained. Casting temperatures are normally in the region of 1,350 deg. C., and the range of work produced includes many finned components, such as compressor crankcases and cylinders and internal-combustion-engine cylinders and heads. Intricately-cored castings are also made in large numbers.

Before deciding to adopt shell moulding for this type of work, the Author investigated a number of aspects, such as comparative costs, production flexibility, and casting quality. It was found that the cost of machine-moulded castings in ordinary sand was usually less than that of similar castings made in shell moulds. Where castings are of such a nature that they must be made by block-core methods, however, important savings can often be

* Paper presented to the London branch of the Institute of British Foundrymen. The Author is general manager of Macmillan Foundries, Limited, Watford.

FIGS. 1 TO 3.—*Groups of Typical Air-cooled Cylinder and Diesel-engine Head Castings made by the Author's Company in Shell Moulds. Many Jobs were previously made by Block Core Methods.*





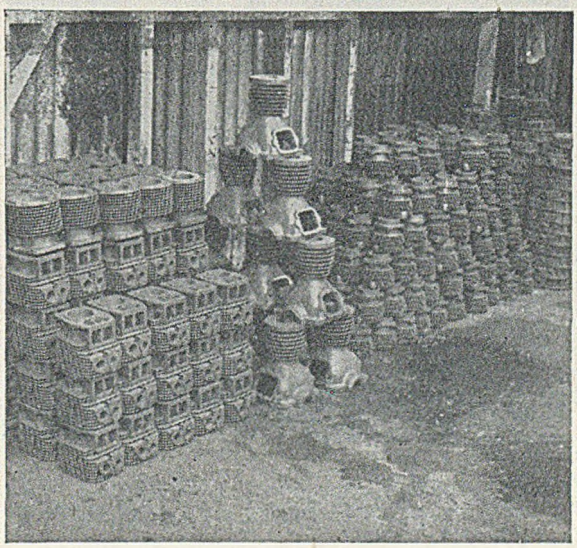


FIG. 4.—*Simple Mixer for Resin/Sand for Shell Moulding. It is equipped with Internal Vanes and driven at 25 r.p.m. by a 1 h.p. Motor.*

made by transferring to shell moulding. Costs for the shell moulds were calculated on the basis of a hand-production technique.

The possibilities of reducing costs by the use of machines for making shells were foreseen, however, and it was felt that development work should be carried out in order that full advantage might be taken of suitable machines when they became available. Most of the castings at present being made by shell moulding at Macmillan Foundries cost as much as, or more than, similar castings produced by conventional methods. Shell-moulded castings, however, are of improved appearance owing to the finer surface finish, and are cast to closer dimensional tolerances. As most of the shell moulds employed so far have been made from existing patterns, suitably adapted, the reductions in machining allowances and costs normally associated with the process are not yet being fully realized. Where new work is being commissioned, however, and new patterns made, the latter are designed to provide smaller machining allowances.

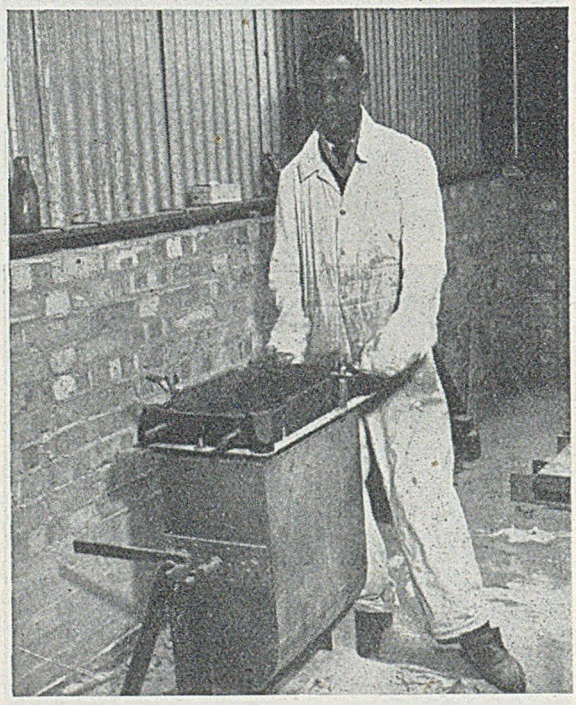


FIG. 5.—*Orthodox "Dump-box" Technique with which most of the Shell-moulding was carried out at the Author's Foundry.*

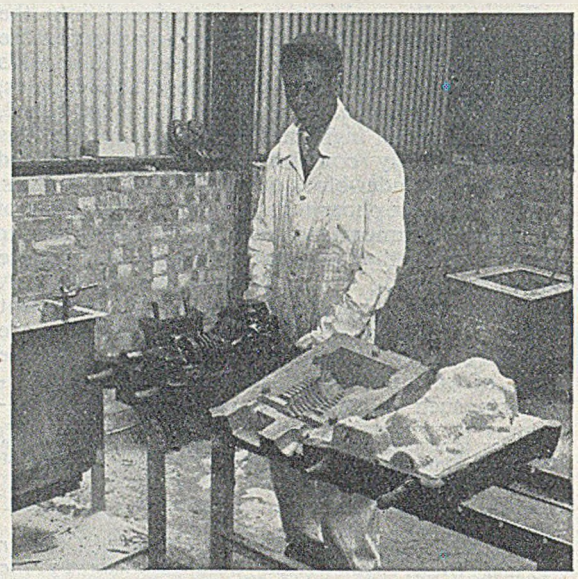


FIG. 6.—*Sequence of Operations in Shell-moulding Cycle interrupted to show (left to right) Air-cooled Cylinder Pattern, a Finished Half Shell and an Uncured Shell after investment.*

Current Practice

The methods employed in making shell moulds are now fairly well known, but to preserve continuity, a brief description of the technique will be given, with fuller details of departures from conventional practice. A mixture of two grades of sand is employed, one coarse and one fine, which gives high permeability and permits economy in resin consumption without sacrifice of shell strength. The sand/resin mixer employed, which was designed and made by the foundry, is shown in Fig. 4, and consists of a drum with internal vanes and an opening for loading, which is sealed by a plate. This mixer is driven by a 1-h.p. motor through a reduction gear, at a speed of approxi-

mately 25 r.p.m., and each sand/resin batch is processed for 10 min.

Into the mixer is first loaded 100 lb. of Redhill H. sand with an A.F.S. number of 150, and to this is subsequently added 40 lb. of Joseph Arnold No. 19 sand. The latter passes a 32-mesh screen but 90 per cent. is retained by a 90-mesh screen. To act as a wetting agent, ¼ pint of paraffin or light Diesel oil is introduced, and this prevents the finely ground resin powder from separating or passing off as dust after mixing. Most of the phenol-formaldehyde moulding resins now on the market have been tried and, generally speaking, it is found that the more expensive resins produce stronger shells, or can be used in smaller percentages. From

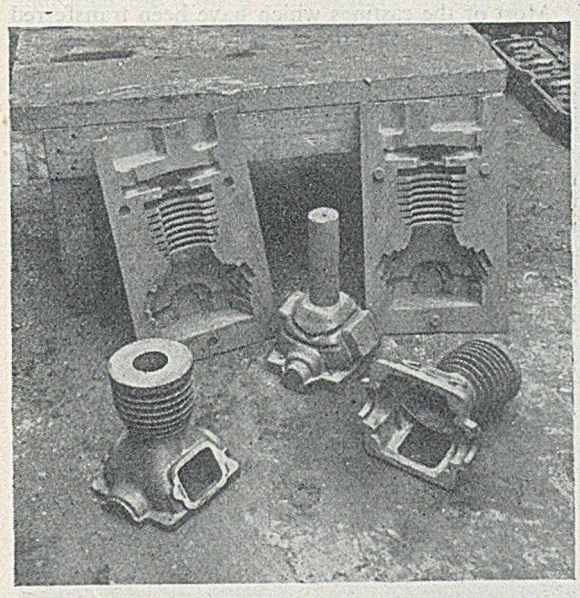


FIG. 7.—*Finished Shells, Castings and Core for the Job illustrated in Fig. 6. The Casting weighs 28 lb., is 10½ in. high and 9 in. wide.*

5 to 6 per cent. of resin by weight is added to the sand, according to the type of casting to be made. Thin-section, light iron castings may usually be produced in shells with a 5 per cent. resin content, while heavier, thicker sections require larger proportions. If a mould is insufficiently strong with a maximum of 8 per cent. resin, recourse is usually had to double investment, as will be described later. Most of the castings shown in Figs. 1 to 3 were made in moulds containing over 7 per cent. of resin.

With the resin/sand mixture in the investment box, the pattern, which has been heated to between 180 and 220 deg. C. in a gas-fired oven, is secured to the aperture by means of simple wing-nuts and swivelling clamps as shown in Fig. 5. Thermostatically-controlled at 300 to 350 deg. C., the oven has slides made from pieces of angle-iron which support the hot patterns and facilitate loading and removal. In Fig. 6 the sequence of operations has been interrupted to show (right) an invested pattern about to be passed into the oven, a cured shell

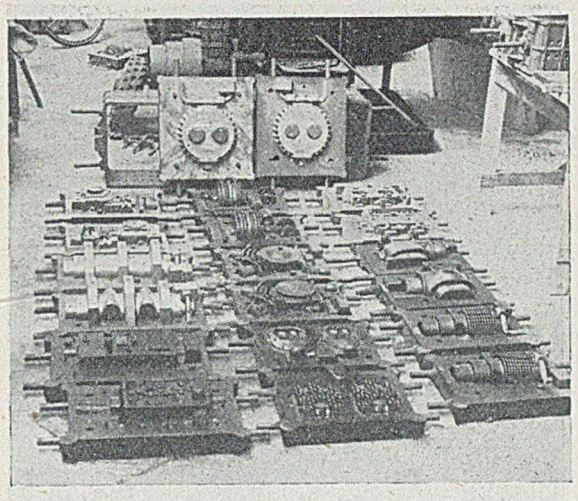


FIG. 8.—*Group of Mounted Metal Patterns as used for Shell Moulding at the Author's Foundry.*

which has just been removed from the patternplate (centre) and the pattern used (left). This patternplate, in turn, is about to be attached to the investment box. For investment, the box, which is trunnion mounted, is quickly inverted and held in this position for 40 to 45 sec. This period gives a shell $\frac{5}{16}$ to $\frac{3}{8}$ in. thick, which is normally of sufficient strength to withstand the ferro-static pressure of the hot metal without the use of backing material. Prior to investment, the hot patternplate is sprayed with "Releasil" emulsion which contains silicons and is an effective separation agent.

For castings of lighter sections the investment time

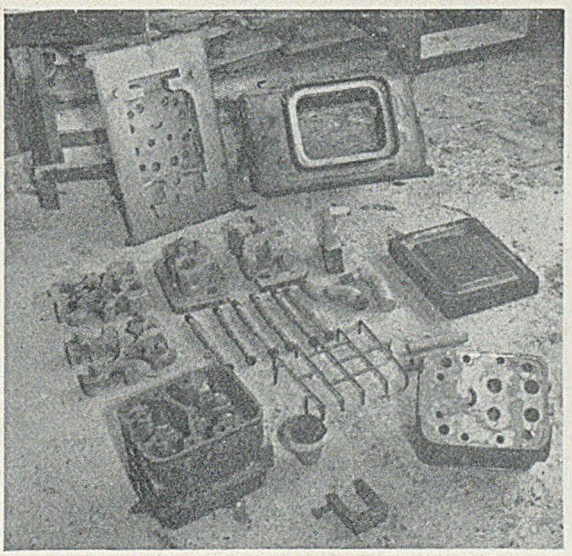


FIG. 9.—*Mould Parts to produce Diesel Cylinder-head Castings weighing 62 lb. (foreground). In the Rear are the Shells, at the Centre are the Ordinary Sand Cores and a Shell-reinforcing Grid.*

FIG. 10.—*Placing the Wire Reinforcing Grid for the Half Shell shown (top, left) in Fig. 9, prior to its Second Investment Cycle.*

is reduced to as little as 20 seconds and a shell thickness of $\frac{3}{16}$ to $\frac{1}{4}$ in. is obtained. The shells shown being made in Fig. 6 are illustrated with the core employed, and two completed castings, in Fig. 7. A completed casting, without runners or risers, weighs 28 lb. and is $10\frac{1}{2}$ in. high and 9 in. wide at the base, the top diameter being $5\frac{1}{2}$ in. The castings shown, which are for an air compressor, are notably clean and smooth. The location dowels formed on one mould face, which engage with corresponding cavities in the opposite half mould, serve to register the two half shells. This location is so accurate that mis-matching of moulds is entirely eliminated.

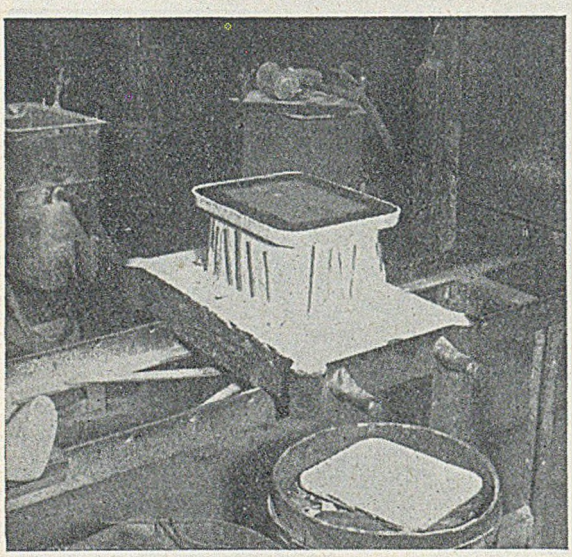


FIG. 11.—*Second Half Mould as shown in Fig. 9 (top, right) in the Course of Production. For this Half, the Top is Blanked-off with an Asbestos Plate and Vertical Reinforcing Rods are incorporated.*

Cores and Running Methods

The core shown in Fig. 7 is of the ordinary type, made by conventional methods. Such cores are perfectly satisfactory when used with shell moulds, and as automatic ovens and associated equipment already existed at the Author's foundry for their production, prior to the introduction of shell moulding, they are still being employed for many castings. Where existing core boxes were suitable or could be adapted for shell moulding, however, this has been done, as will be seen later.

Most of the castings which have been transferred from ordinary moulding techniques to shell moulding have needed some modifications to runner and riser systems. Such modifications cannot be carried out by alterations to the mould such as filing or sawing a larger ingate, as the result obtained is usually completely different when the alterations are subsequently transferred to the pattern plate.

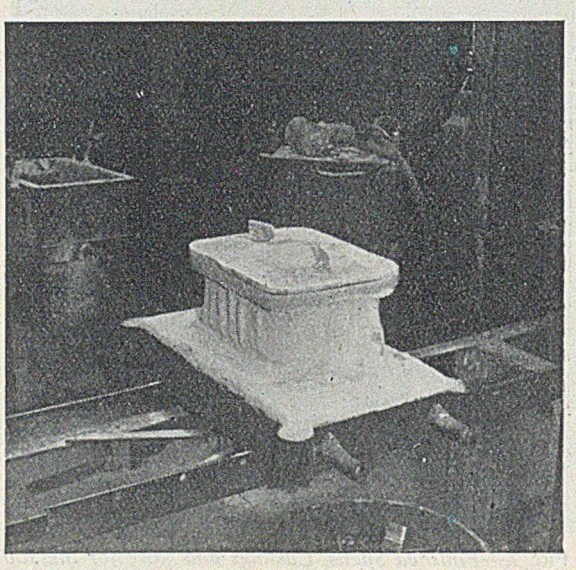


FIG. 12.—*Same Mould Part as shown in Fig. 11 after its Second Investment Cycle, ready for Final Curing.*

The castings shown in Fig. 7 were formerly run through a series of narrow ingates round the thick, top edge of the casting. With the shell mould, however, it was found that the metal in these thin gates solidified quickly, preventing the shrinking casting from drawing on the metal in the runner bar. To obviate this trouble, two large cavities are formed in the mould adjacent to the top edge of the casting, in addition to the runner bar of fairly heavy section. Shorter ingates lead from these cavities directly into the casting cavity, and the metal in these ingates is thus kept molten long enough to allow feeding from the cavities and the runner bar to take place as the casting contracts.

Pattern Materials

Patterns, a few of which are shown in Fig 8, are made from aluminium, brass and cast iron. Choice of pattern material usually depends on several factors, among which may be noted the number of castings to be made, the weight, and the shape of various parts of the casting. Because aluminium loses heat quickly, the shell formed by an aluminium pattern is not so thick as that formed by a similar iron pattern for the same investment time. Sometimes an aluminium pattern will not form a shell of sufficient thickness to withstand bursting stresses when used at a normal temperature, and more heat must then be applied.

Cast-iron patterns are normally to be preferred, but their use is often prohibited on account of high cost, and in general, they are only justified where large numbers of castings are required. If, as sometimes happens, a sufficient build-up cannot be obtained on a corner of an aluminium pattern, the difficulty may be overcome by setting-in a strip of iron or steel, which will remain hot longer than the aluminium and enable greater shell thickness to be obtained locally. It will be appreciated that the sand/resin material immediately surrounding the pattern tends to act as an insulator and to prevent heat from penetrating far into the mixture.

FIG. 13.—*Assembly of the Mould Parts shown in Fig. 9. Note the D-shaped Clamps used to fix the Shells ready for casting.*

In Fig. 9 are shown the mould parts required to make castings, different views of which are seen in the foreground. All the cores employed are made of oil sand, but the two mould halves shown in the background are shell moulded. The completed casting is a cylinder-head for the Diesel engine and weighs 62 lb., without runners. The casting is poured without any outside supports, but wire reinforcements (centre), are employed to ensure sufficient mould strength. The method of applying such reinforcements is illustrated in Fig. 10 which shows the production of the lower half mould shown (rear left) in Fig. 9.

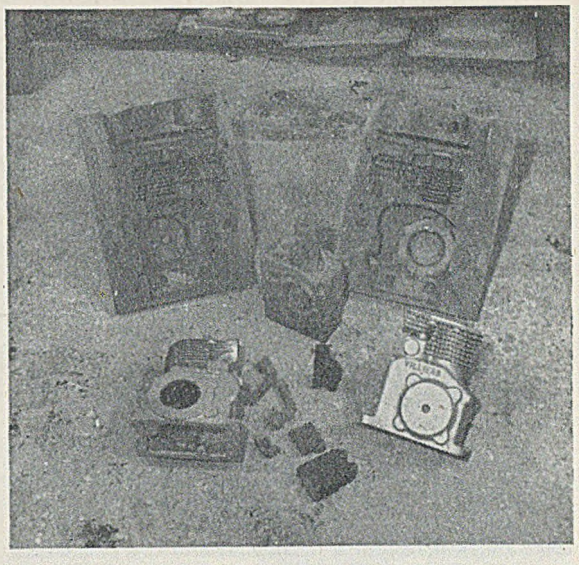


FIG. 14.—*Combined Cylinder and Crankcase Castings for a Small Air-cooled Engine, together with the Shell Moulds, Shell Cores and Ordinary Cores used in their manufacture.*

Method of Reinforcing Shells

The pattern for the half mould shown in Fig. 10 has here reached the stage at which, after investment for a period of 5 to 10 sec., it is about to be

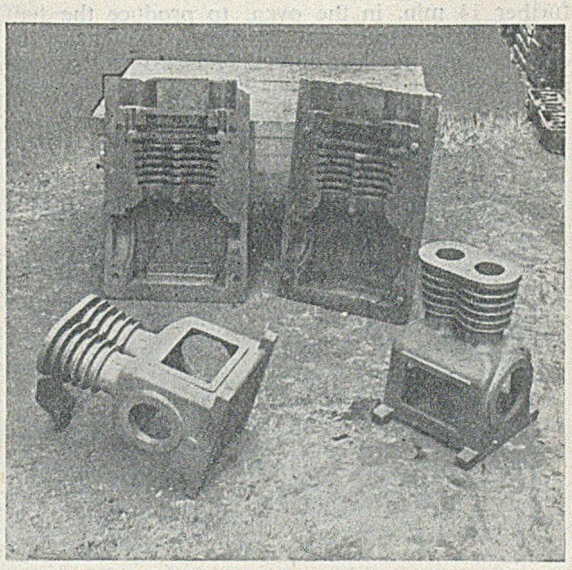


FIG. 15.—*Combined Twin-cylinder Compressor Castings and the respective Shell-mould Parts. These Castings (at 70 lb. each) comprise the Largest of their Type in Regular Production.*

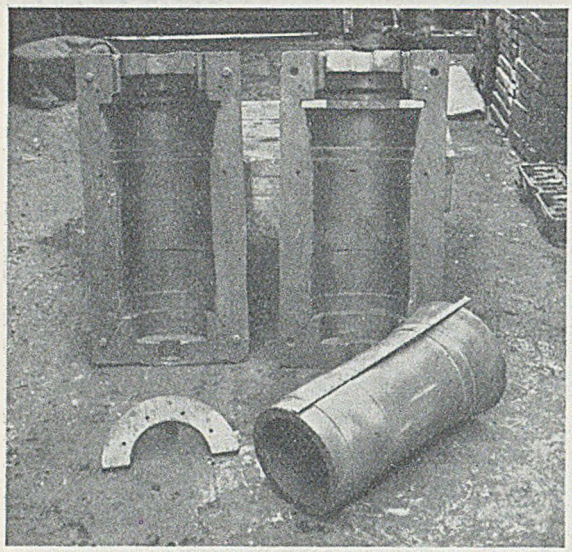


FIG. 16—*Cylinder-liner Casting, 10 in. dia. by 22 in. long (weighing 205 lb.) and Shell Halves from which it is produced. For this Casting the Shell Mould is supported by Sand Backing.*

put into the oven for curing. Before this is done, however, the reinforcement grid shown in Fig. 9 is placed in position, and a little sand/resin mixture is sprinkled over it. The pattern is then cured for 30 sec. in the oven, removed, and returned to the investment box. It is then re-invested for a period of 10 sec., and a total shell thickness of $\frac{5}{16}$ in. is obtained, in the centre of which is buried the wire reinforcement. Finally, the shell is cured for a further $1\frac{1}{2}$ min. in the oven, to produce the half mould shown (top, left) in Fig. 9. To make the opposite half mould (top right), a two-part pattern is employed and this is seen in Figs. 9 and 11. This

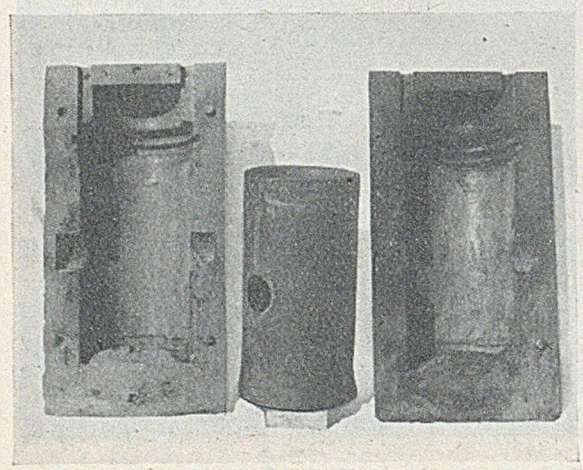


FIG. 17.—*Piston Casting (centre) $21\frac{1}{2}$ in. long, $10\frac{1}{4}$ in. dia. and $1\frac{1}{4}$ in. thick, weighing 200 lb. Also shown are the Half Shells used for its manufacture.*

pattern consists of a rectangular, box-shaped portion, to the upper end of which a slightly larger flat plate, $\frac{1}{4}$ in. thick, is attached by means of two thumb-screws. The pattern is first heated in the oven with the top plate in position, and when it has reached the required temperature, a sheet of asbestos is placed on the top and the thumb screws are inserted. Thus, during investment which is then effected, the resin/sand mixture adheres only to the edges of this plate, the sand being elsewhere insulated from the heat of the top surface by the asbestos. A sufficient supply of sand/resin mixture is maintained in the box to build up to a height of 4 to 6 in. above the highest point of the pattern.

After the first investment, reinforcing wires are placed in position round the sides of the box-shaped portion (Fig. 11), a little more of the mixture is sprinkled on, and the mould is transferred to the oven for curing. Following this stage, the pattern

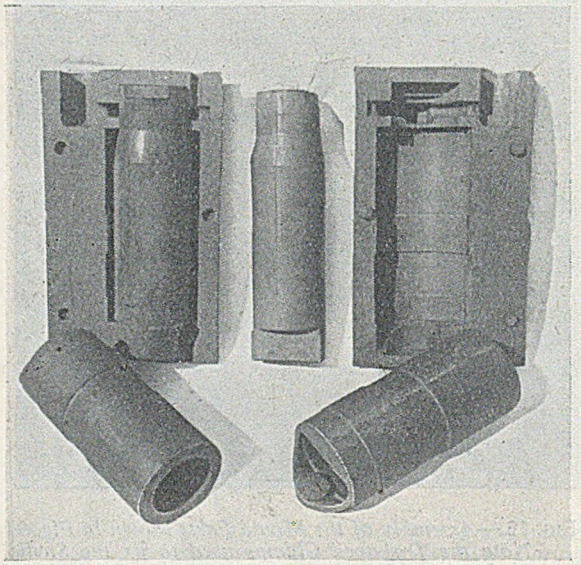


FIG. 18.—*Two Liner Castings (foreground) and (rear) the Shell Mould Halves and Shell Core used for this Job. The Castings weigh 33 lb. each.*

is again invested, giving the result shown in Fig. 12, and after a further curing period the half mould is complete. Before putting the invested pattern in the oven, each time, the asbestos cover is removed, to allow the top plate to be heated. When finished, the mould is stripped on a suitably adapted stripping machine.

For assembly of most of the shell moulds made in the Author's foundry, clamps of similar design to those shown in Fig. 13 are employed. These clamps are cast in iron and are of a simple U-shape, each having a $\frac{1}{2}$-in. Whitworth bolt screwed into one leg. The moulds are sufficiently strong to permit these bolts being tightened with a spanner, if necessary. The part of the shell mould produced by the flat plate, described earlier, serves to locate and

hold the upper cores in position, and, in Fig. 13, one of these cores is shown being assembled. With the two cores in position, the block core is placed on top of them and a runner bush is secured with paste over an opening leading into the runner channel round the lower edge of the block core. When the casting is poured, this runner is filled, and the cavity proper is fed through small ingates in the two cores.

Use of Shell Cores

In Fig. 14 are shown combined crankcase and cylinder castings for a small engine, and it may be noted that in this case the design of the existing coreboxes was suitable for adaption for shell-core production. The core shown (centre), and the mould halves (top) were all made from a mixture containing 3 to 6 per cent. of resin, and the completed castings, which were poured unsupported, weighed 16 lb. after they had been trimmed. The

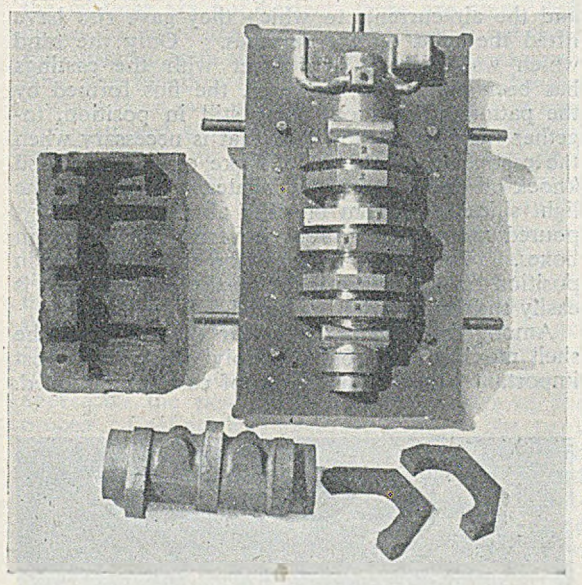


FIG. 19.—*(Foreground and left) Camshaft Casting and its Half Shell for a Diesel Engine. Chills used on the Cams are also shown as well as a Pattern for a Larger Camshaft of Similar Design.*

manufacture of shell cores presents many special problems but for the larger sizes the mixture is merely poured into a hot corebox, allowed to stand for 10 to 20 sec. and then excess is emptied out. With the sand mixture thus partly cured, the box is transferred to an oven to complete the process.

Amongst the largest castings in regular production are the combined twin-cylinder compressor crankcase and cylinder units shown in Fig. 15, which weigh 70 lb. trimmed. To produce these castings, a conventional type of sand core is employed with the shells shown, and the shells are poured supported in sand, as is the cylinder liner casting shown in Fig. 16. This cylinder liner is the heaviest casting so far made and weighs 205 lb. It is 22 in. long, by 10 in. dia., and from 1 to 1¼ in. thick and is

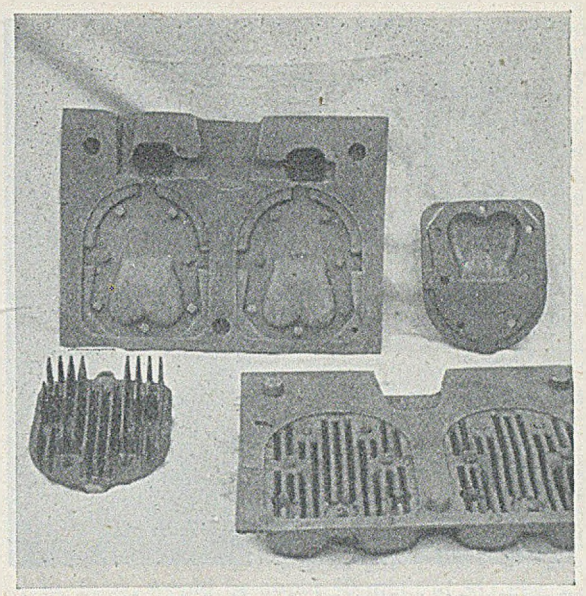


FIG. 20.—*Shells and Castings for an Air-cooled Cylinder Head, on which All Machining was eliminated, save for tapping the Plug Hole.*

run through pencil gates. The shells used for casting this liner are also shown. A normal core made in a wooden corebox is employed with these shells, as the original order did not justify the cost of a metal corebox.

Other Notable Examples

The piston shown in Fig. 17 is 21½ in. long, 10½ in. diameter by 1¼ in. thick, and weighs 200 lb.

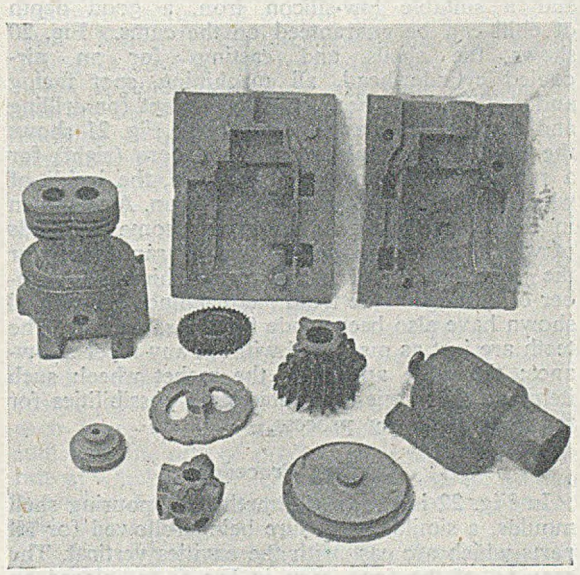


FIG. 21.—*Shell Mould Halves (rear) and (right) Shell Core for a Refrigerator-compressor Crankcase. Grooved Pulleys, a Gear Wheel and Ratchet Wheel produced from Shell Moulds are also included in the Group.*

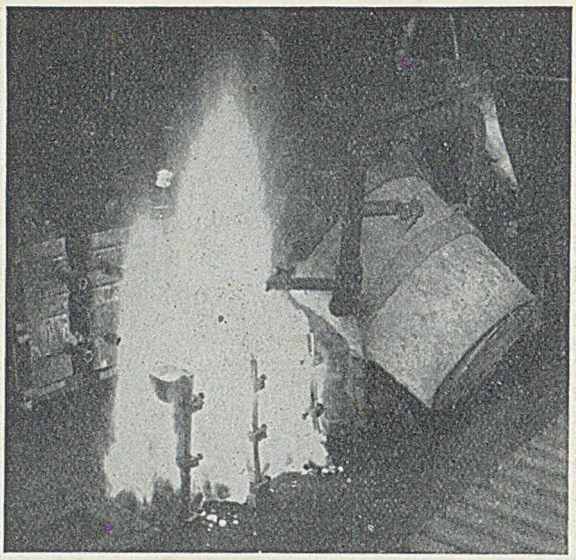


FIG. 22.—*Method of Pouring Shell Moulds, note the Flames from the Initial Combustion of the Resin Bond.*

Fig. 18 shows two liners or sleeves with shell moulds and shell cores, the castings each weighing 33 lb. Fig. 19 shows in the left and foreground a shell and a cam produced from it for a large Diesel engine—a casting weighing 55 lb. The castings used to chill the cam (right, foreground) should be noted. A larger casting (not shown) made from the pattern shown (right) is 21½ in. long and weighs 91 lb. By using this method and a suitable low-silicon iron, a good depth of chill can be guaranteed on the cams. Fig. 20 shows the shells and castings for an air-cooled cylinder-head, all machining, spot facing and drilling have been obviated except for drilling and tapping the sparking plug boss. Fig. 21 shows the shell mould halves and shell core (right) for a refrigerator compressor crankcase, the inside of which has to be very smooth and clean. Also shown in Fig. 21 are two grooved pulleys, some hundreds of which the engineer merely bored, ran a file over the joint line and fitted on his machines. A number of castings made from the machined gear wheel shown have also been made for the same user. The teeth are just as machined without any taper allowance; the same applies to the rachet wheel; such items as these open up interesting possibilities for the shell-moulding process.

Pouring Procedure

In Fig. 22 is shown the method of pouring shell moulds, a similar procedure being followed for all parts which are cast with the cavities vertical. The moulds, of the form seen in Fig 6, are placed on the foundry floor, resting on the double fin formed on the flat faces of the patterns, and are leaned against one another. At each end of a row of moulds is placed "book end"—a heavy weight or casting to prevent them from falling over. Moulds designed for casting with the parting line in the horizontal plane are usually put down on a flat bed of sand at a level suitable for pouring.

When the metal is poured into the moulds at approximately 1,350 deg. C., the gases given off by the burning resin are ignited and the moulds are surrounded by flames (Fig. 22). These flames soon die away leaving shell moulds of normal appearance full of molten iron. It is necessary for there to be sufficient resin in the mould walls to ensure that the metal poured has solidified before all the resin is consumed, because when the binder has gone, the sand falls away. Should this happen before the metal has become solid, or at least formed a solid skin, the molten metal will run out of the mould and the casting will be spoiled.

Shown in Fig. 23 are the same moulds, which were shown being cast in Fig. 21 after standing for about 10 min. The castings were still red hot, and the air currents to which they gave rise have lifted the sand off the surfaces. Only the sand which was directly in contact with the castings has been thus freed, however, the fins formed by the pattern plate faces being still in position, together with the clamps. All that is necessary when the castings are cold, is to shake off the sand and knock off the runners and ingates. To prevent the light silica sand from blowing about the foundry, poured moulds are usually covered with large tin boxes. When this is done, the sand remains in position on the upper faces of the castings, but is easily shaken off when required.

Among the advantages so far derived from the shell moulding of iron, probably one of the most important is the high quality of castings obtained.

FIG. 23.—*Group of Moulds shown in Fig. 22 after standing for about 10 min. following Pouring. Note the decrepitation of the Shell Bodies, leaving the Edges and Clamps standing.*

Due to the uniform rate of cooling of a casting in all parts and the absence of chilling (except where it is required) a closer-grained, harder grey iron may be used than for similar jobs in ordinary moulds. A hardness of 240 to 260 Brinnell can be maintained on all faces, and due to the absence of unwanted chilling, the bores of cylinders, for instance, may be as easily machined as if they had been cast in a considerably softer material. After machining, such bores, having harder surfaces of optimum structure metallurgically, will better withstand the wear to which they are exposed.

Future Trends

None can say at this stage to what size and weight shell moulded castings will go to in the next few years, but from the few examples cited it will be seen that the process has covered a range of castings from a few pounds to 200 lb. already.

The Author is only too conscious, however, that the castings are not perfect, there are many difficulties to overcome before perfection is achieved. For instance, skin blemishes can be a serious problem; the bursting of the moulds for the heavier castings is an ever-present risk, and the use of steel shot, rammed sand or gravel as a backing material simply creates its own problems. Nevertheless, there is no doubt that a great technical advance in the founding of metals has taken place, and for the first time the foundryman has a chance to give the engineer what he requires, namely, sound, consistent castings, with the minimum of machining, the minimum of taper and a skin very different from the mixture of fused sand and metal he is accustomed to receive. As engineers and foundrymen co-operate the more, so will the engineer come to appreciate the possibilities and limitations of the process. Castings will be designed to cut out many machining operations altogether, certain faces will be held to a few thousandths of an inch and machining times greatly speeded up. As the consumption of resin goes up so may its price come down, thereby opening up tremendous possibilities.

"D" Process

It was thought this Paper would be incomplete without a brief reference to the "D" process, which is being currently developed, and the following notes are therefore appended:—

Principle.—The principle of "D" moulding is that of blowing one half of the mould as a shell of designed thickness in an oil-bonded sand. The shell is then baked on the contoured half of the "box" which forms the shell, this being done in a conventional type of oven.

Oil binder.—A specially-prepared oil binder has to be used, which gives sufficient green-strength to the sand (to enable the shell to be handled without damage) and enables a good baked strength to be rapidly developed.

Sand.—Any clay-free sand is suitable, bearing in mind that the fineness of the sand governs to a large extent the finish obtained on the casting. A shell-moulding sand, such as Redhill H, can be used alone or, which is generally preferable, mixed with a proportion, say 40 per cent., of a good quality coarser sand. Three per cent. by weight of the oil has been found to give satisfactory results. A typical sand mixture would be:—60 lb. Redhill H; 40 lb. medium Leighton Buzzard; and 3 lb. special oil. The "baked" tensile strength of this mixture is of the order of 650 lb. per sq. in. If necessary, additions of iron oxide can be added further to increase the hot strength of the shell. (1 per cent. is sufficient.)

Stripping agents.—Stripping agents are not essential to the process. However, there may be a tendency to build up an oily deposit underneath the blowing holes of the corebox, which can lead to sticking. Spraying the corebox with an emulsion of linseed oil and water is effective in preventing this. This mixture is also very desirable for cleaning the patternplate.

Baking.—Any conventional type of core-baking oven can be used. The baking temperature governs the time required and temperatures of 260 to 316 deg. C. are recommended. At a temperature of 260 deg. C., the baking time for a shell of, say, ½ in. thick, would be about 30 min.; at 343 deg. C. the time would be 15 min. The temperature of the contour plate also greatly affects the baking time. Normally these would be kept at a convenient temperature for handling.

Equipment required.—The equipment needed for the "D" process is one patternplate (which remains cold throughout, hence its dimensions should be as for a cold plate) and a sufficient number of contour plates (which are not machined) depending upon the rate of drying. The remaining equipment —mixer, core-blower and oven—are as normally used in the foundry.

Shape of the contour plate.—The shape of the contoured plate will control the thickness of the shell. Normally, the thickness of the shell will be ¼ in-½ in., but if any particular part of the shell needs strengthening, then this can be done by altering the shape of the contour plate by incorporating suitable recesses to form ribbing, etc. Similarly, the shell can be ribbed to prevent any possibility of its warping.

Position of blow holes.—Blow-hole position depends upon the design of the pattern. It appears desirable to blow through the patternplate (around the periphery of the pattern) and vent around the periphery of the patternplate.

Advantages over "C" process.—These include (1) lower cost in binder and equipment needed (binder costs are roughly one third of binder costs); (2) the shell is exactly the same thickness each time; (3) provided the drying facilities are sufficient, the rate of production is the same as the rate at which a shell can be blown; and (4) no dust is produced at any stage—hence there is a reduced operational hazard.

A liquid phenolic-type resin is also being used for the production of "D" process moulds and cores. Here, again, the costs are about one third the price of "C"-process resins.

In conclusion the Author would like to thank

(*Continued on p. 696 at foot of col. two*)

Merchandise Marks Acts, 1953

By F. J. Tebbutt

The Merchandise Marks Acts concern the obligatory marking of imported goods in certain circumstances, and also relate to false descriptions of goods. There has recently been passed a new measure—The Merchandise Marks Act 1953 (making three major measures in operation) which introduces new provisions and alterations to former ones, and in this article, the new Act will be dealt with, together with an explanation, as far as space allows, of what has gone before.

Marking Procedure

There are two systems of marking procedure, in one the marking applies generally to imported goods, that is in all cases where a British firm's name or trade mark—manufacturer, dealer or trader—or the name of place of any district in the United Kingdom, appears in connection with the goods. Then, accompanying this must be some indication of the place of origin of the goods, the provisions of the Acts applying automatically. The provision applies whether goods are sold or exposed for sale. It applies also if goods are distributed for the purpose of advertising goods of some other kind. For example, if some foreign article is given away to advertise an engineering business; then the mark of origin would have to appear on the article given away. It should be noted that it does not apply to exposure for sale wholesale where the person or firm is a wholesale dealer. Goods entirely unmarked—be it noted—are outside the scope of the Acts as regards this provision. Marking can be made obligatory as regards specific goods through the medium of Orders in Council, such being introduced following a considered review of any given case, by one of the Standing Committees appointed under the Acts, the over-riding Government authority usually concerned being the Board of Trade. Application to a Committee for a marking order can be made either by a manufacturer (this applies also to producers, dealers, users of consumers) or by any body of wage earners if considered representative of the interests concerned. After inquiry a Report is issued, and if a recommendation is included, and accepted by the Government Department concerned, an Order in Council as approved by Parliament is published.

The form the indication of origin is to take will be in the relevant Order in Council and also various other particulars. As regards what is called a "sale order," the legal requirement commences when the item is sold or exposed for sale in the U.K. In this connection the expression "sale" includes sales wholesale or retail, but as regards *exposure for sale wholesale*, this must be specifically mentioned in the Order to have effect. It should be noted, however, that even so, the requirement does not apply as regards *exposure for sale wholesale* by a *wholesale dealer* unless the Order specifically includes such dealers. An Order for a mark on importation, is styled an "importation Order"; it operates at the port of entry and is enforced by the Customs Authorities.

Important Points

The mark need only be the word "foreign" in respect of foreign goods, and for goods or products of the British Empire, the word "Empire." Alternatively the name of the particular country can be definitely stated, at the option of the person applying the indication of origin.

Indication of origin must also appear in any advertisement and offers for sale—in newspapers, catalogues, and so forth—and on any sample ordinarily, but as regards sampling the marking provision is considered fulfilled, if a written communication has been made to the prospective purchaser indicating the place of origin.

New Act

The 1953 Act makes alterations to the former Acts, and mostly in connection with the provisions concerning "false descriptions" of goods. The expression "trade description" in the 1887 Act is defined—*inter alia*—as meaning . . . any description, statement, or other indication direct or indirect as to the number, quantity, measure, gauge, or weight of any goods, or as to the mode of manufacturing or producing any goods, or as to the material of which any goods are composed . . . By the 1938 Act, the definitions of the 1887 Act were added to by including . . . any description appearing in any sign, advertisement, invoice, business letter, business paper or other communication.

The term "false trade description" means a trade description which is false *or misleading* in a material respect as regards the goods to which it is applied and the word "goods" means anything which is the subject of trade manufacture or merchandise. Applying any "false trade description" to goods is an offence which may entail on summary conviction a fine not exceeding £100 (increased from £20) or imprisonment up to four months, with forfeiture of goods. The reason for this 1953 Act, it is stated, is that selling methods nowadays are much different from those in the past, and so the provisions of the 1887 Act are out of date, and are too limited.

Nowadays, claims and eulogies are mainly directed towards the performance of goods. This 1953 Act now amplifies the definitions of the term "trade description" of the former Acts as meaning . . . any description as to the standard of quality of any goods according to the classification commonly used or recognized in the trade or as to the fitness for purpose, strength, performance or behaviour of any goods. A further point in connection with these Acts should be noted—there is nothing in them requiring a trader to give any description of his goods; if he does then he must conform to the provisions of the Acts. If his trade descrip- is false in any important feature, then he has committed an offence. Thus, if an alloy is described as "heat resisting" it should reasonably meet this claim. So that the new provisions of this Act do not catch traders with stocks subject to trade descriptions which they cannot clear, the Act did not come into operation on the commencement date, and will not be in operation as regards the "trade description" section until six months from that date, that is January 31, 1954.

Shell Moulding of Cylinder Castings

(*Continued from previous page*)

his directors for their help and encouragement and kind permission to present this Paper, also his co-manager, Mr. T. Emmerson—who has had the handling of the shell-moulding process in the foundry since its introduction—and his other colleagues. Acknowledgment is also made to Mr. Parkes, of the FOUNDRY TRADE JOURNAL, for his generous help, and to *Machinery* for kind permission to use a number of illustrations.

"New Methods for Old"

Film Show to the I.B.F. London Branch

At the first meeting of the London branch of the Institute of British Foundrymen in the autumn session held in the Waldorf Hotel, the first business was the formal induction of the newly-elected branch president, Mr. B. Levy.

He was introduced by the retiring president, MR. D. GRAHAM BISSET. It was customary, he said, formally to introduce to the members the president they had chosen to preside over their deliberations during the ensuing session; it was a pleasure also to invest him with the presidential badge, the design of which was similar in the Institute's branches generally. Mr. Levy, he continued, was a very hard-working member of the branch, most enthusiastic in all that he did, and one was perfectly certain that he would devote his energy and time to ensuring the success of the branch activities.

MR. LEVY, after expressing his appreciation, delivered his Presidential address, the main theme of which was team work.*

Following a vote of thanks for his Address, the PRESIDENT invited Mr. Frank Hudson to show his colour film, "New Methods for Old," which recorded some of the developments which had arisen as the result of the Brassfoundry Productivity Team's report on their visit to the United States. Mr. Hudson, he said, needed no introduction to the branch, his work on the Institute's Technical Council was so well known.

Origin of the Film

MR. FRANK HUDSON, F.I.M. (junior vice-president of the branch), in his introductory remarks, recalled that he had had the privilege of leading the Brassfoundry Productivity Team to America, and in due course they had published their report. Subsequently, they had been travelling about the country in order to see how many firms had acted upon the Team's recommendations. It was found that quite a surprising number of firms had done so, but that a great many more had not, and he had felt it necessary himself to try to do something to stimulate the interest of those founders who had not done much. Therefore, he had decided to make a film illustrating the sort of action which many foundries had taken and the beneficial results which had accrued therefrom.

It became obvious that the film was going to cost a fair amount of money. He could not get the money from the industry itself, however, due to the fact that as a whole the brassfounders of this country did not support trade associations in the way they should. As an alternative, therefore, he decided to approach equipment manufacturers so that, in addition to showing founders the methods it was desirable they should follow, he could also indicate the sort of plant that was used. He apologized that there was a certain amount of advertising in the film, but this was only due to the fact that he could not raise the money for its production from the brassfoundry industry itself. In order to keep the cost of production of the film as low as possible he had decided to make it himself, with the assistance of certain members of his family, and the work had occupied a year and a half.

Originally he had visualized a film with a showing time of 30 min.; but so much interesting material was available that, even with the most drastic editing, it was found impossible to reduce the showing time below 40 mins. This was too long, because viewers would not remember all that was in it, and therefore he had split the material into two films. The main purpose of the films was to create a greater interest amongst smaller brassfounders, regarding increased productivity. For a modest outlay of £2,000 on plant such firms could increase production enormously and he believed that even the smallest brassfoundry to-day could afford to spend that amount on new equipment. When he spoke to brassfounders about mechanization they would say they could not afford it; he would then ask them how they could afford the cars they were using, and he knew that when he left they were thinking about what he had said.

He was glad that the branch president, in his Address, had made reference to present trade conditions as it was essential for this country to increase it exports. Every industry had got to produce something better at a lower price and he hoped the two films might be of some assistance in this direction.

Speaking about the film on aluminium-alloy matchplates he said that since the Brassfoundry Team came back from America one of the outstanding developments had been the production of such pattern plates in Great Britain. He believed it would have an important bearing not only on the production of castings in sand, but also on new methods coming into practice such as shell moulding. Mr. Hudson said how much he was indebted to Mr. D. Potts, of the Westinghouse Brake & Signal Company, Limited, and to his Company, for permission to film the production of the aluminium-alloy matchplates.

The two films were then exhibited.

DISCUSSION

MR. BARNARD, commenting on the use of the exothermic sleeve, asked if Mr. Hudson had tried the necked-off or necked-down risers also.

MR. HUDSON replied that he was very keen on seeing the neck-down riser developed. It was one of those things which he believed would follow as a natural consequence, once founders got down to the use of the exothermic or plaster sleeve.

MR. ROBINSON asked for information as to the relative effectiveness of the exothermic sleeve and a sleeve of gypsum plaster; he had in mind the num-

* Printed in the JOURNAL, November 12.

ber of cubic inches of feeder for a certain mass of metal in a casting.

MR. HUDSON replied that at the moment he could not give any definite rules governing the mass of metal needed in a feeder. Indeed, he was rather scared about the application of "slide rule" methods in the foundry, as a great deal of practical experience was still necessary in deciding how far one could go.

Comparison between Insulating and Exothermic Sleeves

MR. E. C. MANTLE recalled that a paper presented to the Brassfoundry Productivity Conference held in Harrogate in June, 1952, dealt with the efficiency of feeders, both of the plaster and exothermic variety. It had shown that where the metal entering the feeders was hot, there was not very much to choose between the plaster and the exothermic feeders in respect of efficiency, but where the metal entering was relatively cold the exothermic feeder had an advantage; the difference could be reduced to some extent by having an exothermic cap over the plaster feeder. However, the choice of feeders was a matter for the individual foundryman to decide for each particular casting, bearing in mind both economic and technical factors. He believed the plaster sleeve cost about one-third as much as the exothermic. Both were very much better than an ordinary green-sand sleeve.

At the British Non-Ferrous Metals Research Association, with which he was associated, they had elaborated a little the work on feeder sleeves and had tried to neck down the riser used in conjunction with a plaster sleeve. It was found that, provided the necked-down portion in porous plaster was not more than $\frac{1}{4}$ in. deep, the size of the neck could be reduced considerably—down to $\frac{3}{4}$-in. dia. in a $2\frac{1}{2}$-in. dia. feeder.

MR. A. TALBOT asked whether the plaster or the exothermic sleeves gave the metal the longer "life."

MR. HUDSON replied that the answer largely depended upon the type of alloy employed and the design of the casting. For example, if a casting of heavy section was being made, in an alloy having a high liquid shrinkage, it was usual for many foundries to pour the metal as cold as possible and, when metal entered the feeder, solidification may have already commenced. In such cases an exothermic sleeve, or the addition of an exothermic cover, would tend to increase the temperature of the metal in the feeder and promote longer life.

When using exothermic sleeves, it was important to ensure adequate venting in the mould adjacent to the sleeve, otherwise the metal in the feeder might tend to "blow." In the section of the film dealing with exothermic sleeves, it would no doubt have been noticed that the moulding sand adjacent to the sleeves was cut away as a safeguard against back-pressure. If plaster and exothermic sleeves were properly used he did not think one had any particular advantage over the other.

Cutting-off Wheels

MR. ROBINSON said his company had experimented with the exothermic material and had found that, with adequate venting and ramming-up with $\frac{1}{4}$ in. or $\frac{3}{8}$ in. of core sand at the back of the sleeve, gas trouble was eliminated. Speaking of cutting-off wheels, he said his company were using the breakable type and there had been one or two mishaps. He asked where the 16-in. dia. flexible wheel could be obtained, and what was its cost.

MR. HUDSON replied that the photographs of the use of the flexible wheel were taken in the works of the Phosphor Bronze Company, Limited, at Birmingham, and this type of wheel could be obtained, for instance, from either the Universal or Carborundum concerns.

MR. ELLIOTT said he had noticed that there was no guard around the abrasive cutting-off wheel that was shown, and he asked whether Factory Inspectors permitted its use without a guard.

MR. HUDSON said he did not know. Some operations for which the wheels were used were such that guards could not be employed. The operators had every confidence in using such tools and from experience they were confident that there would be little risk of accident.

MR. ELLIOTT commented that at his works one of the wheels had burst, and the man using it would have been killed if there had not been a guard.

MR. HUSON asked whether the wheel in question was actually reinforced. He had not heard of any of the new reinforced or flexible wheels breaking. If they did break they would never fly to pieces for they were held together by a special nylon web.

MR. R. BLANDY said he had burst a so-called "unbreakable" wheel. He agreed, however, that such a wheel would not fly to pieces, whereas the old type definitely did so and could do a lot of harm.

Sulphur Pick-up

MR. V. W. CHILD asked whether Mr. Hudson had experienced any trouble due to gas pick-up when fuel oils of comparatively high-sulphur content were used. He wondered whether the sulphur dioxide or trioxide had an adverse effect and, if so, whether it could be removed by nitrogen scavenging. He was referring particularly to the melting of gunmetal, bronze and possibly cupro-nickel.

MR. HUDSON said he had no experience of detrimental effects due to sulphur dioxide or trioxide.

MR. MANTLE said that from time to time a strong smell of sulphur dioxide had been noticed in the foundry, and it coincided with the production of gassy metal; it was said that sulphur in the fuel was the cause of the trouble. Probably the gas trouble coincided with the fact that the poorer fuel did not burn quite so completely as did a more refined fuel, and there was probably rather a lot of hydrogen in the exhaust gases as well as sulphur dioxide. The B.N.F.M.R.A. had not investigated the matter recently, but evidence indicated that the sulphur dioxide in the atmosphere did harm the

copper-base foundry alloys. Where the troubles had arisen they had vanished again suddenly, and that might coincide with the use of better fuels.

MR. W. G. MOCHRIE (branch hon. secretary and treasurer) said he believed Mr. Child was concerned as to whether any sulphur, as such, was getting into the metal. Fairly high sulphur contents had been reported in gunmetal, but what constituted a "high"-sulphur content was left to conjecture. The maximum sulphur permissible was not mentioned in British Standard specifications, no doubt because of the lack of information in this country regarding the effects of this element on physical properties. One wondered whether American foundrymen could substantiate the low maximum sulphur permitted in their gunmetal specifications, or whether they were "playing safe." There was no doubt that there is much still to be learned in sulphur determinations (*i.e.*, as to the form in which it was present) and the maximum amount permissible without adversely affecting the physical properties.

There were several practical methods for the removal of sulphur from gunmetals. Had Mr. Mantle hinted at still one more method when he remarked that sulphur picked up was liberated as dioxide into the foundry atmosphere? In his (Mochrie's) experience this did not happen, or, if it did, it did not present the total picture; but he would be interested to learn more about it.

MR. MANTLE said he believed some of the sulphur was picked up by gunmetal, but it formed zinc sulphide or lead sulphide, or something of that sort. He did not think that that would make the metal gassy, but perhaps it would make the metal sluggish in pouring.

MR. MOCHRIE asked whether the sulphur in solution was detrimental to the mechanical properties of the castings.

MR. HUDSON pointed out that, if one were troubled with high-sulphur contents in gunmetal, the sulphur could be reduced by fluxing treatment, using a flux such as soda ash.

Runners for Matchplate Patterns

MR. WARD asked how the makers of matchplates knew whether they were incorporating the correct type of runner for the final castings to be made on the matchplates.

THE BRANCH PRESIDENT said presumably the answer was that before making a matchplate one had already made trial castings off the wooden pattern, and one would be guided by those trial castings.

MR. MATTHEWS commented that the founder would make one casting off the pattern in a sand mould. His company were now working with aluminium matchplates.

THE BRANCH PRESIDENT repeated Mr. Ward's question and said the answer would obviously be to make some trial castings by ordinary sand methods. One had already a wooden pattern, off which one could make trials, and that wooden pattern was utilized to make a patternplate which would be used with the same runner system.

MR. HUDSON said a good many firms operated an experimental foundry, which tried out the casting before it went into the foundry.

Degassing

MR. ROBINSON asked if there were statistics available to show what benefits could be derived in regard to elongation and tensile strength, in aluminium alloys particularly, with nitrogen de-gassing.

MR. HUDSON said the development of the nitrogen de-gassing of copper-base alloys in this country had resulted largely from the work of the B.N.F.M.R.A. on aluminium-base alloys; and he invited Mr. Mantle to reply to the question.

MR. MANTLE said that, whatever method of de-gassing were used, provided the metal was made gas-free, it should have the same properties. The question resolved itself into which was the most efficient way to de-gas. In the near future the Research Association might be publishing data indicating the rate of removal of gas from aluminium alloys by media such as nitrogen, or nitrogen with a flux covering, chlorine, etc. All methods did the job, although some required more time than others. A solution was to use something like the reduced-pressure-test apparatus which the laboratory had developed some time ago, to ensure that the metal was gas-free before casting.

MR. HUDSON felt that the problem of getting aluminium alloys gas-free was more difficult than in the case of the copper-base alloys, because aluminium could be overheated more easily than could the latter. Furthermore, many foundries used de-gassing materials such as hexachloroethane and if there were more gas in the metal than the de-gasser could cope with, some gas was bound to remain. It was important to ensure that both time and the quantity of de-gassing material employed were sufficient to cope with the amount of gas present.

MR. MANTLE added that with nitrogen de-gassing of aluminium alloys it was important to use a flux cover which would dissolve aluminium oxide.

MR. G. C. PIERCE (past branch president) sympathized with Mr. Robinson in regard to his query, because there did not appear to be any formula which could be applied. It was his experience that DTD, 424 and similar alloys, if de-gassed with nitrogen, definitely had an improved crystalline structure; the fracture, too, was much improved. However, he warned that care must be exercised if the method were applied to L.33 alloy, because if the metal were modified, subsequent de-gassing would completely de-modify it, and a very large crystal structure would result. If one worked strictly to formula, one might try to modify the aluminium partly before de-gassing with nitrogen, and then, subsequently, a modifying technique could be applied. Unquestionably, he concluded, nitrogen would de-gas metal, but he wished founders could have an absolute formula to apply.

How to Spend £2,000

MR. MATTHEWS, speaking as a representative of a small brassfoundry which was in process of extending, asked if Mr. Hudson could at some time

indicate the equipment he should buy for £2,000 to produce the beneficial results that had been indicated.

MR. HUDSON replied that it depended on what one wanted to do. The equipment suppliers were not prepared to equip a foundry for £2,000, but one could mechanize a small plant to the extent of £2,000 and obtain many advantages. He would be delighted to meet Mr. Matthews and discuss individual problems.

MR. MATTHEWS said he would like to meet Mr. Hudson and discuss the matter some day.

Vote of Thanks

MR. W. R. BUXTON proposed a vote of thanks to Mr. Hudson for his excellent and very interesting films, which give a very graphic representation of modern methods in the foundry, and for his replies to the discussion. The productivity team which had visited America of which Mr. Hudson was the Leader, was sponsored jointly by the Association of Bronze and Brass Founders and the National Brassfoundry Association, and as the result of that visit Mr. Hudson has shown some of the lessons to be learned from the application of modern methods.

Referring to the fact that there was a certain amount of advertising in the films that were shown, Mr. Buxton did not say it should not be there, because a lot of the work done had been made possible by the firms whose products were advertised, but it would not have been necessary had the Association of Bronze and Brass Founders been able to afford to provide the films. That Association represented a large proportion of the industry, not numerically, but in relation to the total number and weight of castings produced. As its representative, Mr. Buxton said that, had it been stronger in numbers of members it would have been able to pay for the films, and that was one good reason why he would like to see all the bronze and brass founders come into the Association.

MR. G. C. PIERCE, seconding, paid tribute to Mr. Hudson as one of the hardest workers in the Institute. Condoling with him for having to apologize for the inclusion of a degree of advertising in the films, Mr. Pierce said that throughout its history the Institute of British Foundrymen had not allowed any advertising in lectures delivered under its auspices, and he considered that was the right and proper course to adopt. He deplored the necessity to advertise at that meeting, arising as it did from the shortage of money. However, appreciating the difficulties which Mr. Hudson had had to face, Mr. Pierce complimented him on a wonderful job; he had given the members a very interesting evening during which he had brought them right down to earth, and they had learned something.

(The vote of thanks was warmly accorded).

MR. HUDSON expressed his appreciation of the very kind remarks that had been made. At the same time, he wanted to have a little come-back concerning Mr. Pierce's remarks on the advertising. He pointed out that the films were made as part of the Brassfoundry Productivity Team's activities; further, he had not asked that he might show it to the branch, but had been invited to do so.

[Following the successful showing of the films " New Methods for Old " and " Aluminium-alloy Matchplates " to the London branch, it has been revealed by Mr. Frank Hudson that the Mond Nickel Company, Limited, have kindly agreed to sponsor these films as an incentive towards increased productivity in the foundry industry. In view of this generous gesture it will now be possible to ensure that these films remain essentially in the technical class. Production of " sound " duplicates is being arranged and copies will be available in approximately eight weeks' time.]

Phosphor Bronze Company's Expansion

The Phosphor Bronze Company, Limited, Birmingham, one of the Birfield Industries Group, is carrying out an extension programme entailing the installation of new plant valued at £400,000 and new buildings costing £250,000. The extensions will, it is anticipated, increase production by 50 per cent. in the next two years. The new premises will include pattern-and-machine-shops, administrative offices, Board room and canteen (the latter to be opened in mid-December). The extensions will increase the floor area from 140,000 to about 210,000 sq. ft.

Foundations are being laid for a new stainless-steel foundry. This enterprise, under the name of Rea Foundries, Limited, will contain four high-frequency furnaces and will raise the present production of stainless-steel and alloy-steel castings from 40 tons a month to between 80 and 100 tons. Bays are to be added which may be devoted to stainless-steel or non-ferrous output according to market trends. Another feature of the expansion is the formation of a larger shop for shell moulding, in which the firm is especially interested, finding it more accurate than sand castings, the higher density of shell-moulded castings making them especially suitable for pressure-resisting work.

About a third of the firm's annual output is exported. It will be recalled that the company recently acquired Kent Alloys, Limited, Rochester, manufacturers of light alloys, iron, magnesium-alloy castings principally for the aircraft industry.

Increases of Capital

THOMPSON BROS. (BILSTON), LIMITED, increased by £250,000, in 5s. ordinary shares, beyond the registered capital of £500,000.

HOLINTER, LIMITED, iron smelters, engineers, etc., of London, E.C.4, increased by £10,000 in £1 ordinary shares, beyond the registered capital of £10,000.

CROSBY VALVE & ENGINEERING COMPANY, LIMITED, London, E.C.4, increased by £100,000, in £1 shares, beyond the registered capital of £100,000.

GLOUCESTER RAILWAY CARRIAGE & WAGON COMPANY, LIMITED, increased by £75,000, in 10s. ordinary shares, beyond the registered capital of £1,050,000.

E. MILLS & COMPANY (KETTERING), LIMITED, engineers and ironfounders, etc., increased by £6,000, in £1 ordinary shares, beyond the registered capital of £6,000.

W. EDWARDS & COMPANY (LONDON), LIMITED, scientific apparatus manufacturers, etc., increased by £50,000, in £1 ordinary shares, beyond the registered capital of £250,000.

HILLSIDE FOUNDRY & ENGINEERING COMPANY (CUPAR), LIMITED, Leven (Fife), increased by £16,000, in £1 unclassified shares, beyond the registered capital of £4,000.

WILMER LEA FOUNDRIES (HOLDINGS), LIMITED, London, E.15, increased by £149,900, in 1s. ordinary shares, beyond the registered capital of £100. The above increase is for the purpose of acquiring not less than 90 per cent. of the issued share capital of Wilmer Lea Foundries, Limited. The company was converted into "Public" on August 5, 1953.

Dust Control from Pedestal Grinders

In addition to the verbal discussion at the session of the annual conference of the Institute of British Foundrymen dealing with dust control from pedestal grinders (JOURNAL, November 26, 1953, p. 651 *et seq.*), written comments have been received for publication as follow:—

MR. COLIN GRESTY, in a further contribution to the discussion, wrote that dust counts have to be both taken and interpreted with care. Under the best conditions, results are subject to variation, as is the atmosphere itself, and they are admittedly relative to the surrounding air. Given these points, however, they represent the only quantitative method available for testing dust-laden air. It is consequently somewhat difficult to understand the reluctance of the British Steel Castings Research Association to publish detailed dust count figures. The British Cast Iron Research Association, while recognizing the value of illuminating dust streams for visual examination, had no hesitation in asking Mr. Lawrie, as an independent authority and as one skilled in this particular work, to make dust counts on their device by the thermal-precipitator method. The results disclosed in the paper are on a proper scientific basis and all the figures obtained are published, not merely selections therefrom.

In spite of the fact that light beams are believed to illuminate all dust particles, irrespective of size, the limitations of purely visual observation are obvious. By varying the pressure of work on the wheel, variations of which the operator may be unconscious, it is possible to obtain results which completely frustrate a visual comparison presumed to have been made under identical conditions.

Fig. 12 of Mr. Lawrie's earlier paper (FOUNDRY TRADE JOURNAL, December 11, 1952, p. 676), shows four dust streams which have to be controlled. Two of these, parallel to the axis of the wheel, never enter the hood. Hence no collection inside the hood can deal with them.

Divergent Viewpoints

Some founders, without stopping to examine the two designs in detail, have suggested that they might be combined in one, but such examination shows that they are the result of two completely opposite thought processes and hence cannot be combined. By making provision to trap the dust at the point of origin, the designers of the B.C.I.R.A. system are able to open up the wheel. The experiments in running a 16-in. wheel in a 24-in. casing conclusively prove that the gap caused by a worn wheel makes no difference and calls for no modifications. Indeed, the operator is not required to make any adjustments of any description.

The B.S.C.R.A. arrangement appears to close up the wheel in every direction and hence serves to restrict the air stream following the wheel and raise its pressure. The unwillingness of operators to use adjusting devices which they have to operate themselves is a matter of common experience, and it is difficult to believe that they will be ready to make the frequent changes called for to maintain a virtually closed system. Some danger may lie in these close tolerances, as well as cost in making the necessary parts adjustable. The grinding of the corners of castings may give a wrong impression of what happens, as it frequently must in practice, when the casting being ground cuts the whole of the peripheral air stream developed at the open part of the wheel, *i.e.*, when grinding on edge or face on the full width of the wheel. This stream is bound to turn along the work and up the body of the operator. In the B.C.I.R.A. film, plumes of dust arising under these conditions are clearly seen and are taken care of by the external extraction unit which is the essential feature of the device. In the B.S.C.R.A. film, however, no such plumes of dust are seen, from which it would appear that the difference must lie either in the material being ground or, as indicated above, in its shape. Since the B.S.C.R.A. claim to control dust from iron castings, an independent test seems clearly to be required to enable a proper comparison to be made. Indeed, without such a test, prospective users will require to exercise the utmost care in selecting the type of apparatus suitable for their work.

Acknowledgment

DR. J. G. PEARCE wrote that he wished to repair an omission in Mr. White's Paper by acknowledging the indebtedness of the B.C.I.R.A. to Coneygre Foundry, Limited, for the loan of the 24-in. wheel on which the reports by Mr. White and Mr. Lawrie were based. This was a standard commercial wheel, apart from the extractor unit fitted by the Association for the tests described by Mr. Lawrie. His results were striking in showing that, at the operator's breathing zone, the air was as good as that in the surrounding atmosphere and indeed little difference existed at that level whether the machine was operating or not.

Opportunities in Canada

In an address to the Canada Club in London, Mr. R. A. Butler, Chancellor of the Exchequer, said that Britain desired to take as large a part as her resources would allow in the immense development that was now taking place in Canada. There had recently been a considerable increase in U.K. investment in Canada, he declared. It had sometimes been thought that investment had been stopped. That was not so. We had permitted such investment within the limits that our resources could provide since the end of the war.

The Chancellor referred to the opportunities afforded to British civil engineering and building contractors, and spoke with satisfaction of the establishment of the U.K. aircraft industry in the Dominion. More of the right types of exports were now being shipped to Canada, he continued. Exports of machinery totalled some 38,000 tons, nearly four times as much as in 1938, while 21,000 cars, compared with 600, had been shipped. There had also been a considerable expansion in shipments of machine tools, electrical and other kinds of machinery, steel sheets, wrought tubes, and pipes and fittings.

Personal

MR. CECIL F. HURST, vice-chairman of Samuel Osborn & Company, Limited, steel and tool makers, of Sheffield, is to be the the new president of the Sheffield Exchange.

MR. JEAN DONDERS, the president of the Nancy regional organization of the "*Centre Technique*," has been created a *Chevalier de la Légion d'honneur*.

MR. H. W. BOSWORTH, A.M.I.E.E., chairman, Lancashire Dynamo Holdings, Limited, is leaving this country on the Pretoria Castle to-day to make a short business visit to South Africa.

IT IS ANNOUNCED that MR. EDWARD A. O'NEAL, Jr., chairman of Monsanto Chemicals, Limited, has in addition been elected a vice-president of Monsanto Chemical Company, St. Louis, Missouri, U.S.A.

MR. BASIL SANDERSON has been reappointed president of the Federation of Shipping. He is chairman and managing director of Shaw Savill & Albion Company, Limited, among several interests in shipping companies, and is also a director of the Ford Motor Company, Limited.

MR. DAVID GUNSTON, of Baker Perkins, Limited, engineers, of Peterborough, who has been closely connected with the gas and oil fired bread and biscuit ovens made by the firm, is on a month's visit to the Argentine to inspect bakery plants recently installed in the country by the firm's engineers.

MR. J. R. KELLY, who joined the Board of Vickers-Armstrongs Limited, on December 1, at the same time became a director of the following companies in the Vickers Group: Powers-Samas Accounting Machines, Limited; G. J. Worssam & Son, Limited, and A.B.C. Motors, Limited.

MR. JOHN C. SMITH, after 32 years' service with Mavor & Coulson, Limited, is retiring at the end of this year from his position as district manager for mining machinery in Northumberland and County Durham. His successor is MR. J. H. ROGAN, whose office will be at 1, Eldon Square, Newcastle-upon-Tyne, 1.

MR. A. A. ATKINS, who has been education officer at Samuel Fox & Company, Limited, steelmakers, of Stocksbridge, Sheffield, for the past two years, is to take up the post of chief education officer to Birfield Industries, Limited, at its training centre near Stratford-on-Avon. The group is mainly composed of engineering companies in the Midlands.

"A FAMOUS ENGINEER with a kind heart, a sense of humour, and a level head" was how MR. J. Ramsay Gebbie, managing director of William Doxford & Sons, Limited, Sunderland, described MR. W. H. PURDIE when he presented him with an inscribed silver salver last week. Mr. Gebbie was speaking at a dinner given in Mr. Purdie's honour to mark his retirement as general manager of the engineering department after an association of 42 years with the firm.

MR. L. JAMES, general manager of John Lysaght's (Scunthorpe) Works, Limited, has been appointed chairman of Lincolnshire Ironmasters' Association in succession to MR. STANLEY G. DAVIES, who recently retired from the position of general manager of Richard Thomas & Baldwins, Limited, Scunthorpe. Mr. Davies, who has been chairman of the association since 1948, has been presented with a silver salver. LT.-CMDR. G. W. WELLS, managing director of the Appleby-Frodingham Steel Company Branch of the United Steel Companies, Limited, has been appointed vice-chairman.

Obituary

MR. JOHN MCMILLAN, who was a partner in Archibald McMillan & Company, coppersmiths and brassfounders, of Edinburgh, died last week.

MR. FREDERICK HESLOP, who died recently, was formerly manager of the coke ovens and by-products plant of Bearpark Colliery, owned by the Bearpark Coal & Coke Company, Limited, Middlesbrough.

MR. ARTHUR WINKLES, who retired from the secretaryship of the Austin Motor Company Limited some six months ago after 25 years' service in that position, died at the end of last month at his Birmingham home. On retirement he continued to serve the company on special work.

SIR LIONEL WARNER, who was for over 20 years general manager and secretary of the Mersey Docks and Harbour Board, died on November 21 at the age of 78. He was appointed to the post in 1920 and retired in 1941. He had been created C.B.E. in 1919 and was knighted in 1936.

MR. LLEWELLYN SHORT, of West Kilbride, who has died in a Glasgow nursing home, was a former manager of Babcock & Wilcox's works at Dumbarton. He travelled widely on the Continent and U.S.A. in connection with new processes which the company installed at Dumbuck Works. He was a member of the Institution of Mechanical Engineers.

MR. THOMAS E. H. HEYWOOD, retired, of Aberdeen, former chief mechanical engineer for the Scottish area, L.N.E.R., has died at the age of 75. In 1914 he joined the Great North of Scotland Railway as chief mechanical engineer and in 1924 went to Manchester, returning to Scotland three years later as chief mechanical engineer to the Scottish area, L.N.E.R., at Cowlairs, Glasgow. He retired in 1942.

MR. JAMES HAROLD KING died in the United States on November 14, at the age of 61. Graduating from Yale University he joined the Babcock & Wilcox Company, New York, which is associated with Babcock & Wilcox, Limited, engineers and boilermakers, of London, E.C.4, in 1914. He became manager of the marine department in 1931 and was elected vice-president of the company in 1945. Mr. King was president of the Society of Naval Architects and Marine Engineers in the U.S.A. in 1952.

The death occurred last week of LT.-COL. SIR PHILIP WIGHAM RICHARDSON, a former chairman of Swan, Hunter & Wigham Richardson, Limited, the Tyneside shipbuilders. He was in his 89th year. Born at Newcastle-upon-Tyne, Sir Philip was the son of the late Mr. John Wigham Richardson, founder of the Neptune Shipbuilding Yard and Engine Works at Low Walker in 1859. He was educated at Rugby and King's College, Cambridge, and begun his career at the Neptune Works in 1887. He was elected a director in 1891, and continued as a director on the amalgamation with C. S. Swan & Hunter, Limited, in 1903. He was appointed vice-chairman of Swan, Hunter & Wigham Richardson, Limited, in 1938, and in 1945 became chairman, remaining in that position until 1949, since when he had retained his directorship. A remarkably active man, even in advancing years, Sir Philip travelled widely abroad in search of business. An enthusiastic rifle shot, he received a knighthood in 1921 for services connected with rifle shooting, and a baronetcy in 1929 for political and public services. He was M.P. for the Chertsey Division of Surrey from 1922 to 1931.

News in Brief

DAVY AND UNITED ENGINEERING COMPANY, LIMITED, announce that Mr. G. S. McLay has resigned from the Board of directors.

MIDLAND IRON & HARDWARE COMPANY, LIMITED, announces that Treasury consent has been given for a proposed capital bonus of one for one.

THE NEW PREMISES of Ruston & Hornsby in Toronto were opened on October 30 by Mr. Gordon Bowen, the senior United Kingdom Trade Commissioner.

MORE THAN 2,000 WORKERS at Herbert Morris, Limited, Loughborough, have drawn an extra week's pay which is a bonus to commemorate a record year's trading.

ON CHRISTMAS EVE gold watches will be presented to 11 employees of Hepworth & Grandage, Limited, engineers, Bradford, to mark 25 years' continuous services with the firm.

THE CENTENARY of the founding of the Gloucester branch of the Amalgamated Engineering Union was celebrated by Gloucester engineers with a dinner presided over by Mr. E. Davies.

MR. SAMUEL SPENCER VARNEY, of Allestree, founder and managing director of Northern Malleable Foundry Company, Limited, City Road, Derby, who died on September 14 last, left £16,024.

THE KINCARDINE LANDWARD COMMITTEE have decided to fit pre-war council houses with continuous burning fires in place of old-fashioned ranges. The new fires will be fitted in 19 houses in Johnshaven and nine at St. Cyrus.

PLANS are being made for the formal opening in February of extensions to the Wolverhampton and Staffordshire Technical College, costing over £100,000. The extensions include the engineering wing and new premises for the National Foundry College.

MR. JAMES P. DAWSON has transferred his business, carried on under the name of George Ure & Company, engineers and brassfounders, at Largs Road, Fairlie, Ayrshire, to Donald S. McInnes, who will continue it on his own behalf under the existing name.

WHILST IN NO WAY responsible for the error which crept into the advertisement of Foundry Services, Limited, in our issue of November 26, which printed the expression "steel moulding" for "shell moulding," we associate ourselves with the firm in regretting this obvious mistake.

FURTHER TO OUR announcement that the Hepburn Conveyor Company, Limited, were putting on the market a shell-moulding machine, a new company—Anson Industries, of Church Street, Castleford, Yorkshire—has been formed to handle sales, and inquiries should be addressed to the new concern.

THE MINISTRY OF MATERIALS announces that from Tuesday, December 1, 1953, its selling price for tungsten ores of standard 65 per cent. grade and ordinary quality was reduced as follows:—Wolframite from 210s. to 195s., and scheelite from 195s. to 180s. per long ton unit delivered consumers' works.

PEGLERS, LIMITED, brassfounders, of Doncaster, have plans for re-engaging up to 200 of their former employees during the next two months, following an increase in business. Some four months ago the firm felt the drop in the demand for goods and production had to be curtailed and a number of employees dismissed.

MORE THAN 650 MEMBERS of the staff of the British Insulated Callender's Cables, Limited, Group—from London, southern branch offices, Construction Company district offices in the south, and the Erith Works—were entertained by the directors to a dinner, dance and cabaret at the Seymour Hall, London, last month.

ONE OF THE DEEPEST drawing power presses in the Midlands has been installed in the Bilston works of Joseph Sankey & Sons, Limited, and is expected to be working early in the New Year. Made by the Lake Erie Engineering Corporation of Buffalo, New York, it is a 1,500 hydraulic press, capable of drawing to a depth of from 24 in. to 30 in.

THE 6-MILLION DOLLAR ORDER, which the Hercules Cycle & Motor Company, Limited, Birmingham, has secured from America is believed to be the largest order received at the Cycle and Motor Show at Earls Court. A Persian order, for 14,000 cycles, is the first bulk order which the Hercules Company has received from Persia since the oil dispute began.

FOUR MEN were injured, two seriously, when a crucible of molten metal burst at Argus Foundry, Thornliebank, Glasgow, recently. Two of them, Charles Kane and Archibald Donaldson (metallurgist), are detained in the Victoria Infirmary with severe leg burns. Two other men, Thomas McLellan and David Bradley, were allowed home after treatment.

WORK HAS BEEN COMMENCED on the extension of a new metal patternshop in Summer Hill Street, Birmingham, 16, for Crockett Lowe, Limited. It will cover 40,000 sq. ft. and is being built for the production of pressure-cast patternplates and shell-moulding pattern equipment. Contracts in hand for this class of work will mean employment for some 300 additional staff.

THE ENGLISH ELECTRIC COMPANY, LIMITED, recently acquired controlling interest in the Canadian Marconi Company, and it was announced on Monday that MR. HENRY GEORGE NELSON, who is deputy managing director of English Electric, has been asked to join the Board of Canadian Marconi. His appointment will assist in creating a close liaison between these two organizations.

ABOUT 20,000 free advance copies of the catalogue of the Birmingham section of the B.I.F. are being sent to possible buyers and visitors all over the world. This is 6,000 more than last year. The catalogue with 3,000 items, has an index in eight languages. It is announced that the 1955 London Fair will be run by a Corporation shortly to be set up, instead of under the auspices of the Board of Trade.

A 60-YEAR-OLD 50 ft. Christmas tree sprayed white and decorated with 400 coloured electric bulbs is to be erected 40 ft. above the roadway at Joseph Lucas's factory at Hockley, Birmingham, as a gesture of goodwill from management to employees. A loudspeaker at the base of the tree will relay carols as workers leave for the Christmas break. The tree and others at Lucas factories in Birmingham will be illuminated each night.

THE MANUFACTURE OF AIRCRAFT in Scotland—as distinct from aero engines—is to be urged by the Scottish Advisory Council for Civil Aviation. It has been decided to prepare a report for the Ministry of Supply in support of proposals that Scotland should have a larger share in the work of designing and production of aircraft. Some 20,000 are employed in aero-engine work in Scotland, an increase of almost 19,000 over the 1939 figures.

(*Continued on page* 704)

News in Brief

(*Continued from page* 703)

BIRMINGHAM'S LORD MAYOR (Ald. G. H. W. Griffith) proposed the toast to the Association at the annual dinner-dance of the Birmingham Association of Mechanical Engineers. Among principal speakers was Mr. Charles E. Forryan, immediate past-president. The Association, which has the coat of arms of Birmingham in its badge, was founded in 1889 from an earlier body known as the Foreman's and Draughtsman's Mechanical Association.

LABOUR COSTS for industry as a whole per unit of output in the six months to September 30 have probably been fairly steady because the rise in wage rates was only about 1 per cent., and productivity was going up again after a decline, according to the Treasury Bulletin for Industry. In the first nine months of 1953 wage rates rose by an average of 2 per cent., compared with 4 per cent. and 7 per cent. in the same periods of 1952 and 1951.

AT 10 A.M. on November 26, the 2,000,000th vehicle made by the Austin Motor Company, Limited, left the production lines. It was an A 40 Somerset saloon. It took the company 40 years to produce its first million vehicles; the second million have been made in 7 years. In 1906 the works covered 2½ acres and employed 270 workpeople. To-day the works area covers 160 acres and there are 19,000 employees producing at the rate of over 200,000 vehicles a year.

MANCHESTER CHAMBER OF COMMERCE, representing nearly 5,000 firms, have submitted a memorandum to the Government, in which the Board of the Chamber gives its views that the censuses of both production and distribution are of no practical value to firms engaged in commerce and industry. Many firms, states the Chamber, have complained that the data provided from the censuses is of "no practical value to them and that it is hopelessly out of date" as a result of the time-lag in publication.

TEACHERS AND YOUTH EMPLOYMENT officers from the Wednesbury, Darlaston, Bilston and Willenhall areas were shown on November 24 and 25, how modern ideas are being applied to personnel management and apprentice training in the ironfounding industry. A two-day course at F. H. Lloyd & Company, Limited, James Bridge, was the third organized by the Wednesbury and Darlaston Manufacturers' Association, to provide a better idea of conditions in industry and relations between employer and worker.

A PARTY OF BELLRINGERS and friends from Buckminster made the journey to Taylor's Bell Foundry at Loughborough recently to see the re-casting of the fifth bell of their peal. The bell is being re-cast and dedicated to the memory of Sir Lionel and Lady Tollemache. The full peal is at the foundry for renovation. Mr. F. Taylor escorted the party on a tour of the foundry and, after seeing the bell re-cast and inspected, as well as a number of other bells, the senior ringers tried their hands on the peal at the foundry, and the younger members rang the handbells.

AT A BOARD MEETING of John Harper & Company Limited held recently it was resolved that an interim dividend of 10 per cent. (less income tax) be paid on the ordinary stock. At the same meeting Mr. E. McGill was appointed a director of the company to fill the vacancy caused by the retirement of Mr. H. Field. Mr. D. W. M. Stone was appointed secretary to succeed Mr. McGill, who resigned from that office. At a Board meeting of John Harper (Meehanite) Limited it was resolved that a net interim dividend of 1½d. per share be paid on December 11, 1953.

EFFORTS made by a number of companies to revive the non-ferrous metal mining industry in the United Kingdom have met with some measure of success, but there are many difficulties to be overcome. At a recent meeting of some of those engaged in the industry it was decided to form an association which would serve as a channel through which Government or other authorities could confer with the industry. Chairman of the formation committee of the new association is Mr. Sydney E. Taylor, with headquarters at 2, White Lion Court, Cornhill, London, E.C.3.

OF 19 INDUSTRIAL FIRMS in Birmingham's redevelopment area, which are willing to rebuild their displaced factories on sites provided by the Corporation, 12 have stated that they prefer single-storey buildings. Four are prepared to build two floors and three would build three floors. A report made on the first meeting of the Birmingham Development Plan Standing Joint Conference on Trade and Industry, points out that, though modern methods of production are tending towards single-floor assembly lines, industrial land is not unlimited and some expansion must take place vertically.

AT A MEETING of the Midland Regional Board for Industry on November 24 it was confirmed that the trend towards less unemployment in the region was continuing. Major C. R. Dibben, chairman of the Board, urged manufacturers further to increase exports and stated that the Board is "deeply concerned that much of the increased production of to-day is going to the home market probably because that is the easy way." It was reported that efforts to form exporting groups among small and medium sized firms in the Midlands that had not exported previously, had met with only partial success.

THE LARGEST PORTABLE SCALES in the world, with a weight capacity of 200 tons, made by George Salter & Company, Limited, West Bromwich, have been tested at Lloyd's Proving House, Netherton. Despite the fact that they will weigh up to 200 tons in graduations of one ton, the movement of the weighing mechanism is only one-eighth of an inch. The scales weigh six tons; the weighing mechanism is housed in a circular casting. The scales have been made for the English Steel Corporation of Sheffield and are to be used for weighing large castings and forgings. They have been tested to 50 per cent. plus strain, a total weight of 300 tons.

WORKPEOPLE employed by Aiton & Company, Limited, of Derby, who assembled for the opening of their new baths on November 23, heard Mr. A. McDougall, chairman of the Executive Council for the Amalgamated Union of Foundry Workers, who had been invited to perform the opening ceremony, warmly praised the firm for its initiative in providing such a facility for its employees without waiting to be compelled to do so. The baths have cost over £8,000. Showers and other washrooms, and locker rooms for working and outdoor clothes, are included in the new building, which is spacious and has an attractive colour scheme.

FINE EXAMPLES of the Silversmith's art were presented, on December 1, by the British Electrical and Allied Manufacturers' Association, to Cambridge University, to commemorate the endowment there of the Chair of Electrical Engineering. They comprised a silver rosewater bowl and ewer. The designer of the plate was Mr. M. E. Gould, of Twickenham Technical College, who won the £100 prize offered by the B.E.A.M.A. in a competition organized on their behalf by the Worshipful Company of Goldsmiths. The plate has been made by Mappin & Webb. It will be recalled that members of the B.E.A.M.A. subscribed £72,000 to ensure the perpetual endowment of the chair.

Raw Material Markets

Iron and Steel

Outputs of the blast furnaces supplying the steelworks with basic iron are readily absorbed, and those providing for the foundry industry are equally able to dispose of their makes, apart from a less insistent demand for the high-phosphorus grades.

During recent months outputs of the high-phosphorus irons have been greater than demands, due to slackness at the light and jobbing foundries, and the furnaces have been compelled to retain some tonnage in stock. The position now shows some change, as the foundries are taking up larger tonnages because of the improved demand for light castings. Makers of such articles as cookers, washers, and other domestic equipment report increased buying from home and oversea sources, while steady support is afforded by the building trades. The jobbing foundries also are receiving increased business from the many trades for which they cater, and the position at both these and the light foundries shows some improvement on the lethargic conditions which governed them for so long. Much larger demands are needed to keep all plants at capacity production, and increased forward buying would be a welcome sign of a continuance of the revival in trade.

The engineering and speciality foundries are maintaining a steady rate of employment. The motor and allied trades, machine-tool makers, collieries, steelworks, and electrical trades are utilizing good quantities of castings, the production of which is absorbing current makers of the low- and medium-phosphorus irons and hematite. There is very little to spare after current needs have been satisfied and most of these foundries could take up larger tonnages. Present deliveries barely cover requirements and anxiety is felt because of the absence of stocks at furnaces and foundries. The call for refined irons has shown some improvement.

The heavier grades of cast-iron scrap are readily taken up, and the improved conditions at the light foundries have increased the demand for light scrap. Deliveries of foundry and furnace cokes are satisfactory. These are now supplied against the winter schedule, which makes provision for current consumption requirements and for three weeks' stock at the end of April next. Ganister, limestone, and firebricks are in adequate supply.

The re-rollers continue as the most depressed section of the iron and steel industry. Their production is confined almost entirely to the home trade, whose demands for small sections, bars, and strip, although on a fair scale, do not provide sufficient work to keep the mills in full production. There is little difficulty in obtaining the required tonnages of steel semis, including billets, blooms and slabs, to cover requirements.

While output of heavy sections and joists continues to be maintained at a high level, makers are finding that the tonnage of new specifications received is not equivalent to the daily volume of despatches, the exception being plates, demand for which is still very heavy. Sheetmakers are very busy indeed.

Non-ferrous Metals

Last week proved to be a bad one for holders of metals, for, with the exception of tin, losses were registered in all directions. Experienced observers of the market have for some time past been apprehensive that the rise was being overdone and copper seems to have touched off the downward slide on the Metal Exchange. Even though the negotiations between Chile and the United States have been suspended, discussions are going on in Santiago and a certain amount of news has been coming out day by day. The issues are somewhat confused, but, on the whole, it seems as though the Chilean copper lying inside the United States, said to be about 120,000 short tons, will be purchased by Washington, possibly at 30 cents per lb. Although there is no reason to anticipate that Chile intends to unload copper on the London market, buyers of cash showed themselves rather reluctant last week and, in consequence, the price fell by £5 per ton to £234. Three months, however, declined by no more than £2 10s. and the backwardation narrowed to £8 10s., which was the smallest gap between the two quotations seen since the market opened. In the United States the price remained at 30 cents, at which level a fair business is going through. In zinc there was an unusually large turnover, especially during the second half of the week, but prices fell away to close slightly above the lowest, but, nevertheless, £3 15s. down for November and £2 10s. lower for February. A satisfactory feature was the disappearance of the backwardation, which was replaced by a contango of 5s. In New York the quotation remained at 10 cents.

Lead, too, showed an easier tendency, closing £3 5s. lower for the current month, but only £1 down for the forward position. Accordingly the backwardation came in to £1 15s., which is the smallest seen for some time past and one may reasonably hope that it will run off altogether. Tin was again quite active and consumers have been buying. The close at £655 for cash was £5 up on the previous Friday, while three months at £642 10s. was £12 10s. higher. Here again there was a contraction in the premium for the cash price to £12 10s. which compared with £20 a week earlier. No special news has come through from Geneva where the conference is in progress, but it would appear there are some hopes that a restriction scheme may be evolved. The scrap market has eased off somewhat, but prices are still very high in comparison with new metals and a further fall is bound to occur probably before long.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* November 26, £235 10s. to £236; November 27, £234 to £234 10s.; November 30, £232 to £233; December 1, £230 to £231 10s.; December 2, £230 to £231.

Three Months: November 26, £225 5s. to £225 10s.; November 27, £224 15s. to £225; November 30, £223 10s. to £224; December 1, £222 to £222 10s.; December 2, £222 to £222 5s.

TIN, Standard—*Cash:* November 26, £657 10s. to £660; November 27, £655 to £656; November 30, £640 to £645; December 1, £625 to £627 10s.; December 2, £622 10s. to £627 10s.

Three Months: November 26, £647 10s. to £650; November 27, £642 10s. to £644; November 30, £627 10s. to £630; December 1, £615 to £617 10s.; December 2, £610 to £612 10s.

ZINC—*November:* November 26, £73 to £73 5s.; November 27, £71 15s. to £72 5s. *December:* November 30, £72 15s. to £72 17s. 6d.; December 1, £72 15s. to £73 5s.; December 2, £73 12s. 6d. to £73 15s.

February: November 26, £73 to £73 5s.; November 27, £72 to £72 5s. *March:* November 30, £72 15s. to £72 17s. 6d.; December 1, £72 15s. to £73 5s.; December 2, £73 10s. to £73 12s. 6d.

LEAD—*November:* November 26, £92 10s. to £93; November 27, £90 15s. to £91. *December:* November 30, £90 to £90 5s.; December 1, £90 to £90 2s. 6d.; December 2, £90 to £90 2s. 6d.

February: November 26, £90 to £90 5s.; November 27, £89 5s. to £89 10s. *March:* November 30, £88 10s. to £88 15s.; December 1, £88 to £88 5s.; December 2, £88 10s. to £88 15s.

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

(Delivered unless otherwise stated)

December 2, 1953

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £13 18s. 0d.; Birmingham, £13 11s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £16 14s. 6d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £17 0s. 3d.

Scotch Iron.—No. 3 foundry, £16 11s. 0d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £18 3s. 0d.; South Zone, £18 5s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £19 3s. 0d.; South Zone, £19 5s. 6d.

Hematite.—Si up to 2½ per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. Coast and N.-W. Coast of England, £16 12s. 0d.; Scotland (Scotch iron), £16 18s. 6d.; Sheffield, £17 13s. 0d.; Birmingham, £17 19s. 6d.; Wales (Welsh iron), £16 18s. 6d.

Basic Pig-iron.—£14 6s. 6d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered).

Ferro-silicon (6-ton lots).—40/55 per cent., £53 10s. 0d., basis 45 per cent. Si, scale 21s. 6d. per unit; 70/84 per cent., £82 10s. 0d., basis 75 per cent. Si, scale 23s. per unit.

Ferro-vanadium.—50/60 per cent., 23s. 8d. to 25s. 0d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 10s. 0d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £165 0s. 0d. to £181 0s. 0d. per ton; 38/40 per cent., £229 0s. 0d. to £235 0s. 0d. per ton.

Ferro-tungsten.—80/85 per cent., 14s. 6d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 17s. 6d. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent. C, £85 4s. 0d., basis 60 per cent. Cr, scale 28s. 3d. per unit; 6/8 per cent. C, £80 17s. 0d., basis 60 per cent. Cr, scale 26s. 9d. per unit; max. 2 per cent. C, 2s. 0½d. per lb. Cr; max. 1 per cent. C, 2s. 1d. per lb. Cr; max. 0.15 per cent. C, 2s. 2d. per lb. Cr; max. 0.10 per cent. C, 2s. 2½d. per lb. Cr; max. 0.06 per cent. C, 2s. 2½d. per lb. Cr.

Cobalt.—98/99 per cent., 20s. 0d. per lb.

Metallic Chromium.—98/99 per cent., 6s. 3d. to 6s. 9d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £225 0s. 0d. to £232 0s. 0d. per ton; 96/98 per cent., £255 0s. 0d. to £262 0s. 0d. per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 40s. 0d. to 70s. 0d. per lb., Nb + Ta.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 12s. 6d.: tested, 0.08 to 0.25 per cent. C (100-ton lots), £26 2s. 6d.; hard (0.42 to 0.60 per cent. C), £28 0s. 0d.; silico-manganese, £33 16s. 0d.; free-cutting, £28 16s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £32 12s. 0d.; case-hardening, £33 0s. 0d.; silico-manganese, £34 17s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic soft up to 0.25 per cent. C, £29 16s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £30 16s. 0d.; acid, up to 0.25 per cent. C, £33 0s. 0d.

Sheet and Tinplate Bars.—£25 11s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £30 6s. 6d.; boiler plates (N.-E. Coast), £31 14s. 0d.; floor plates (N.-E. Coast), £31 15s. 6d.; heavy joists, sections, and bars (angle basis), N.-E. Coast, £28 9s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £32 4s. 6d.; flats, 5 in. wide and under, £32 4s. 6d.; hoop and strip, £32 19s. 6d.; black sheets, 17/20 g., £41 6s. 0d.; galvanized corrugated sheets, 24 g., £49 19s. 6d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £51 14s. 3d.; nickel-chrome, £73 3s. 6d.; nickel-chrome-molybdenum, £80 18s. 3d.

Tinplates.—57s. 9d. per basis box.

NON-FERROUS METALS

Copper.—Cash, £230 0s. 0d. to £231 0s. 0d.; three months, £222 0s. 0d. to £222 5s. 0d.; settlement, £231 0s. 0d.

Tin.—Cash, £622 10s. 0d. to £627 10s. 0d.; three months, £610 0s. 0d. to £612 10s. 0d.; settlement, £625 0s. 0d.

Zinc.—December, £73 12s. 6d. to £73 15s. 0d.; March; £73 10s. 0d. to £73 12s. 6d.

Refined Pig-lead.—December, £90 0s. 0d. to £90 2s. 6d., March, £88 10s. 0d. to £88 15s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £101 7s. 6d.; rolled zinc (boiler plates), all English destinations, £99 2s. 6d.; zinc oxide (Red Seal), d/d buyers premises, £90 0s. 0d.

Other Metals.—Aluminium, ingots, £150 0s. 0d.; magnesium, ingots, 2s. 10½d. per lb.; antimony, English, 99 per cent., £210 0s. 0d.; quicksilver, ex warehouse, £61 15s. 0d.; nickel, £483 0s. 0d.

Brass.—Solid-drawn tubes, 22½d. per lb.; rods, drawn, 32½d.; sheets to 10 w.g., 249s. 3d. per cwt.; wire, 30d.; rolled metal, 236s. 0d. per cwt.

Copper Tubes, etc.—Solid-drawn tubes, 27⅝d. per lb.; wire, 265s. 6d per cwt. basis; 20 s.w.g., 294s. 6d. per cwt.

Gunmetal Ingots.—R.C.H. 3/4 per cent tin, £192 0s. 0d, to £197 0s. 0d.; BS. 1400—LG2 (85/5/5/5), £197 0s. 0d.. to £202 0s. 0d.; BS. 1400—LG3 (86/7/5/2), £206 0s. 0d., to £211 0s. 0d.; BS 1400—G1 (88/10/2/½), £261 0s. 0d. to £266; BS. 1400—Gl (88/10/2/1), £255 0s. 0d. to £257 0s. 0d. per ton.

Phosphor-bronze Ingots.—BS. 1400—P.Bl, guaranteed A.I.D. released, £280 0s. 0d. to £285 0s. 0d. per ton.

Brass Ingots.—BS. 1400—B3, £167 0s. 0d. to £172 0s. 0d.; BS. 249, £184 0s. 0d. to £189 0s. 0d., per ton.

Phosphor Bronze.—Strip, 352s. 6d. per cwt.; sheets to 10 w.g., 374s. 3d. per cwt.; wire, 44⅜d. per lb.; rods, 39d.; tubes, 37d.; chill cast bars: solids 41d., cored 42d. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × .056, 3s. 0¾d. per lb.; round wire, 10g., in. coils (10 per cent.), 3s. 6d.; special quality turning rod, 10 per cent.; ½ in. dia., in straight lengths, 3s. 5d. All prices are net.

Parliamentary

The second reading of the Industrial Diseases (Benefit) Bill, which extends the provisions of the Pneumoconiosis and Byssinosis Benefit Act, 1951, to cases of partial disablement, was moved by MR. OSBERT PEAKE, Minister of Pensions and National Insurance, in the House of Commons last week. A large number of persons, he said, had failed to get compensation either under the Workmen's Compensation Acts or the Industrial Injuries Scheme. The reason for this was two-fold. Many of them had contracted pneumoconiosis before it was covered under the Workmen's Compensation Acts, and others leaving the prescribed industries had failed to prove they were disabled within the time limit laid down. These men had been described as the forgotten men of industry.

Experience with the 1951 Act, the Minister declared, had now led them to believe that 15,000 cases were likely to succeed under the Bill. They proposed a flat rate of payment equal to one half of the rate payable under the 1951 Act for total disablement. It would apply to all classes of partial incapacity of a degree sufficient to attract a continuing payment under the old Workmen's Compensation Acts.

It was estimated that in a full year the charge imposed on the industrial injuries fund would be £750,000 for pneumoconiosis patients and about £50,000 to £60,000 for other diseases. The full amount would be about £1,500,000 a year, which would tend to diminish annually. The Bill would do something to remedy a justifiable and longstanding grievance, and would provide some additional income where the wage earner had lost in industry the physical capacity to enjoy life and to support his family. It would also give some recognition of the misfortunes these men had suffered and an assurance that if their condition deteriorated they and their families would be entitled to a larger measure of security than they had enjoyed hitherto.

A call for the adoption of even more vigorous measures against industrial diseases was made by MR. LEATHER (Con.), who said he hoped the Minister would put pressure on the Ministry of Fuel and Power to intensify research into the prevention of diseases. MR. FORT (Con.) asked the Minister to give information about the progress of research work into the causes of pneumoconiosis and byssinosis.

Prevention of Disease

The view that it was not only the duty of Parliament to look after those who were broken in industry, but also to take all reasonable steps to prevent industrial accidents happening, was put forward by MR. NABARRO (Con.). Far too much time was spent in legislating against effect, he said, and far too little legislating against cause. The present Bill would be valueless unless there were complementary measures to prevent dust in mines and other places in industry where the dangers of pneumoconiosis and byssinosis arose.

The hope that measures would be introduced to include men in occupations not directly associated with the mining industry where pneumoconiosis could arise was voiced by MR. FINCH (Lab.). This was echoed by DR. STROSS (Lab.), who said that comprehensive cover was wanted to ensure that every human being was safeguarded in some way if he was rendered ill or crippled by his occupation. He hoped that the provisions of the Bill would only cost £800,000, but would not be surprised if the cost in the first year was £1,250,000 or £1,500,000. It was, however, an expenditure that would decline over the years.

The Government was asked by MR. WIGG (Lab.) to ensure that the provisions of the Bill received wide publicity and to consider making retrospective compensation to women whose husbands had died from either of the two diseases. Satisfaction that the Bill ended the system of time limits in workmen's compensation legislation was expressed by MR. BERNARD TAYLOR (Lab.).

MR. TURTON, Parliamentary Secretary to the Ministry of Pensions and National Insurance, said that one reason why there had been a period of two years between the two Bills was the desire not to swamp the medical boards. Cases being dealt with by panels had dropped from 250 a week to 50, so it appeared that the new measure could be introduced without overloading the panels. Even so, there was a certain amount of danger in that direction.

Research into pneumoconiosis was being undertaken at the Welsh National School of Medicine and at the universities of Edinburgh, Durham, Sheffield, and London, and also by the Pneumoconiosis Research Unit under the auspices of the Medical Research Council. There were two mobile research units, one of which would be based at Cardiff and the other at Edinburgh. Byssinosis research was being undertaken at Manchester University.

The Bill was read a second time and the money resolution agreed to in committee.

Russian Manganese

In reply to MR. HAROLD DAVIES, the PRESIDENT OF THE BOARD OF TRADE said that there were no imports of manganese ore or metal from Russia from January 1, 1946, to September 30, 1953, and no import licences had been issued for manganese metal this year. Manganese ore could be imported freely under open general licence and no application to his department for permission to import was required.

Nickel-bearing Scrap Exports

No export licences had been granted for nickel-bearing scrap (including stainless-steel scrap) unless his department had been satisfied that the material was unsuitable for use in the United Kingdom and no purchaser could be found for it, said MR. PETER THORNEYCROFT.

MR. MAUDLING, Economic Secretary to the Treasury, assured Mr. G. Williams that the Capital Issues Committee performed an essential function in advising on individual applications for consent to raise money for capital purposes. The Chancellor of the Exchequer had no intention of dispensing with its services.

IN A WRITTEN ANSWER the Minster of Supply stated that certain stocks of ferro-alloys held for the Ministry by the British Iron and Steel Corporation were insured. The insurance, which covered fire, explosion, flood, storm, and tempest, was placed commercially by the Corporation through insurance brokers. It would not be practicable to exclude that part of the stocks which was owned by the Government from the Corporation's general insurance cover.

ASKED BY Miss Burton whether he was aware that the work done by the British Standards Institution was suffering because of the lack of funds available for a suitable publicity campaign and if he would consider the possibility of a larger grant for this purpose, the President of the Board of Trade said they were at present considering the future grant-in-aid to the Institution and this review would cover the question of publicity.

ANNOUNCING

THE BRITISH MASTER PATTERNMAKERS ASSOCIATION

This Union, which is non-profit-making has, as one of its principal objects, the regulation of relations between employers and employees. Amongst its other objects is standardisation of pattern equipment and castings and all matters appertaining to patternmaking.

This Association will be known as the "National" body and will protect the interests of its members. All firms who employ bona fide pattern-makers are eligible for membership and are advised to communicate for further particulars with :—

The Secretary: The British Master Patternmakers Association, 54 Wheeleys Road, Edgbaston, Birmingham 15

Pig-iron and Steel Production

Statistical Summary of September Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation for September. Table I summarizes activity during the six months' period. Table II gives production of steel ingots and castings in September and Table III, deliveries of finished steel in the same month. Table IV gives the production of pig-iron and ferro-alloys in September, and furnaces in blast. (All figures weekly averages in thousands of tons.)

TABLE I.—*General Summary of Pig-iron and Steel Production.*

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (all qualities). Imports.[1]	Output of ingots and castings.	Deliveries of finished steel.	Stocks.[2]
1951	284	170	206	186	175	8	301	244	585
1952[3]	306	190	228	202	171	29	310	252	739
1953—April	319	189	242	213	189	20	349	270	868
May	319	198	243	215	190	19	351	263	902
June[4]	301	202	238	211	188	14	338	263	914
July	281	197	229	202	153	19	277	223	958
August	273	203	226	204	159	19	291	211	1,046
September[4] ..	292	215	232	214	196	14	347	—	1,012

TABLE II.—*Production of Steel Ingots and Castings in September*, 1953.

District.	Open-hearth. Acid.	Open-hearth. Basic.	Bessemer.	Electric.	All other.	Total. Ingots.	Total. Castings.	Total ingots and castings.
Derby, Leics., Notts., Northants and Essex ..	—	4.0	6.1 (basic)	1.8	0.2	11.1	1.0	12.1
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire	1.5	26.0	—	1.8	0.6	28.6	1.3	29.9
Yorkshire (excl. N.E. Coast and Sheffield) ..								
Lincolnshire	—	36.2	—	—	0.2	36.2	0.2	36.4
North-East Coast	2.4	61.1	—	1.3	0.6	63.4	2.0	65.4
Scotland	3.5	39.5	—	1.7	0.8	43.5	2.0	45.5
Staffs., Shrops., Worcs. and Warwick	—	17.4	—	1.1	0.7	17.4	1.8	19.2
S. Wales and Monmouthshire	4.6	67.7	6.1 (basic)	1.1	0.1	78.9	0.7	79.6
Sheffield (incl. small quantity in Manchester) ..	10.3	29.8	—	0.6	0.6	48.1	2.2	50.3
North-West Coast	0.6	1.3	5.6 (acid)	0.5	0.1	8.0	0.1	8.1
Total	22.9	283.0	17.8	18.9	3.9	335.2	11.3	346.5[4]
August, 1953	14.9	242.3	17.0	14.4	2.8	282.6	8.8	291.4
September, 1952	25.8	259.1	21.8	19.4	3.7	318.3	11.5	329.8

TABLE III.—*Deliveries of New Non-alloy and Alloy Finished Steel.*

Product.	1951.	1952.[3]	1952. August.	1953. July.	1953. August.
Non-alloy steel :					
Ingots, blooms, billets and slabs[5]	4.0	4.5	4.5	3.8	4.1
Heavy rails, sleepers, etc.	10.1	9.8	7.9	10.3	8.2
Plates ¼ in. thick and over ..	41.0	41.4	34.9	42.6	34.0
Other heavy prod.	39.9	39.0	37.5	32.5	37.9
Light rolled sections and bars ..	46.7	46.0	39.3	39.8	42.3
Wire rods	15.9	15.9	16.1	9.6	13.2
Bright steel bars ..	6.5	6.5	4.9	6.1	5.3
Hot-rolled strip ..	19.5	18.8	15.8	15.2	14.1
Cold-rolled strip ..	6.0	6.1	4.9	3.8	4.2
Sheets, coated and uncoated ..	30.4	31.6	25.4	28.9	27.2
Tinplate, terne-plate & blackplate	13.8	16.0	12.1	13.9	11.3
Steel tubes and pipes	20.3	20.1	15.2	18.4	16.7
Tube and pipe fittings	0.5	0.4	0.3	0.3	0.3
Mild wire	11.6	12.2	11.5	8.2	8.5
Hard wire ..	3.5	3.6	3.2	2.9	3.1
Tyres, wheels and axles	3.7	3.5	2.5	3.9	3.5
Forgings (excluding drop forgings) ..	2.3	2.8	2.7	2.7	2.6
Steel castings ..	3.8	4.2	3.9	4.0	3.0
Tool and magnet steel	[6]	0.3	0.3	0.3	0.2
Total	279.5	282.7	242.9	247.2	239.7
Alloy steel	11.4	13.7	11.4	12.2	11.0
Total deliveries from U.K. prod.[6] ..	290.9	296.4	254.3	259.4	250.7
Add : Imported finished steel ..	5.8	13.8	12.0	4.6	5.0
	296.7	310.2	266.3	264.0	255.7
Deduct : Intra-industry conversion[7] ..	55.0	60.2	55.9	42.9	46.0
Total net deliveries ..	241.7	250.0	210.4	221.1	209.7

TABLE IV.—*Production of Pig-iron and Ferro-alloys during September*, 1953.

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total
Derby, Leics., Notts., Northants and Essex	26	—	18.5	22.0	1.1	—	41.6
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire ..	8	—	15.4	—	—	1.7	17.1
Yorkshire (incl. Sheffield, excl. N.E. Coast) ..							
Lincolnshire ..	12	—	28.8	—	—	—	28.8
North-East Coast	24	4.4	45.5	—	—	1.3	51.2
Scotland	9	0.8	13.5	2.4	—	—	16.7
Staffs., Shrops., Worcs., and Warwick ..	9	—	8.3	1.7	—	—	10.0
S. Wales and Monmouthshire	8	5.2	25.4	—	—	—	30.6
North-West Coast	8	16.2	—	0.1	—	1.6	17.9
Total ..	104	26.6	155.4	26.2	1.1	4.6	213.9
August, 1953 ..	105	25.2	150.8	23.4	1.2	3.8	204.4
September, 1952	103	26.6	148.2	28.3	2.1	3.4	208.6

[1] Weekly average of calendar month.

[2] Stocks at the end of the years and months shown.

[3] Average 53 weeks ended January 3, 1953.

[4] Five weeks all tables.

[5] Other than for conversion into any form of finished steel listed above.

[6] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.

[7] Material for conversion into other products also listed in this table.

[6] Included with alloy steel.

Forthcoming Events

DECEMBER 7

Beeston Boiler Foremen's Association

"Introducing Nottingham and District," by B. Twelvetrees, 7.30 p.m., in the canteen, Beeston Boiler Company, Limited, Mona Street, Beeston, Notts.

Institute of British Foundrymen

Sheffield branch:—"Shell Moulding," by J. Fallows, 7.30 p.m., in the Sheffield College of Commerce and Technology, Department of Engineering, Pond Street. Joint meeting with the Sheffield Society of Engineers and Metallurgists.

Royal Society of Arts

Cantor Lecture, "Alloys," III:—"Alloys for Resistance to Creep and Corrosion-Resistant Alloys and General Conclusions," by G. L. Bailey, 6 p.m., John Adam Street, Adelphi, London, W.C.2.

DECEMBER 8

Institute of British Foundrymen

Slough section:—"Sands," by A. P. Lovat, 7.30 p.m., in the Lecture Theatre, High Duty Alloys Limited, Slough.

Institution of Works Managers

Birmingham branch:—"Industrial Relations," by F. E. Everard, 7 p.m. in the Grand Hotel.

East Midlands Metallurgical Society

"Powder Metallurgy," by L. Harrison, Ph.D., 7.30 p.m. in the Nottingham and District Technical College, Shakespeare Street, Nottingham.

Incorporated Plant Engineers

Manchester branch:—"Use and Application of Mobile Paint," by J. L. Sturrock, 7.15 p.m., in the Engineers' Club, Albert Square.

DECEMBER 9

East Midlands branch:—"Failure of Metals," by Professor J. A. Pope, 7 p.m., in the Demonstration Theatre, East Midlands Gas Board Showrooms, Parliament Street, Nottingham.

Institute of British Foundrymen

West Riding of Yorkshire branch:—"Graphitization of Cast Iron," by H. Morrogh, 7.30 p.m., at the Technical College, Bradford.

Institute of Fuel

Midland section:—"Smoke Abatement," by G. W. Farquharson, 6.30 p.m., at the Imperial Hotel, Temple Street, Birmingham.

Manchester Metallurgical Society

Discussion:—"Temperature Measurement and Control," 6.30 p.m., in the Lecture Room, Central Library, Manchester.

DECEMBER 10

Institute of British Foundrymen

Birmingham Students' section:—"Examples of light-alloy Founding," by E. Raybould, 7.15 p.m., at the Chance Technical College, Smethwick.

Lincolnshire branch:—"An Evening with Electricity," by T. E. Hartley, 7.15 p.m., Lincoln Technical College, Lincoln.

Institution of Production Engineers

Coventry section:—"Recent Developments in Labour Incentive Systems," by N. A. Dudley, 7 p.m., in the Geisha Café, Hertford Road, Coventry.

Institution of Works Managers

Doncaster branch:—"Cost Control," by K. J. Lomas, 7 p.m., in Danum Hotel, Doncaster.

Liverpool Metallurgical Society

"Bearings and Bearing Alloys," by P. T. Holligan, 7 p.m., Liverpool Engineering Society, The Temple, Dale Street.

DECEMBER 11

North-east Metallurgical Society

"Steels and other Alloys for High-temperature Applications," 7.15 p.m., Cleveland Scientific and Technical Institution, Middlesbrough.

Institute of British Foundrymen

Tees-side branch:—"How to Make It," by P. Pennington, D. Atkinson and T. Wolverson, 7.30 p.m., at Head, Wrightson and Company, Limited, Teesdale Iron Works, Thornaby-on-Tees.

DECEMBER 12

Bristol and West of England branch:—"Progress in British Ironfounding," by W. W. Braidwood, 3 p.m., at the Grand Hotel, Bristol.

East Midlands branch:—"Examples of Moulding Technique," by H. B. Farmer, 6 p.m., at the College of Arts, Derby.

Newcastle branch:—"Production of Diesel-engine Castings in Grey Irons," by J. R. Charlton, 6 p.m., at the Neville Hall, Westgate Road, Newcastle-upon-Tyne.

Scottish branch:—"Technical Problems in the Production of Non-ferrous Valves and Plumbing Fittings," by E. C. Mantle, 3 p.m. at the Royal Technical College, George Street, Glasgow.

NOTICE

Replies to Box Numbers to be addressed to "Foundry Trade Journal," 49, Wellington Street, London, W.C.2.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

REPRESENTATIVE required by well-known Non-ferrous Foundry in Midlands for sale of Bronze and Aluminium Castings, in London area, on commission and expenses basis.—Give details of experience, etc., to Box 3897, FOUNDRY TRADE JOURNAL.

METAL STORES CONTROL.—Man required by Merseyside Non-ferrous Founders to develop and take charge of comprehensive control system. Costing background preferred, with some foundry and metallurgical experience. Salary: £550-£650, according to qualifications. Good pension scheme.—Apply, giving full details, to Box 3891, FOUNDRY TRADE JOURNAL.

WANTED. Experienced Moulder for Aluminium castings, in Devon. A.I.D. Standard. Capable of taking charge of small shop. S/C Flat available to suitable applicant. Full details of experience, etc.—Box 3894, FOUNDRY TRADE JOURNAL.

METALLURGIST required for large Engineering Works in the Lancashire area. Experience desirable in Iron Foundry Control. Carrying out of Mechanical and Analytical tests of materials, and control of Heat Treatment Plant.—Write, stating age, experience, and salary required, to Box 3923, FOUNDRY TRADE JOURNAL.

GRAVITY Die Casting FOUNDRY MANAGER required. Capable of handling all aspects of production and die design. Duties would also include sales promotion. Foundry in Lancs. Good salary offered for right man.—Full particulars, please, to Box 3884, FOUNDRY TRADE JOURNAL.

STEEL FOUNDRY requires Sales Engineer for North Western Counties. Essential qualifications are (1) Selling experience (2) Knowledge of Foundry processes (3) Engineering background. This is a full time staff appointment and a car will be provided; agents and part time representatives, as such, are not required. Letters only to The Sales Manager, CATTON & Co., LTD., Leeds, 10, giving information on career to date, age, health and salary envisaged.

WANTED.—CHIEF METALLURGIST, to take complete charge of well-equipped Metallurgical Laboratory in progressive Steel, Iron and Roll Foundry. Experience in manufacture of Chilled and other special Rolls will be an advantage. Salary according to experience and qualifications. Pension scheme in operation.—Apply GLANMOR FOUNDRY CO., LTD., Llanelly, S. Wales.

SITUATIONS VACANT—*contd.*

DRAUGHTSMEN required, preferably with experience of Gravity Dies, Pressure Dies or Plastic Moulds.—Apply JOHN DALE, LTD., London Colney, Herts.

WANTED.—Loose Pattern Moulders, for small firm of Iron and Non-ferrous Founders in Lincolnshire. Good wages and regular employment for the right men.—Box 3925, FOUNDRY TRADE JOURNAL.

METALLURGIST required for Steel Foundry in Sheffield district, operating High Frequency furnaces. Knowledge of analysis, sand testing heat treatment, and high frequency furnace melting practice essential.—Write, stating salary, experience, to Box 3927, FOUNDRY TRADE JOURNAL.

FOUNDRY SUPERINTENDENT, with all-round production experience, used to operating mechanised moulding unit. Fully conversant with both grey iron and alloy iron automotive castings of all descriptions. Must have a thorough knowledge of core-making as well as light and heavy moulding, also cupola practice. Present daily melt 60 tons. First-class conditions, offering permanent position, superannuated. Foundry situate North Midlands.—Box 3916, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN required in Bradford area (housing not available) by old-established firm producing high grade General Engineering Machine Tool and Hydraulic Castings from small repetition and jobbing to large in green, dry and loam up to 25 tons. Applicant must be first-class man, with extensive practical experience, knowledge of cupola control, and able to handle labour. Technical, commercial or sales experience would be an advantage. This situation is to give general assistance to our Foundry Manager with a view to taking over that position in due course if satisfactory.—Write, stating age, experience, and salary required, to Box 3917, FOUNDRY TRADE JOURNAL.

ASSISTANT WORKS MANAGER required for well-known cooker factory in Midlands. Applicants must be about 30 years of age, and have foundry, vitreous enamelling, machine shop experience. State training, experience, and salary required to Box 3919, FOUNDRY TRADE JOURNAL.

CHEMIST or METALLURGIST required for Non-ferrous (Brass, Gunmetal, Bronze) Secondary Metal and Refining Works, to take complete charge of their chemical and spectrographic laboratory, and to develop the metallurgical department both physical and metallographic. Only applicants having the requisite experience and qualifications will be considered. Please supply full details of experience, qualifications, salary required, etc. Present staff are aware of this vacancy.—Box 3920, FOUNDRY TRADE JOURNAL.

METALLURGIST required by Midland Iron Foundry (Stourbridge area) melting approximately 10 tons per day. Mainly jobbing, but some repetition Grey Iron and High Duty Castings.—Box 3921, FOUNDRY TRADE JOURNAL.

FIRST-CLASS MOULDERS, used to Machine Tool castings, and having served apprenticeship, wanted for Machine Tool Foundry in provincial town in North Wales (castings up to 5 tons). Good rates of pay, plus bonus. Houses available for suitable applicants.—Write Box 3922, FOUNDRY TRADE JOURNAL.

PATENT

THE Proprietor of Patent No. 644465, for "Process of Case-Hardening Metals and their Alloys," desires to secure commercial exploitation by licence or otherwise in the United Kingdom.—Replies to HASELTINE, LAKE & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

MACHINERY WANTED

WANTED—Laboratory Sand Mill or Mixer with 5 to 10 lb. capacity. Apply: The Purchasing Department, Parkinson Stove Co. Ltd., Stechford, Birmingham, 9.

REQUIRED, to purchase, by Belgian metallurgical works: Secondhand High Frequency Electric Furnace for steel melting; minimum capacity 880 lbs.—Full particulars to Box 3888, FOUNDRY TRADE JOURNAL.

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WANTED.—Secondhand Rotary Dryer, for sand or swarf. Capacity ½ to 1 ton per hour. Oil or coke fired.—Box 3928, FOUNDRY TRADE JOURNAL.

WANTED.—Drop Bottom Cupola. 3 ft. 6 in. dia. inside shell. 17 ft. from floor to bottom of charging hole. Spark Arrester, Fans and Motor, 400 volts, 3-phase, 50 cycles.—Box 3926, FOUNDRY TRADE JOURNAL.

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SHOTBLAST Machine, Airless Rotary Barrel. 5-cwt. cap. Impeller projected abrasive.

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MACHINERY FOR SALE—*contd.*

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ONE only Mercury Arc Rectifier. 400/440 volts, 3-phase, 50 cycles, with full equipment for operation of above machines.

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NEW Centre Axis Tilting Furnace. 600 lbs. Oil-fired, with Morgan Oil Burner and new Keith Blackman A.C. Blower. £375.

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All suitable for 440/3/50 supply.

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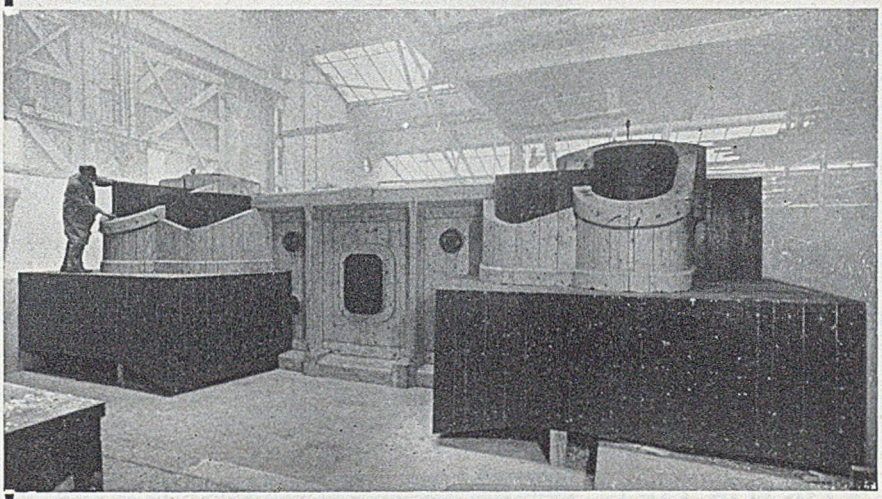

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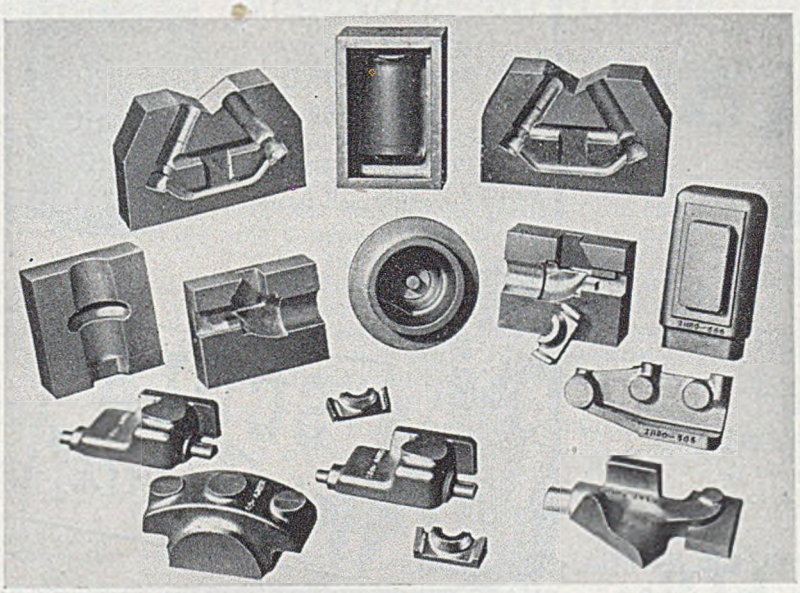

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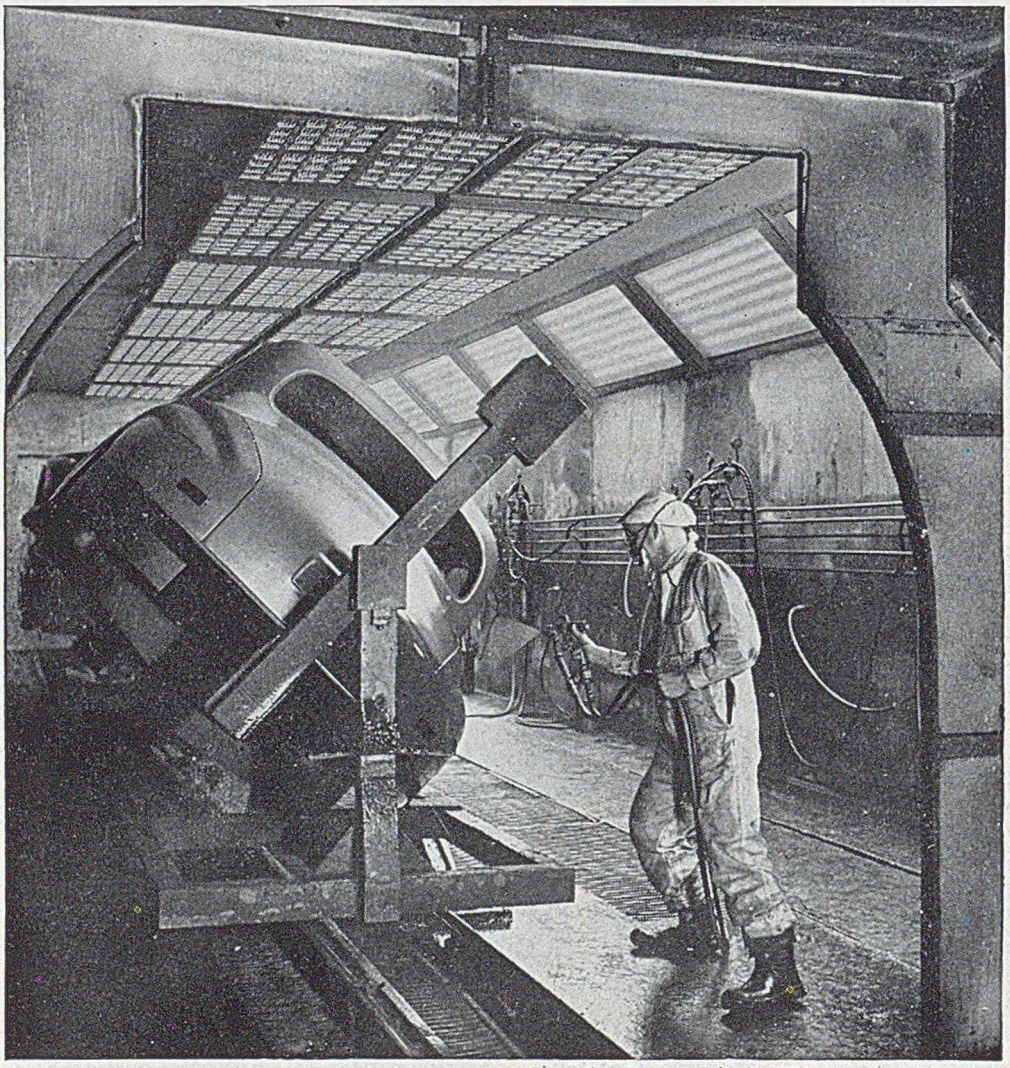

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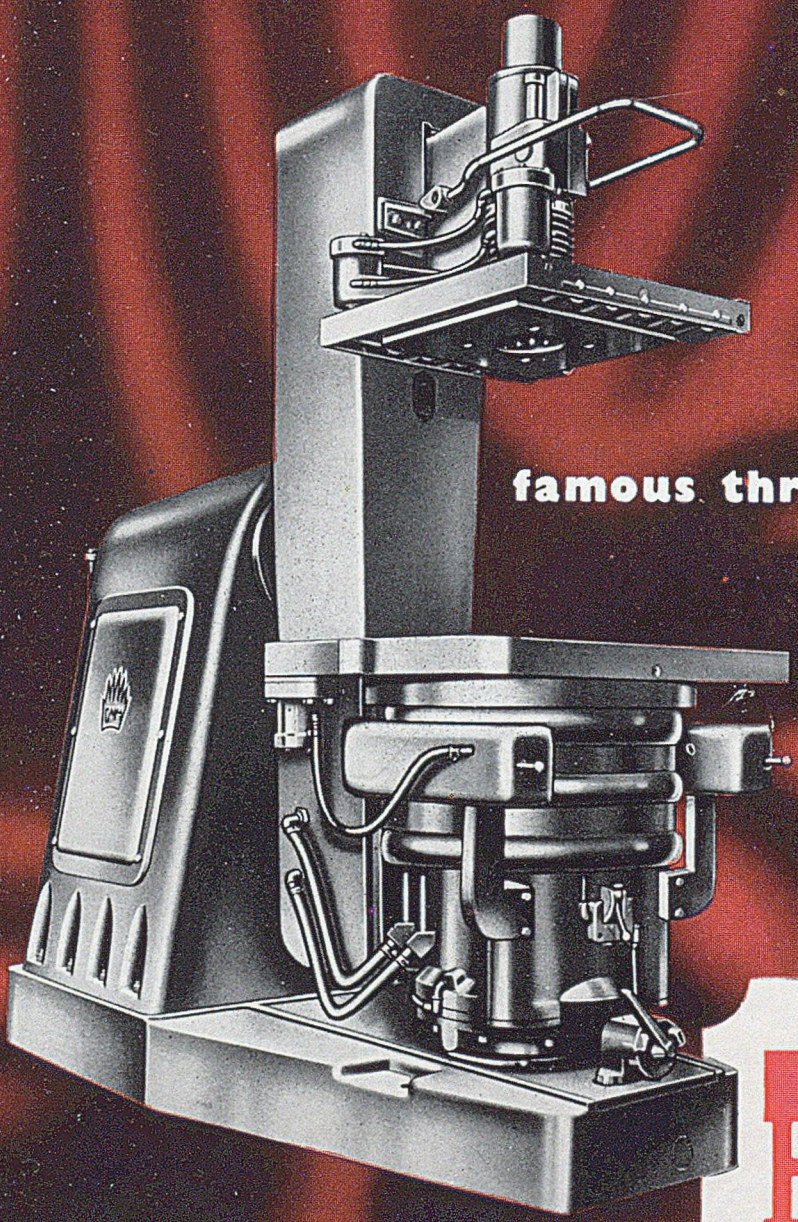

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