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PRINCIPAL CONTENTS

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Works Supporters' Clubs

There appeared in last Monday's issue of the London *Daily Telegraph* an anonymous letter on the subject of works joint consultative committees. It was a very sensible letter and stated initially that these committees, consisting as they usually do of an equal number of people drawn from the operatives and management, naturally divide themselves into two opposing camps. This results into a sort of welfare debating society, " each side playing for what it can get and such matters as efficiency and the operation of industry for the consumer's benefit are never mentioned." Now it so happens that one of the most successful schemes of which we have thorough knowledge invariably places these two problems of efficiency and the customer prominently on the agenda.

In quite a number of concerns, committees of this kind have been tried and have been unsuccessful. It is possible because of size they have been found to be unnecessary as there is a family atmosphere pervading the whole works. Yet if a consultative committee can be welded into a really co-operative body, it can be a useful adjunct in creating efficiency and provide opportunities for studying the customer's needs. When joint committees are created, it is not unusual for the inaugural meeting and perhaps quite a few of the following ones to be marred by spates of oratory from one of the shop stewards. If this period can be endured without rancour, then there is every chance of getting down to business. It is essential to get this type of individual, possessing as he does two loyalties—one to his firm and the other to his trade union, to realise that the time spent on consultative committees is purely for the good of the former. There exists a well-organised system, where loyalty to a trade union can be exercised to the full. This aspect of the committee needs emphasis, for unless membership is on the basis of promoting the interests of the firm, no satisfactory progress will be made. If a man joins the committee of a football team's supporters' club, he puts aside all other loyalties and does his best to help along his side to win the honours for which it strives.

We believe that if only employers when initiating works consultative committees (we object to the inclusions of the word " joint " as it indicates the presence of two parties) can obtain membership on this basis of loyalty to the firm, then and then only will such efforts come to fruition and play their vital part in re-establishing the industrial life of this country to the position its historical achievements demand. It would be sane to change the name of the joint consultative committee to the Jones Foundry Company's Supporters' Club.

National Foundry Craft Training Centre

Fourth-course lads at the National Foundry Craft Training Centre, West Bromwich, were presented with their qualifying and final certificates at the Centre's residential club on November 15. In order to stimulate the flow of new students to the Centre, Mr. R. B. Templeton, past-president of the Institute of British Foundrymen, has agreed to help the Council of Ironfoundry associations by calling personally on managements who have boys in their employment who would benefit by this periodic instruction. Any ironfoundry manager who would like to discuss problems pertaining to the release of boys for this training are invited to get in touch with Mr. Templeton through the secretary of the C.F.A.

More and more of the larger foundries, either collectively or individually, are employing training supervisors to teach their apprentices. The benefits of *good* training are becoming increasingly recognised, both in attracting better recruits into the trade and by cutting down the labour turnover. The small firm that cannot afford and has not the scope for a full-time teacher can still give their younger employees all-round, intensive training at the National Craft Centre.

The dates of the next five courses at the Centre are as follow:—

Term No.	Start.	Finish.	Course.
32	Nov. 26, 1951	Dec. 21, 1951	1st year
33	Dec. 31, 1951	Jan. 25, 1952	2nd year
34	Feb. 4, 1952	Feb. 29, 1952	3rd year
35	Mar. 10, 1952	April 4, 1952	4th year
36	April 16, 1952	May 9, 1952	1st year

Applications for places in these courses should be addressed to the hon. secretary of the Centre, Mr. R. Forbes Baird, 117, Church Lane, Handsworth Wood, Birmingham, 20. An illustrated booklet on the Training Centre has been prepared by arrangement with the Trustees, and a copy with the detailed syllabus can be obtained either from Mr. Baird or the secretary of the C.F.A.

Grey Ironfounding Productivity Summary

The response to the offer by the Council of Ironfoundry Associations of free supplies of the summary of the Grey Ironfounders' Productivity Team's Report has been very encouraging. Up to date, 588 firms have taken advantage of this offer by distributing a total of 56,000 copies to ironfoundry employees. Supplies are still available to any ironfoundry management wishing to distribute this booklet, which is an illustrated popular version of the Productivity Report, to foundry workpeople. Early application to the secretary, Council of Ironfoundry Associations, Crusader House, 14, Pall Mall, London, S.W.1, should be made.

"Work Saving Week" in home and industry is being celebrated this week in response to an appeal launched by Prof. J. R. Immer, M.Sc., and supported by a number of large and small concerns. Briefly, as announced earlier, it is a campaign to obviate unnecessary and wasteful movement from all sorts of operations and combines the ideals of motion study and mechanisation. Several foundries have arranged special features; among them C. & J. Hill, Limited, of Willenhall, are having an evening show in their new canteen at which three foundry films will be exhibited to employees and guests.

Conference Paper Author

Mr. N. A. Charlton

Mr. N. A. Charlton, who is the Author of the Paper "Production of Heavy Castings for Electrical Generating Equipment" printed on the opposite page, is the chief metallurgist, foundry division, of C. A. Parsons & Company, Limited, Newcastle-upon-Tyne. He received his technical training at Heaton Technical School, and Rutherford Technical College. From 1925 to 1935 he worked in the laboratories and foundries of the North Eastern Marine Engineering Company, Limited, Wallsend, and joined C. A. Parsons & Company, Limited, in 1935. He was secretary of the junior section of the Newcastle branch of the Institute of British Foundrymen before it was disbanded, and president of the Newcastle branch from 1949-50. Mr. Charlton was a member of the Ironfounders' Productivity Team which visited the United States in 1950, and he has since attended many meetings of technical bodies with a view to publicising this Report, and adding personal comments. He is chairman of Technical Sub-committee (T.S.) 37 of the Institute, formed in March, 1951, to review test specifications for cast iron. He was elected to the Institute's General Council in 1950; and has presented several Papers at branch meetings.

International Foundry Congress

Atlantic City, May 1 to 7, 1952

Provisional arrangements for the official party from the Institute of British Foundrymen to the International Foundry Congress to be held in the United States in 1952 are as follow:—Thursday, April 10, depart from Liverpool in the Britannic, arriving New York on April 18. On arrival there will be a tour of about 12 days' duration, visiting foundries in principal industrial centres. Among the cities scheduled to be visited are Buffalo, Cleveland, Chicago, Milwaukee, Washington and Philadelphia. After attending the Congress, to be held in Atlantic City from May 1 to 7, there will be a further short tour, probably visiting foundries in Pittsburgh, New York, and Boston. The official party will return from New York in the Queen Mary on May 14, arriving at Southampton on May 19. Arrangements are also being worked out for abbreviated tours for those who wish to be away for a shorter period and air transport is also being investigated.

The Congress will be one of the largest foundry assemblies ever held, and simultaneously there will be an exhibition of foundry plant and equipment. Members of the Institute who are interested are invited to communicate with the secretary.

Last Friday, Mr. W. Wilson and Mr. A. Talbot of Western Foundries addressed the Foremen's Mutual Benefit Society in Southall Technical College on the subject of founding and improvisations to cope with unusual jobbing work. In the discussion, some time was devoted to the shortage of craftsmen and means of recruitment on the theme that craftsmanship had always been Britain's mainstay in selling to the world's markets.

Production of Heavy Castings for Electrical Generating Equipment*

By N. Charlton

The history of the development of turbo-generating equipment during the last 60 years, in common with other engineering accomplishments is a story of ever increasing size and efficiency of machine. Early machines were, as would be expected, small in size, with outputs of less than 100 kw.; to-day single units generating 100,000 kw. and using steam at 850 lb. per sq. in. pressure and at a temperature of 900 deg. F. are built. Although iron castings are not used for the particular sections subjected to these high pressures and temperatures, it is apparent that where they are used, the service conditions are severe, and the foundryman is presented with the problem of producing castings capable of withstanding them.

Method of Moulding

Fig. 1 illustrates a 100,000-kw. machine in course of erection on the test bed and includes, to the left of the picture, the L.P. cylinder and exhaust sections, to which further reference will be made later. The total weight of iron castings used in the construction of a unit such as this is of the order of 190 tons. They range from small details of a few pounds in weight to the largest single item, the exhaust section, of approximately 26 tons.

The production of these large castings is, and no doubt always will be, the prerogative of the skilled artisan and involves problems which cannot be lightly set aside.

The major requirement in the castings is of course, soundness, and this apart from the many other factors involved calls for the exercise of considerable skill on the part of the producer, as the section thicknesses in any one casting may range from one to nine in. and give rise to difficult feeding problems. Various opinions as to the type of moulding best suited to the production of castings of this sort do, and no doubt always will exist, but the factors which determine the methods used in any particular foundry are probably largely influenced by the type of operative available and the facilities which exist in the foundry.

Use of Sandslinger

In the foundry with which the Author is connected, all moulds and cores for large castings are produced by loam-moulding methods. The moulding operation is assisted by the use of a Sandslinger, which is utilised for the purpose of backing up with sand the loam facing applied to the pattern. This is probably an unusual application of the Sandslinger, but it is one which in the circumstances has several factors very much in its favour.

Once the loam facing with the necessary bricks, grates and gaggers etc., in position has been built to the pattern, the Sandslinger relieves the moulders of the laborious task of ramming sand into the remaining space in the pit or box, thus releasing them for the performance of work more in keeping with their high degree of skill and productive ability.

It should be borne in mind that during this final ramming operation there is no necessity for interrupting the process for the insertion of gaggers or for packing sand under awkward protrusions on the pattern. The Sandslinger is kept in almost continuous operation servicing nine moulding pits, the

* Paper presented at the Annual Conference of the Institute of British Foundrymen, Mr. E. Longden in the Chair.

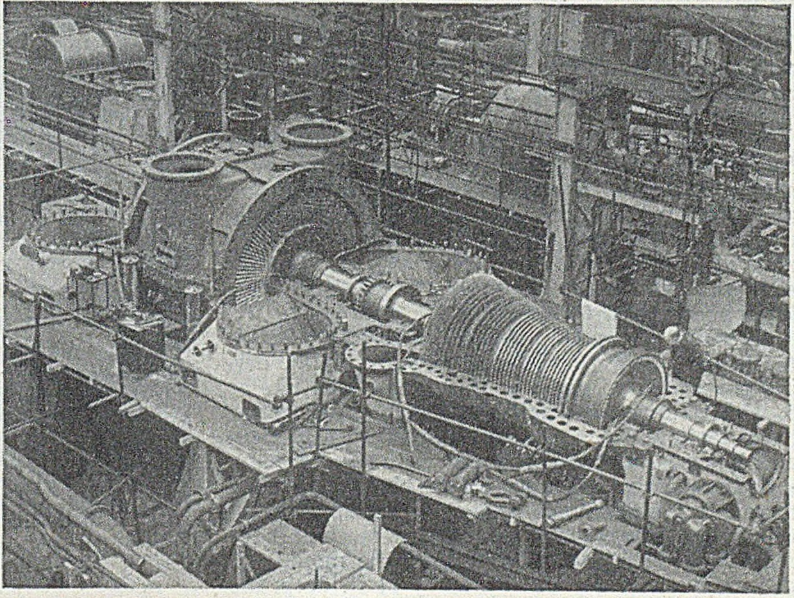


FIG. 1.—*Turbo-generator, 100,000 kw. Capacity, in Course of Erection on the Test Bed.*

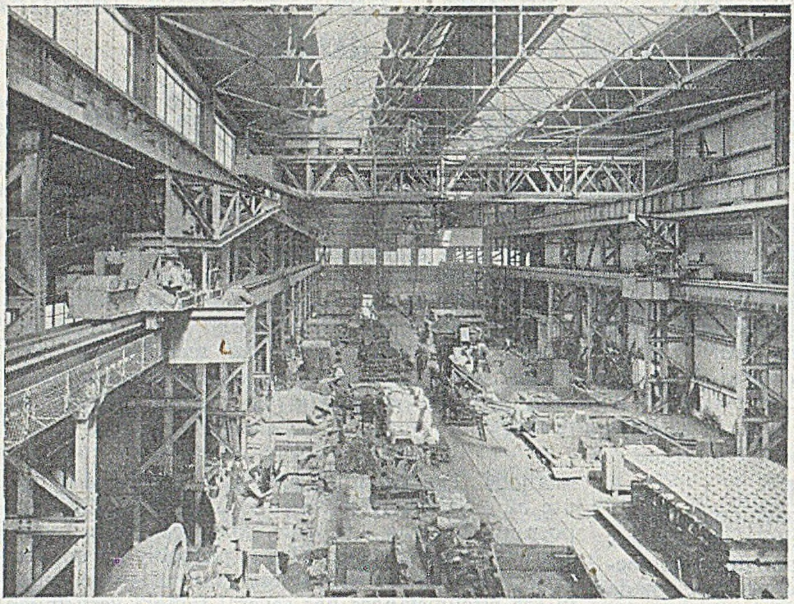


FIG. 2.—*General View of Heavy Castings Foundry utilising a Tractive-type Sandslinger along the Length of the Shop.*

largest of which is 24 by 16 by 11 ft. deep, and the sundry smaller box-moulded jobs. Fig. 2 gives a general impression of the arrangement.

Ramming operations are successfully carried out to depths of up to 14 feet below the Sandslinger head, and it is not uncommon for the machine to ram 10 tons of sand in a single uninterrupted operation. Performances such as this would be very rare, if not impossible, but for the fact that by the method of moulding used, that is, loam facing, the pattern is in many cases completely covered before ramming commences.

Pattern Equipment

The method of moulding influences the type of pattern used, and Fig. 3 is an illustration of typical equipment. In this particular instance the well-known practice of casting "two in a box" is being made use of on a large scale. Two exhaust section castings, each weighing 13 tons are being made simultaneously in one pit.

For the production of the large cores necessary for castings of this nature, equipment of the type shown in Fig. 4 is provided. Cores of this size and shape present certain difficulties in handling, and precautions must be taken to ensure that grates and lifting eyes built into them are of adequate strength and disposition to allow of their being lifted and transported safely.

In some instances provision must be made for the support of out-of-balance cores during the drying process; an example of this can be seen in Fig. 5, which illustrates a half core for the cylinder exhaust casting, Fig. 6, which weighs 25 tons 15 cwts. and is the largest yet produced in the foundry.

In the position as shown on the planing machine, this casting is from the foundry point of view, inverted, the flange shown against the machine table actually being formed in the top of the mould. It was moulded in a pit 24 by 16 by 11 ft. deep, the main feature of the mould being the number and size of drawback sections used in its construction.

Fig. 7 shows one of the largest drawback sections being placed into the mould which already contains the main bearing cores. Castings of this type are bottom-poured from two ladles, and by an arrangement of plugs in the runner basins, hot metal is introduced into the top flange just prior to the completion of pouring; Fig. 8 shows pouring in progress.

Easing

Some little time, usually 12 to 16 hrs. after pouring, the top box is removed from the mould and the centre cores are eased to guard against the risk of the casting cracking. In order to facilitate this unpleasant operation, the top portion of the centre core is built in sections in such a manner that when assembled in

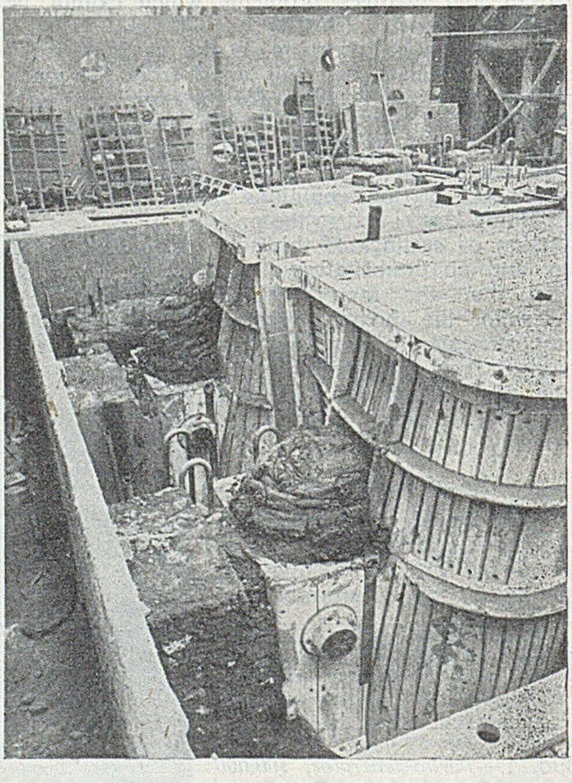


FIG. 3.—*Pattern Equipment for Cylinder Exhaust Sections, Moulded Two Side-by-side in the Same Pit.*

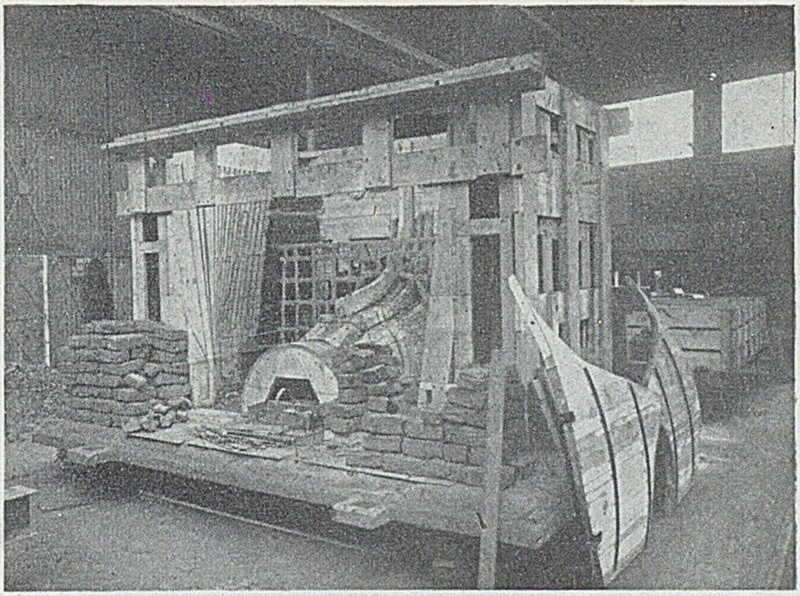


FIG. 4.—*Corebox for Cylinder Exhaust Section showing the Considerable Reinforcement required.*

the mould they form a hollow square. A cast block, provided with suitable means for rapid and easy attachment to the crane is inserted in the centre of this square and the remaining space between the cores and the block is filled with sand. The easing operation, after removal of the top box, then consists of withdrawing the block, thus releasing the top layer of cores which are readily removed by the crane. Fig. 9 shows a portion of the core framework partially assembled in the mould.

Core and Mould Drying

All moulds and cores are dried either in ovens or by portable units which are fired by town's gas. The drying ovens are operated on a recirculation system and are thermostatically controlled, the normal drying temperature used being 250 deg. C. Moulds and cores up to 20 by 15 by 8 ft. deep can be handled. Those sections of moulds which must of necessity remain in the pits are dried *in situ;* covers are placed over the pit, and unit driers arranged at the necessary points circulate hot air into the mould, the number of units used on any one mould depending of course upon its size.

Use of Chills

Fig. 10, a photograph taken on the assembly bed, shows the exhaust section already discussed, to which is attached the bottom half L.P. cylinder casting. It will be noted that a portion of the blading has been assembled in the cylinder. This blading is located in serrated grooves machined in the cylinder barrel. These grooves are cut to a depth of $1\frac{1}{2}$ to 2 in. in a section of metal $4\frac{3}{4}$ in. thick and must present a clean sound face free from risk of crumbling at the peaks of the serrations due to porosity or open grain.

In order to ensure that the casting shall be sound and free from this trouble when machined, the core forming this barrel is made with a facing of silicon-carbide blocks.* This has the effect of chilling the metal and producing a close-grained but readily machinable surface on the cylinder.

The chilling or densening effect obtained is less severe than that which would be produced by the use of metal chills, due no doubt to the fact that the thermal conductivity of silicon carbide is 0.0243, whilst that of iron is 0.12, a comparative figure for moulding sand is 0.003. This method possesses other definite advantages over metal chills in so far as that there is not the slightest risk of fusion of the surface of the chilling agent, or of blowing, as could occur with dirty or improperly-coated metal chills. Chill life is infinitely superior, and possibly the greatest factor so far as the casting in question in concerned, is that the core, if correctly constructed, can be removed in one piece from the casting and used again. The method of construction of a core of this type is simple and is illustrated in Fig. 11.

Silicon-carbide blocks, in this instance standard side-arch bricks, are built on a pronged grate, a strickle board being provided to ensure that the correct profile is obtained. The bonding material used is prepared loam similar to that used for the

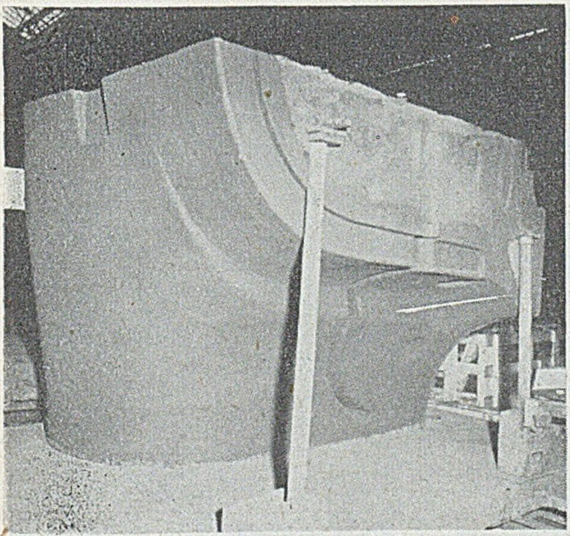


FIG. 5.—*Out-of-balance Half Core for a 100,000 kw. Turbine Exhaust Section shown in Fig. 6.*

* Process covered by British Patent Rights, R. H. Smith and C. A. Parsons & Company, Limited.

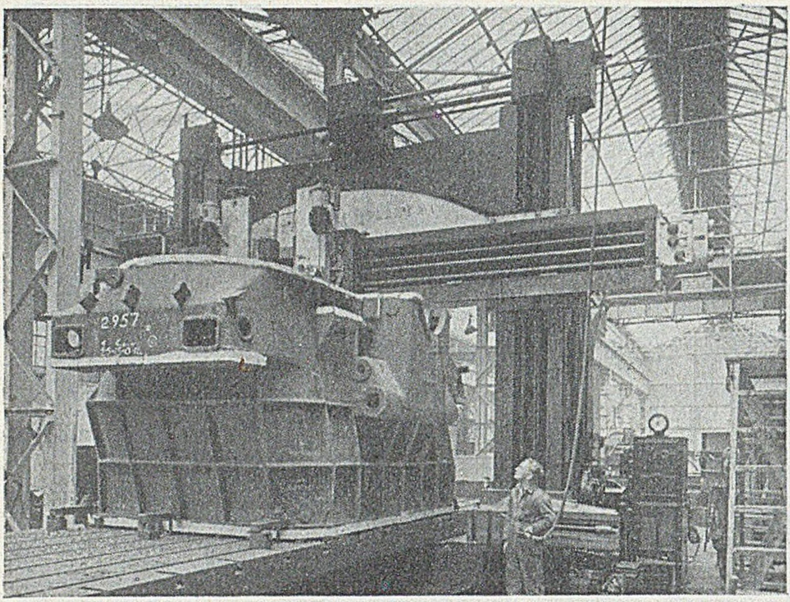


FIG. 6.—*Exhaust Section Casting, weighing 25 tons 15 cwts., on the Planing Machine. For Casting this Job was Inverted.*

ordinary moulding or coremaking operation, and as the building proceeds the centre of the core is packed with ashes and vented in the normal manner.

After drying, the surface is coated with blacking. Fig. 12 illustrates the top half for the L.P. cylinder shown in Fig. 10 during the course of machining. The arrangement of the silicon-carbide blocks used in the core construction can be clearly seen. This process has many other applications in the foundry and in castings of all sizes has completely superseded the use of metal chills for the control of cooling.

The deterioration of the silicon-carbide blocks is slow and due for the most part to cracking and breakage. This in no way detracts from the usefulness of the material as the pieces are used until such time as they become too small for reasonable handling.

Box Moulding

The castings referred to in the foregoing remarks have all been of the larger type which are made in specially-constructed pits in the foundry floor. Many castings of slightly smaller weights and dimensions are produced from moulds made in the conventional type of box.

The method of moulding and the moulding materials used are precisely the same as those already described except that in some instances oil-sands replace the loam used for coremaking. Fig. 13 illustrates an example of this type of casting, a stator core end-plate, weighing approximately 6 tons. The slots, *etc.*, in the inner diameter of this casting are formed in an oil-sand core build-up of segments as shown in Fig. 14.

The design of many of the castings produced is such that they present large flat surfaces, ideal for the formation of scabs and buckles if the moulder should be in the least careless in the placing of the grates behind the loam facing.

Experience has shown that if the grates are placed not less than ½ in. below the mould surface this trouble becomes almost non-existent. The practice of using ½ in. distance pieces at two or three points between pattern and grate has been found to be most beneficial; care is taken to see that the small pieces of wood used are removed and the mould surface made good when the pattern is stripped from the mould.

Knock-out and Sand Handling

The difficulties of stripping cast moulds and the reconditioning of sand in a foundry producing

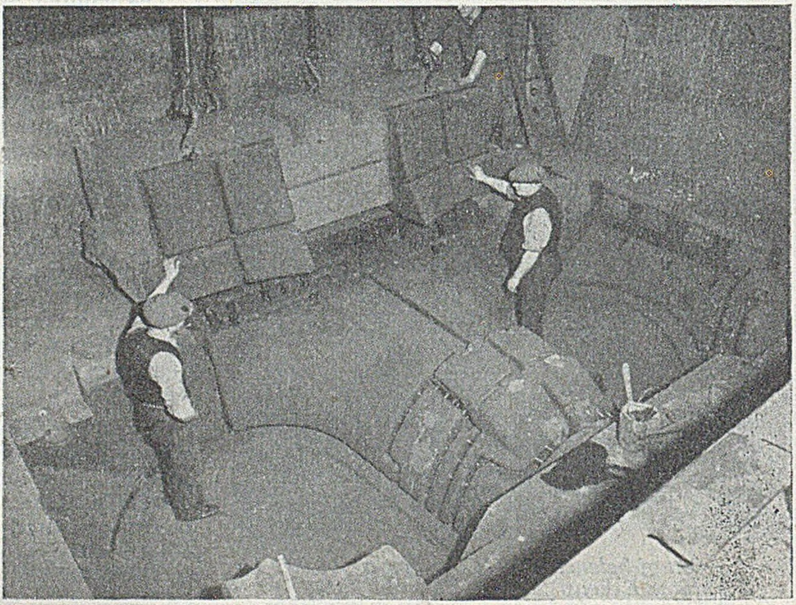


FIG. 7.—*Large Drawback being placed in a Mould for a 100,000 kw. Turbine Exhaust Section.*

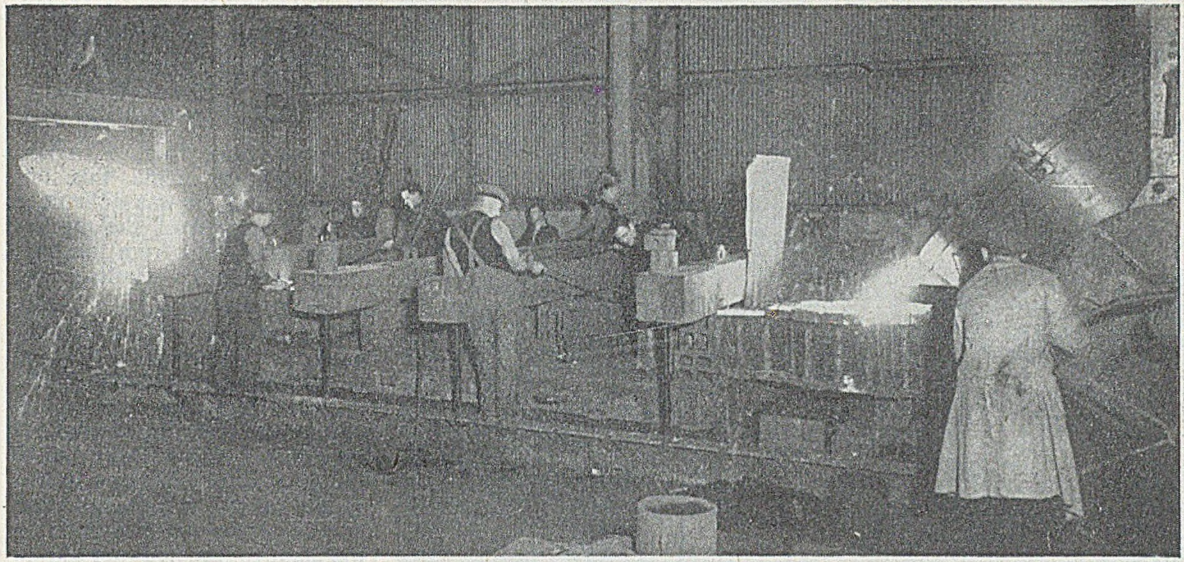


FIG. 8.—*Pouring a Turbine Exhaust Section Casting, using Two Ladles. Mainly, Bottom Gating is used, but Hot Metal is Introduced to the Top Flange at a Late Stage.*

heavy castings are well known. In many foundries of this type a great deal of space which could be used for productive work is utilised for the storage and preparation of sand. This difficulty has been overcome in the foundry under discussion by the installation of a compact unit, combining knock-out area, sand storage, preparation, and facilities for the storage of prepared sand.

The castings are transferred from the moulding pits to a large stationary knock-out grid, adhering sand is removed and passes *via* underground belts through a rotary crusher which breaks down any lumps, then under a magnetic separator. From the separator the sand is elevated and passes through a rotary screen into a storage hopper situated over the continuous-type mill. New sand additions are made when necessary from hoppers situated betwen the knock-out chute and rotary screen.

Sand discharged from the mill is elevated, passed through a disintegrator and fed into two storage hoppers from which the shop supplies are drawn. A portion of the prepared sand is transported in a portable hopper to a second mill where it is used as the basis for the loam facing mixture. The remainder is fed to the Sandslinger and used for backing. In order to avoid stoppages due to shortage of sand at the Sandslinger, two 10-tons capacity portable hoppers are used, one being refilled at the sand plant whilst the second is in use on the machine.

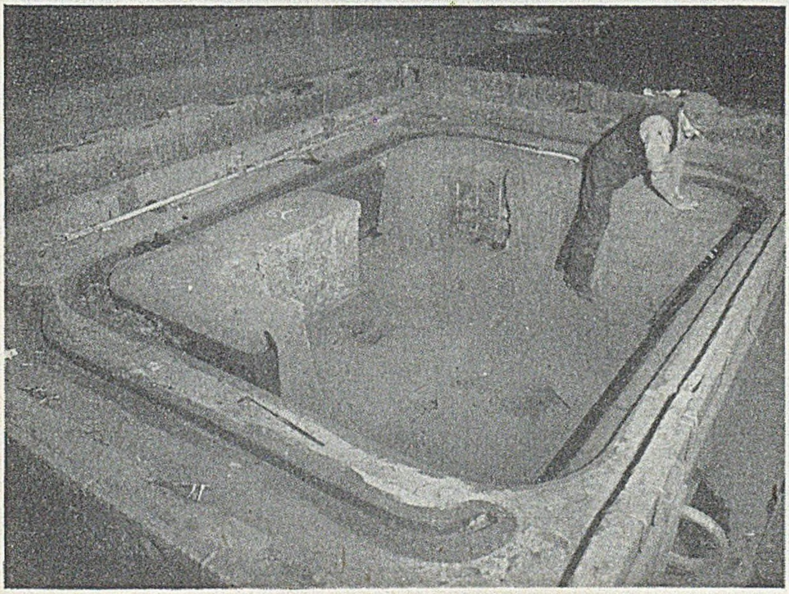


FIG. 9.—*Top Part of the Exhaust Section Mould showing the Arrangement of Core Assembly to Facilitate Easing; a Cast Block is used to fill the Centre Portion.*

Dust Suppression

The stripping operation gives rise to a very considerable amount of dust and so as to maintain as clean an atmosphere as possible, the plant is fitted with dust-extraction equipment. The main source of dust is at the knock-out; a powerful fan extracting air through ducts immediately below the grid

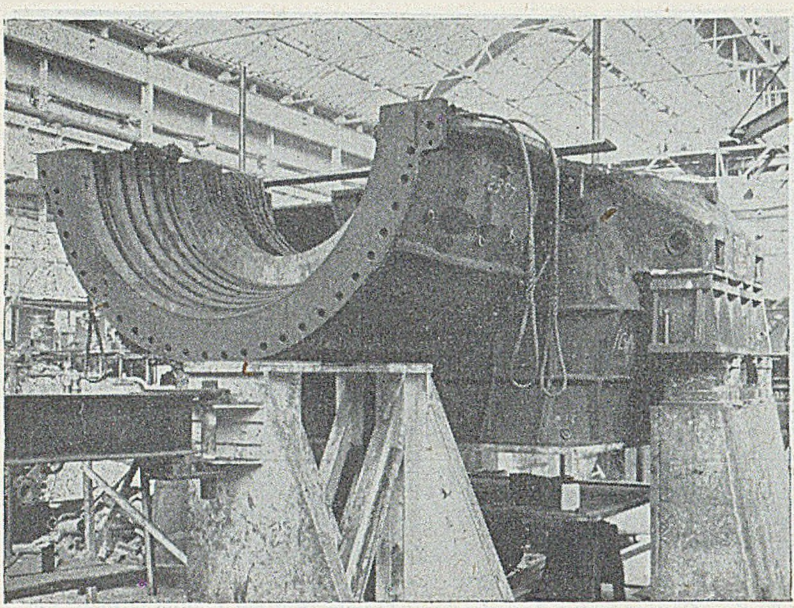


FIG. 10. *Bottom Half Low-pressure Cylinder Casting attached to Exhaust Section Casting on the Assembly Bed.*

removes the major portion of this, depositing it in a two-stage collecting system. Secondary ducts are connected to the rotary screen and the sand mill to deal with dust arising there. Fig. 15 is a general view of the knock-out and sand preparation plant.

In conclusion the Author wishes to express his indebtedness to C. A. Parsons & Company Limited, for permission to present this Paper.

DISCUSSION

MR. F. GREAVES, opening the discussion, said members should congratulate Mr. Charlton on the very admirable way he had presented his Paper, describing the foundry with which he was connected, and the high standard of work attained therein. There were, however, one or two questions he wished to pose.

First, regarding sand, where and how were new sand additions made to counteract losses? He presumed that they did lose some sand even though there was a reclamation plant. Did Mr. Charlton's experience confirm that the presence of core sand. *i.e.*, oil sand, in loam, was the cause of shelling, and if so what procedure did he adopt to avoid it? He also asked if pitch was used in the loam mixture, and were the results encouraging. One of the most disturbing faults in heavy casting manufacture was the tendency to scab on horizontal surfaces. The condenser door illustrated was a likely type of casting to have this fault. He wondered if a mechanical means had been developed to reclaim and straighten round soft iron rods recovered at the knock-out. One of the faults of sand mechanisation was the dropping of sand below the rubber belt at points where it passed over a guide roller. It was expected that when belts were installed some measure of "good housekeeping" would be accomplished, and it was disappointing continually to have to employ men to sweep up and to have complaints from men working on the floor in the vicinity. Had Mr. Charlton been able to avoid this unpleasantness? It was difficult to judge the speed of the mullers in the sand mills from the film, and he would like details of this.

MR. CHARLTON said, first with regard to unit sand and additions of new sand, he had pointed out that a portion of the prepared sand from the plant illustrated was transferred to another mill and wetted down to use as a mould facing. It was at that point that new sand was added. There was provision on the plant for the addition of new sand to the knock-out sand, but this was seldom used as it was found that the new sand addition made at the second mixer was more than sufficient to maintain the bulk.

As to the elimination of core sand from the loam, in actual fact, very little core sand was used in the

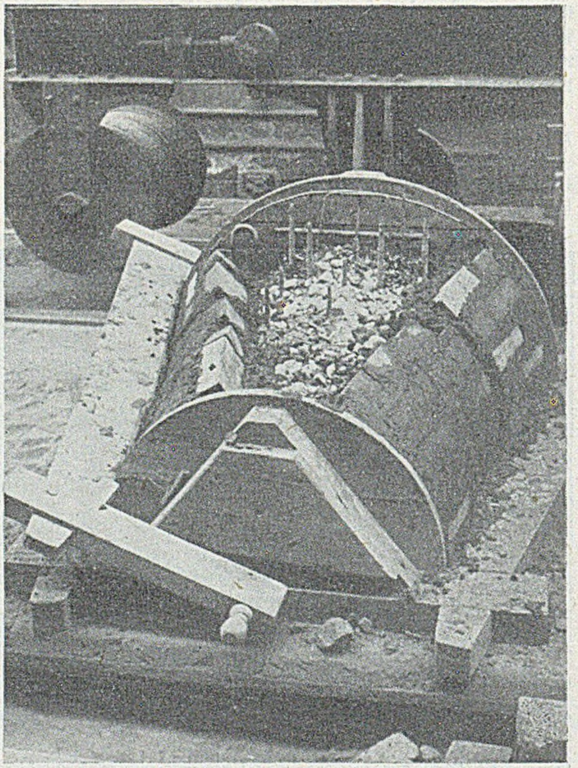


FIG. 11.—*Construction of a Core, faced with Silicon-carbide Blocks to give Moderate Chilling.*

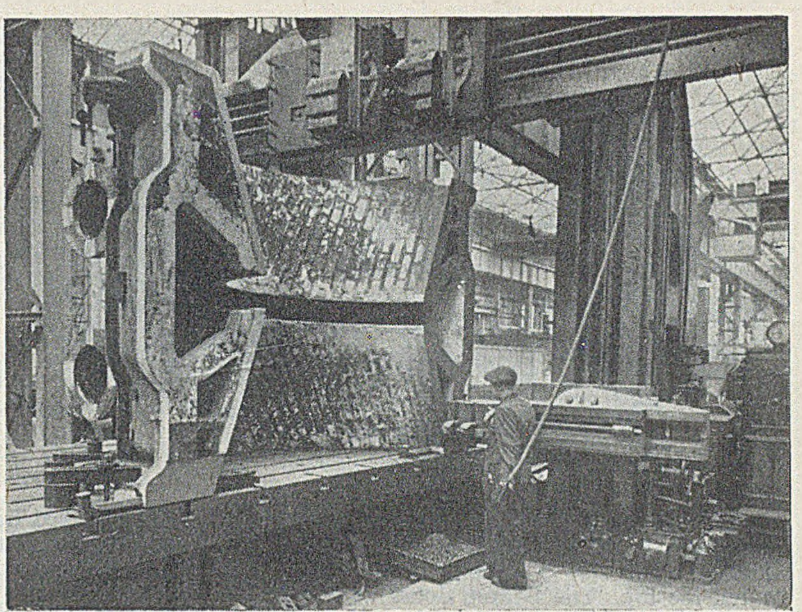


FIG. 12.—*Top Half Casting for the Low-pressure Cylinder shown in Fig. 10. The Casting is mounted for machining and the Chilled Faces produced by the Silicon-carbide Blocks are clearly visible.*

heavy foundry, but what was used was simply mixed with the other sand and went straight through the mixer. Difficulty with scabbing or keeping up the strength of the sand was not encountered. Frankly, he failed to see any connection between the presence of oil-sand and the existence of scabbing because it was quite possible to make synthetic sand with sand of the same quality as that used for making cores and not have scabbing, provided the strength of the sand was properly adjusted.

At the moment, his firm had not made much progress with the use of pitch in a loam-sand mixture. Pitch was used extensively in the foundry on the light-castings side, and on the smaller dry-sand work where there was skin drying. Experimentally, small additions of pitch had been made to loam and he thought it might provide one of the solutions, or at least part solution to the question of "mapping" on the surface of some of the castings.

The majority of the core irons were just dumped into a heap, and a man, usually an elderly employee, was given the job of straightening such as could be used again. It was a reasonably economic way of doing the job.

He agreed with Mr. Greaves that sand underneath belts was a problem which could be alleviated, but he thought not entirely eliminated. On several belts a helpful extra guard had been added, but it was still necessary for someone to go along and clean the belts.

On the question of the speed of the sand mills, he thought that the film had been taken and projected at the correct speeds. The mill capacity was such that, so far at any rate, it had been unnecessary to worry about the speed.

Mr. Charlton said no variation whatsoever was made in the speed of the Sandslinger head. The Sandslinger was not used as a moulding machine; it was simply used as a rammer for backing material. The whole of the pattern was faced with loam and the machine was used to ram the sand behind that. Ramming speed was approximately 3 to 4 cub. ft. per min.

Drop-bottom Charge

MR. FARMER asked if members could be given a few more details of the drop-bottom cupola charger which they had seen illustrated in the film.

MR. CHARLTON admitted that he had not anticipated that question, otherwise he would have brought a photograph of the plant. It was not of an

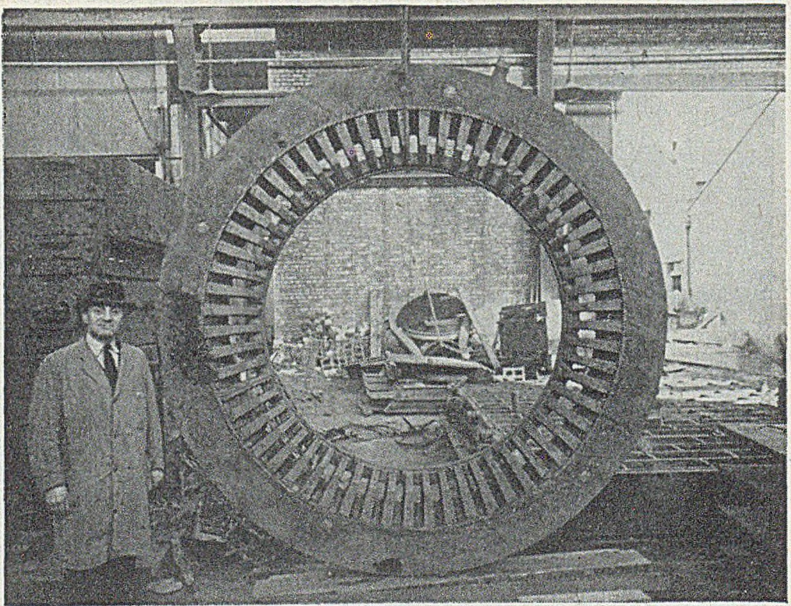


FIG. 13.—*Stator Core End-plate Casting for an Alternator produced in a Moulding Box; it weighs about 6 tons.*

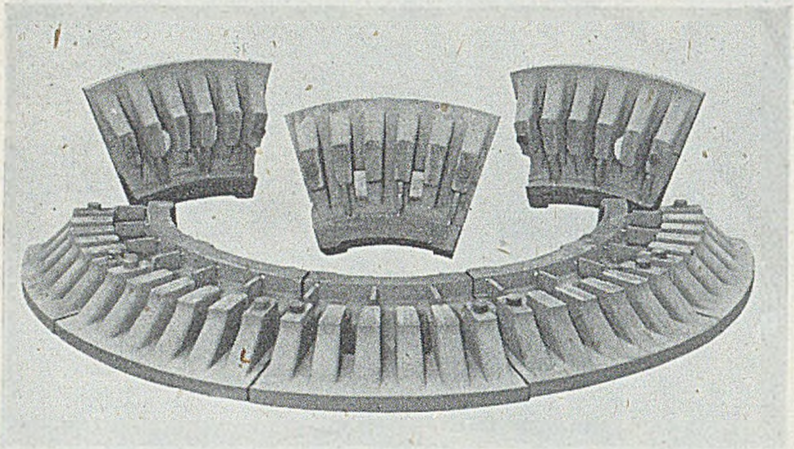


FIG. 14.—*Oil-sand Core Segments for the End-plate Casting shown in Fig. 13.*

unusual type, except that the method of dropping the bottom might be rather new to some of the audience. The skip was constructed with a rim around the top. The bottom doors were operated through links which worked in slots down the side of the skip and were connected to a beam in the top of the skip. The charge was placed in the skip; the crane picked it up and lowered it into the cupola; in the cupola throat the rim sat on four brackets and, as the lowering was continued, the bottom dropped.

Spillage from Belts

MR. T. B. BURROWS mentioned that he had been through the foundry which had been illustrated, and had always considered it as a model layout. With regard to oil-sand contaminating unit sand, his experience had been that it could be of distinct advantage. He had deliberately put the principal ingredients of oil-sand into loam sand and, provided care was taken with the strength and it was not allowed to fall too low, his experience had been that it was beneficial. The only serious drawback was that, if the oil-sand was introduced in the form of broken pieces of core, then there could be trouble through lumps not being thoroughly disintegrated during mixing.

Sand Spillage

Everyone familiar with the handling of sand knew that it was very difficult to take care of spillage. It had been found that it was not always possible to have conveyors above ground and, when below ground, it was an irksome business to have to go down and clean them out, but below ground spillage was " out of sight—out of mind." In many cases the trouble arose from side spillage on the top side of a conveyor belt. Much could be prevented by arranging a skirt, preferably of rubber which adapted itself to the belt. If a metal skirt was fitted and did not give the belt a chance to move, the consequences could be disastrous. Some foundrymen were troubled from time to time with sand carried over the ends of the belt. In the foundry with which he was connected considerable experiment had been undertaken with a view to stopping that sand from falling on or near personnel; it could be very uncomfortable. Various types of brushes had been tried, but they had found the best was one they made up from $\frac{1}{2}$-in. rubber. The brush took its drive from the tail-end pulley. He could provide details for anyone interested in the speed of the brush in relation to the speed of the belt. Arrangements had always been made to have extended tail-end shafts, so that an additional wheel could be fitted if wanted, and they had found this precaution very beneficial for any additional drives required. The brush coped effectively with spillage from the underside of the belt.

MR. CHARLTON, on the question of sand spillage, mentioned a practice in their heavy foundry which they had found helpful. A space, covered by a steel

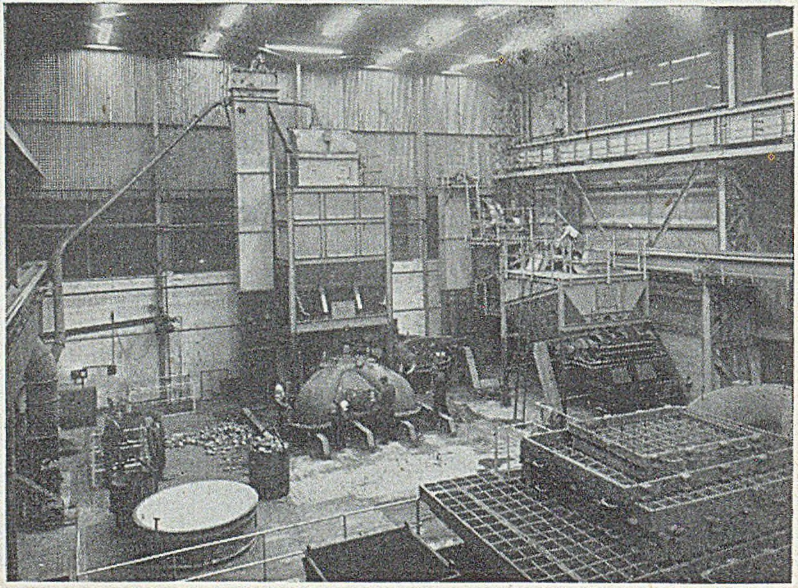


FIG. 15.—*General View of the Knock-out and Sand-treatment Plant. Dust Extraction from the Knock-out is by Suction from Below.*

grating, was provided around each pit. This was used primarily as storage for a reserve of sand, but as will readily be appreciated, the gratings allowed spilled sand to pass and be collected below. Periodically the gratings were lifted, and the level of the sand reduced.

Vacuum Cleaner

A MEMBER said he was not quite sure from the film whether an industrial vacuum cleaner was being used. Had Mr. Charlton any satisfactory experience in using synthetic sand for heavy work, and what was the average permeability of the sand.

MR. CHARLTON confirmed that an industrial vacuum cleaner was used in the foundry for dusting down the walls. He had no experience of any type of vacuum cleaner suitable for cleaning the foundry floor. He was not satisfied, though, that that particular cleaning was satisfactory because the discharge air from the cleaner went back into the shop and some fine dust found its way back into the foundry this way.

The permeability of the backing sand was of the order of about 80 to 90, but once it was wetted down to form the facing material the permeability was negligible. He had no experience of using synthetic sand on castings of that size. Occasionally use was made of synthetic sand on smaller castings and it was very successful.

MR. GREAVES thought the point about core-sand contamination had been rather misconstrued. He had been told that the sand grains got a coating of greasy material and in consequence water would not take to them. This gave rise to troubles beneath the surface of the mould.

The dust extraction method had struck him as being peculiar. Surely a new plant like the one illustrated had not been installed only to discover suddenly the need for a dust extractor?

He wondered if they had had any trouble with water in the moulding pits. When moulding boxes were to be knocked-out, they should be treated as castings, and pneumatic picks, *etc.*, used as for de-coring.

MR. CHARLTON agreed that there was a coating of carbonaceous material on the sand grains, but it was found in practice it did not have any serious effects. Possibly if the volume of core-sand going back into the general sand was large, then there might be trouble.

On the question of dust extraction, they had, of course, carefully considered the matter before the plant was installed. But the problem at the time was to produce castings and the moment the sand plant was installed it had to go into action. It was simply a fact that the dust-extraction plant had not then been delivered and they could not afford to wait, but had to get started without it.

The deepest of the pits below the plant was some 25 ft., but fortunately there was little trouble with water. In the first instance, the pits had been faced with a waterproof mixture, and there was a sump in the bottom to collect seepage, but not more than three to four gallons accumulated in a week.

Loam Mixture

MR. H. HAYNES thought Mr. Charlton should be congratulated on making big castings; castings of that size were not playthings and one could not afford hit-and-miss methods. In making the cores for such large castings there must be considerable shrinkage in the core and that gave rise to cracking. This could take a lot of time to patch and dry out again before blacking. He would like to know the time of mixing and composition of the loam for that type of core.

Answering Mr. Haynes' questions, MR. CHARLTON said the loam was prepared in a pug mill with very heavy rollers, and the mixing time was nine to ten minutes. With regard to core cracking they had found since they built the new foundry and had installed gas-fired coke-ovens fitted with a re-circulating system of drying, that they could control the drying. They dried at 250 deg. C. and although they still got a certain amount of cracking the extent had been considerably decreased and the core-makers did not have to spend an abnormal amount of time in cutting-out and making up those cracks.

Silicon-carbide Blocks

MR. HUGHES referred to the use of silicon-carbide blocks, and wanted to know if they were used with a coating of blacking only or had a covering of loam. Had Mr. Charlton considered the use of carbon blocks because of their high thermal-conductivity, and if so what had been the results. Was there any economy in using them as against the present use of silicon-carbide?

MR. CHARLTON said Mr. Hughes was quite right in his assumption that the silicon-carbide blocks were used simply with a coating of blacking. There was no other preparation. They built the core of silicon-carbide bricks and applied a coating of blacking. They had had no experience in the use of carbon blocks. The silicon-carbide process had been developed in their own works.

Conclusion

Summing-up the discussion and calling for a vote of thanks to the lecturer, the CHAIRMAN (Mr. E. Longden) said members were used to mechanisation being applied to making small castings of a repetitive nature, but they had now seen how much the engineer was contributing to economies even in the heavy founding industry. Much could be learned from the application of machinery to continuous-casting plant, and he was sure that C. A. Parsons & Company had really applied the maximum amount of mechanisation suitable to their purpose and they were to be congratulated on it. The film shown had added to the store of excellent illustrations of foundry operations which had been developed so much during the past two or three years. Such pictures were worth many thousands of words of explanation. As far as the use of silicon-carbide blocks was concerned, he did not know whether C. A. Parsons & Company could lay prior claim to the use of that material; such materials had been used ever since he could remember for accelerating the rate of cooling of certain sections of moulds.

Royal School of Mines Centenary

THE OLD Drapers' Hall in the City of London made an ideal setting for the centenary banquet, which was arranged by the Royal School of Mines Association at the end of last month. The list of distinguished guests was headed by H.R.H. Princess Alice Countess of Athlone and the Earl of Athlone. A loyal message to the King was sent from the banquet, and the chairman, Mr. Vernon Harbord, president of the association, read a reply which had been received from his Majesty's private secretary thanking them for their message.

An opportunity for seeing something of the work of the school was afforded by a formal centenary conversazione held at the Royal School of Mines, Prince Consort Road, Kensington, during the evening of the Imperial College commemoration day. An excellent display of exhibits and demonstrations had been arranged by the students of the various departments. The metallurgical department exhibited a small foundry equipped with high-frequency induction furnaces as well as gas-fired furnaces, welding and gas-cutting, metallography, X-ray equipment, and mechanical testing.

In the assay laboratory, a number of industrial firms had co-operated and exhibited details of specialised processes with which they are associated. Exhibits included the process of magnesium extraction from seawater; a "Perspex" model of the Proteus gas turbine built to show the different metals and alloys used in the construction of the engine; the carbonyl refining process for nickel was demonstrated by a working model; large mounted photographs and flow sheets illustrating the methods used in extracting and refining germanium, gallium, and the precious metals; a model of the original Hall furnace for the production of aluminium, together with a specimen of aluminium prepared by catalytic distillation, with accompanying literature and photographs, and a model of the refluxer plant for producing high-purity zinc were shown. A special display had been arranged by the Nuffield Research Group in extraction metallurgy, which were intended to indicate research in progress on the fundamental chemistry of metal extraction at high temperatures. It included apparatus for the determination of the activities of sulphur transfer between copper and sulphur, investigation into the activities of PbO in molten silicate slag at 800-1,200 deg. C., reduction of FeO films with hydrogen, and the equilibrium between sulphur and oxygen in gases and liquid slags.

Board Changes

NATIONAL GAS & OIL ENGINE COMPANY, LIMITED—Mr. Alexander Campbell Geddes has resigned from the board.

RENISHAW IRON COMPANY, LIMITED—Mr. H. H. Draycott, the company's secretary, has been elected a director.

SELSON MACHINE TOOL COMPANY, LIMITED—Following the death of Mr. Frederick M. Selson, Mr. D. W. Cooper has been appointed managing director and Mr. J. Simpson, who is a director, will act as general manager. Mr. Cyril M. Cohen remains chairman.

World Metallurgical Congress

The National Metal Exposition, held recently in conjunction with the World Metallurgical Congress at Detroit, was even more extensive than in previous years and gave the foreign delegates, as well as the American visitors, opportunity to review the latest products from the leading companies in the world. Amongst the new products shown were a magnetic hardness tester, suitable for very large or small surfaces; pin-type self-locking fastenings; microscopes and other optical equipment; and many others. Precision casting seemed to have taken the lead from powder metallurgy as the new method for multiple production. Two of the carbide firms on the other hand were showing heat-resistant carbides; one composed of nickel-bonded chromium carbide (Cr_3C_2) and the other nickel-bonded titanium carbide. The favourable density, high thermal shock resistance and low coefficient of expansion seem to indicate a wide field of use for these products. Another interesting exhibit was in connection with the ductile cast irons. Nearly 80,000 people visited the show during the five days.

The World Metallurgical Congress closed with a banquet for 800 delegates at which the U.S. mobilisation director, C. E. Wilson, spoke. He told the assembly that the Communist threat placed a premium on metal fertility to overcome the critical metal shortages. On the other hand, he assured the audience that there was no cause for alarm over the current mineral shortages since many of them were temporary. However, he said that these shortages could only be overcome by conservation, as an example of which he cited his action that day in banning the development of colour television in the U.S.A. until the present emergency ended. He then traced the delay in the appearance of the metals diverted to national needs, as useful items to combat aggression. He explained that "we have learned that the enemy while deaf to the appeals of peaceful persuasion, has a very acute ear for the language of strength."

A silver replica of the congress medal was then presented to Mr. Wilson and also to Dr. Zay Jeffries. Mr. Eisenman was presented with a gold replica to mark his untiring efforts to make the congress a success.

Historic Models Acquired

Foundrymen with an appreciation of the history of the industry will have noted with interest that the recently-opened Museum of Science and Industry in Newhall Street, Birmingham, has acquired the models of machines made by Boulton, Watt and Murdoch in the early days of the Soho Foundry. The collection includes models of rotary engines made by Watt and a 19-in. long, 14-in. high model locomotive by William Murdoch, to whom Watt gave his first chance to develop his inventive genius at the foundry. Documents and drawings from the archives of the Soho Foundry firm, of Boulton and Watt, are being retained in Birmingham Reference Library.

Core Sand Collapsibility Test

By I. J. Birch

With so many types of core-binder available, it is desirable when considering a new binder to have some means of assessing its collapsibility. The method to be described is a simple one, but has given reproducible results during a year's use. The core sands tested are aluminium core sands and it was for this reason that all tests were conducted using RR.50 alloy. (B.S. 1490 LM7P.)

The dry compression figure for a standard A.F.S. core, does not give a true indication of its collapse under casting conditions. Suitable examples are the synthetic-resin type core-binders, where a sudden increase in collapsibility occurs, at a temperature which alters the physical or molecular stability of the resin.

With the ever-increasing popularity of synthetic-resin binders, it was decided that some information on their collapse would be of interest. The effect of variation of cereal, red sand, and resin, would not be complete without mention of the effect on the friability of the core. The results set down (as friability gms.) were obtained using the "Friability Tester" as described in the I.B.F. *Proceedings* 1949, p. 184.

Method for making a Collapsibility Test

(1) A standard A.F.S. core a 2 in. by 2 in. cylinder is prepared from the core sand requiring test.

(2) The core is stoved at the required temperature for 1 hr.

(3) After coating when warm with a suitable wash *e.g.*, 50 per cent. plumbago 50 per cent. proprietary wash, the core is placed in a split jacket mould (Fig. 1). The jacket thickness for a standard test is ½ in.

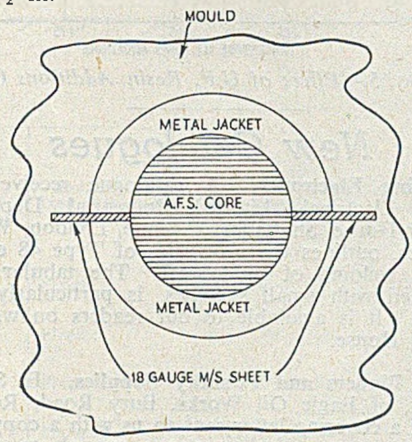


Fig. 1.—*Plan View of Mould after Casting.*

(4) Metal at a known temperature is poured into the mould. After cooling, the core is carefully stripped from the jacket.

(5) A standard dry-compression test is carried out and the figure obtained is expressed as dry collapsibility in lb. per sq. in.

Using the method described, a series of tests were carried out to find the effect of a wall thickness on the core collapsibility. The sand was bonded with a "semi-solid" and the results obtained over a range of thicknesses are shown graphically (Fig. 2). From the graph it can be seen that with in-

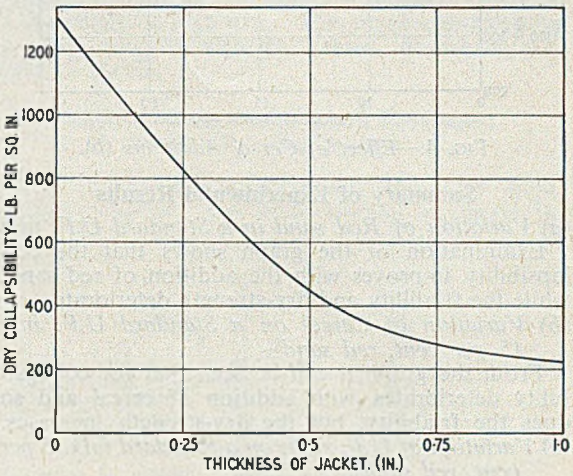


Fig. 2.—*Effect of Wall Thickness on Core Collapsibility.*

crease in jacket or wall thickness the collapsibility falls quite rapidly. Using the ½ in. jacket thickness experiments were carried out on a proprietary U.F.-resin binder. For a complete assessment of properties, the variables are considered separately in Figs. 3, 4 and 5.

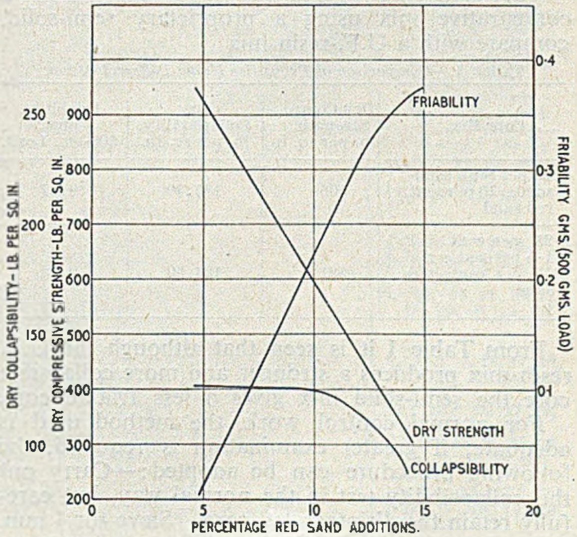


Fig. 3.—*Effect of Red Sand Additions (a).*

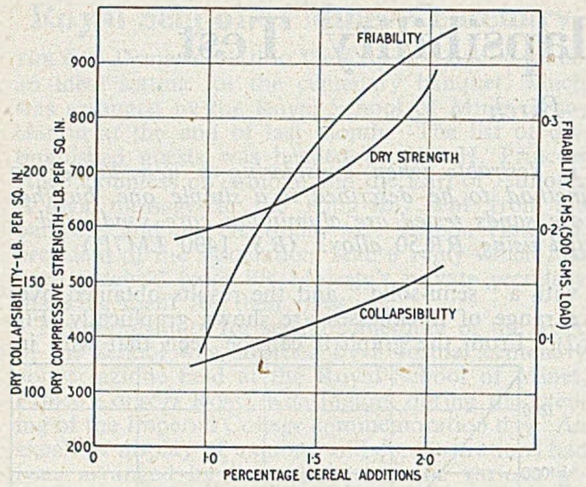


FIG. 4.—*Effect of Cereal Additions* (*b*).

Summary of Experimental Results

(*a*) *Variation of Red sand in a Standard U.F. mix*

Examination of the graph shows that the collapsibility improves with the addition of red sand, while the friability and dry-strength deteriorate.

(*b*) *Variation of Cereal on a Standard U.F. mix (5 per cent. red sand)*

From the graph it can be seen that the collapsibility deteriorates with addition of cereal and so does the friability, but the dry-strength increases.

(*c*) *Variation of U.F. resin on a Standard mix (5 per cent. red sand)*

It can be seen from the graph that the collapsibility deteriorates with U.F. resin addition and the dry-strength and friability improve. The 2 per cent. mix contains 20 per cent. red sand, and it is noticeable that the collapsibility is poor, indicating the need for economy in the amount of resin and cereal used.

Results Obtained using a Semi-solid Binder

The following figures (Table I) show how a comparative mix using a proprietary semi-solid, compare with a U.F.-resin mix

TABLE I.—*Comparison of Properties Using Different Mixes.*

Core Mix.	Dry Comp. Strength, lb. per sq. in.	Dry Collapsibility, lb. per sq. in.	Friability, gms. 500-gm. Load.
2.75 per cent. semi-solid. 10 per cent. red sand	506	185.50	0.07
1·25 per cent. U.F. 1·5 per cent. cereal. 10 per cent. red sand	591	124.50	0.22

From Table I it is seen that although the U.F. resin mix produces a stronger and more collapsible core the semi-solid mix gives a less friable core.

For normal control work, the method used is adequate; if greater examination is required, the following procedure can be adopted:—Carry out the collapsibility test in the normal way, but carefully retain the disintegrated core. Sieve for ½ min. through a 16 mesh B.S.S. sieve using a rotary sieve machine. Express the weight of sand "passing" the 16 mesh sieve as a percentage of the original specimen weight.

General Conclusions

In the opinion of the writer, valuable information can be gained, if the collapsibility and friability characteristics of core sands are assessed. All the figures quoted, are from routine checks and no doubt are open to criticism. However, the method outlined will serve as a guide to assessing some hitherto elusive core-sand properties.

Acknowledgment

The Author expresses his thanks to Mr. Knapp and Mr. Tedds for their co-operation and to the Bristol Aeroplane Company, Limited, for permission to publish this Paper.

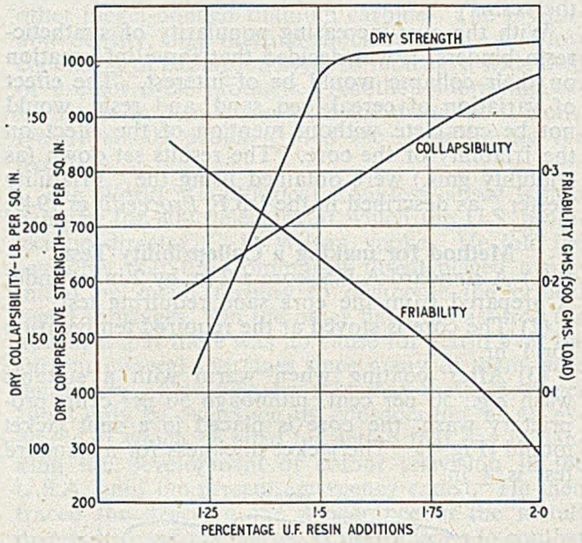


FIG. 5.—*Effect of U.F. Resin Additions* (*c*).

New Catalogues

Welding Electrodes. A catalogue received from Philips Electrical, Limited, Industrial Department, Century House, Shaftsbury Avenue, London, W.C.2, in 16 pages, outlines the properties of Type 48 electrode for the welding of mild steel. The tabular matter, associated with small sketches, is particularly clearly set out. It is available to our readers on writing to Century House.

Core Binders and Foundry Supplies. E. S. Lord, Limited, of Eagle Oil Works, Bury Road, Rochdale, have in a covering letter sent to us with a copy of the latest catalogue, been courteous enough to acknowledge the help they have received from our *critiques* of their earlier publications and have amongst other things now incorporated a full index. That this was needed is shown by the fact that it now requires two pages to list the lines they market. There is only one criticism we have to make and that is a reference on page 31 to a sand "grinding" mill. Sand should not be "ground" but mixed. It is a very useful little booklet as buyers will find listed therein articles not always easy to find. It is available to our readers on writing to the Eagle Oil Works.

Mechanical Charging of Cupolas*

By W. J. Driscoll, B.Sc.(Eng.), A.M.I.Mech.E., M.Inst.F.

(*Continued from page* 560.)

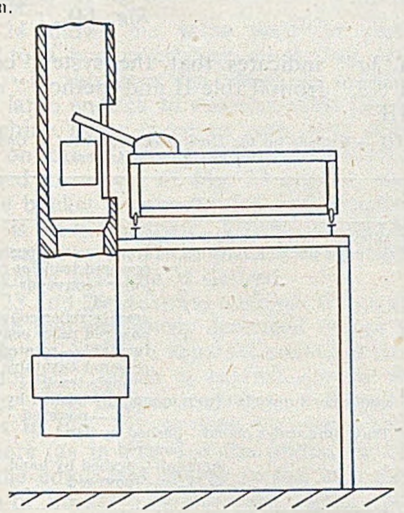
Travelling Gantry Crane Charger

The travelling gantry crane charger shown in Fig. 22 is a charger that has been most commonly applied to existing cupola installations where two or more cupolas in line have been hand-charged from a common platform which is suitable for carrying the gantry crane and over which the headroom is too small to allow the installation of, say, an underslung travelling crane or a monorail charger. The method of operation is as for the Fig. 20 charger although the span of the gantry may be appreciably smaller than that of the normal overhead travelling crane. The charging buckets are usually hoisted from ground level through a suitably positioned aperture in the charging platform. The crane controls are normally integral with the gantry, on which the operator travels.

Weighing Metal Charges and Movement to the Charging System

It is considered as axiomatic that, for good cupola operation, the total amount of metal in

* Paper presented at the annual conference of the Institute of British Foundrymen. Mr. Colin Gresty in the chair. The Author is attached to the British Cast Iron Research Association.



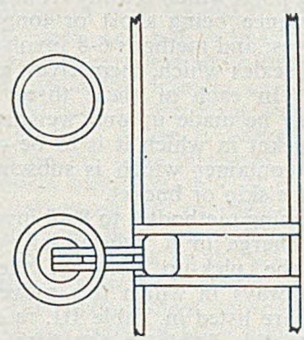


FIG. 22.—*Travelling Gantry Crane Charger.*

Table II.—*Summary of Charge Weighing Methods.*

Charge weighing method No.	Weighing point fixed or travelling.	Charge weighed in charging skip or bucket or in separate container.	Direction of movement of completed charge to pick-up point of hoist or charger.	Method of horizontal movement of completed charge to pick-up point of hoist or charger (see Table III).	Fig. Nos. of hoists or chargers to which charge weighing method is applicable (heavy type numbers indicate most suitable cases).
1	Fixed	Skip or bucket ..	Charge completed in skip or bucket in position for hoisting	—	9,* 10,* 12,* 13* 14 16, 17, 18, 19, 20, 21, 22
2	Fixed	Separate container	Container discharged by gravity direct into skip or bucket in position for hoisting	—	9,* 10*, 14, 15
3	Fixed	Skip or bucket ..	Skip or bucket transferred horizontally from weighing point to pick-up point	*a, b, c, d, e, f, g, h*	9 † 10,† 11, 12,† 13† 16, 17 18, 19, 20, 21, 22
4	Fixed	Separate container	Container transferred horizontally from weighing point, then discharged by gravity into skip or bucket in position for hoisting	*a, j, k*	9,* 10,* 14, 15, 16, 17, 18, 19, 20, 21, 22
5	Fixed	Separate container	Container discharged by gravity into skip or bucket, which is then transferred horizontally to pick-up point	*a, b, c, d, e, f, g, h*	9,† 10,† 11, 16, 17, 18, 19, 20, 21, 22
6	Travelling ..	Skip or bucket ..	Skip or bucket picked up direct from travelling scales	*p, q, r, s*	12,† 13,† 16, 17, 18, 19, 20, 21, 22
7	Travelling ..	Separate container	Container discharged by gravity direct into skip or bucket in position for hoisting	*p, q, r, s*	9,* 10,* 14, 15, 16, 17 18, 19, 20, 21, 22
8	Travelling ..	Skip or bucket ..	Skip or bucket transferred horizontally from travelling scales to pick-up point	(*p, q*) (*a, d, e, f, g, h*)	9,† 10,† 11, 12,† 13† 16, 17, 18, 19, 20 21, 22

* When integral skip is employed. † When removable skips are employed.

Mechanical Charging of Cupolas

each individual charge should be accurately controlled by weight. This single weighing of each completed metal charge may be sufficient, for instance, in the simple case where the charge is made up only from one pig iron and returned scrap, and also in other simi'ar cases, but in the majority of instances it is highly desirable for the weight of each component of the metal charge (*e.g.*, pig irons, returned scrap, bought scrap, steel scrap, etc.) to be weighed individually. The decision as to which one of these methods is preferable is one of the factors which will influence the charge weighing method to be employed.

The methods which are used for the making-up and weighing of the metal charges and for the movement of them, if necessary, to the pick-up point for the hoist or charger are summarised in Table II. It will be seen from the Table that methods 1 and 2 involve weighing the charge at a fixed weighing point which itself is located at the pick-up point; methods 3 to 5 involve weighing the charge at a fixed weighing point which is away from the pick-up point, the distance being short or long according to circumstances; and methods 6-8 involve weighing the charge on scales which, themselves, are capable of travelling. In each of these three categories, the charge may be made up and weighed either in the skip or bucket in which it is to be charged, or in a separate container which is subsequently discharged into the skip or bucket.

Charge weighing methods 3 to 8 all involve movement of the charge in a substantially horizontal direction to the pick-up point of the hoist or charger. The ways in which this movement may be performed are listed in Table III, reference also being made to this Table in the fifth column of Table II.

There are obviously very many different ways of handling and weighing the metal charges for mechanical charging if one considers the possible combinations of weighing methods (Table II) and movement methods (Table III) but an attempt is made in Figs. 23 to 38 to illustrate some examples which are common, are typical of one of the major groups, or are of particular interest. Each example is so classified that, for example, " charge weighing method 3*a* " indicates that the system comprises method " 3 " from Table II and method " *a* " from Table III.

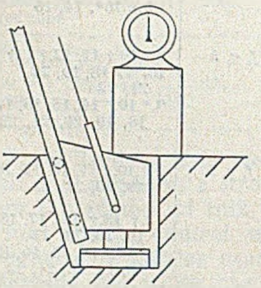


Fig. 23.—*Charge Weighing Method* (1) *as Applied to Hoists, Figs.* 9 *and* 10 (*Similarly for Figs.* 12, 13 *and* 14).

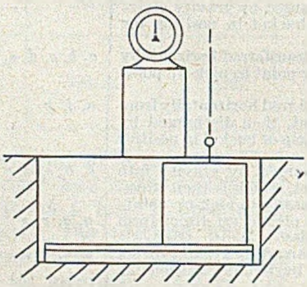


Fig. 24.—*Charge Weighing Method* (1) *as Applied to Chargers, Figs.* 16 *to* 22 *inclusive.*

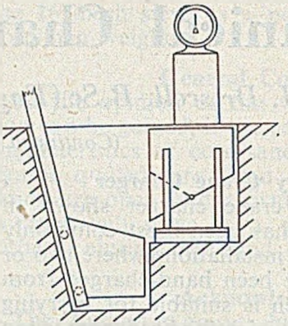


Fig. 25.—*Charge Weighing Method* (2) *as Applied to Hoists, Figs.* 9 *and* 10.

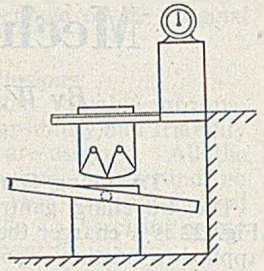


Fig. 26.—*Charge Weighing Method* (2) *as Applied to Charger, Fig.* 15 (*Similarly for Fig.* 14).

Table III.—*Methods for the Horizontal Movement of Charged Skips Buckets and Containers.*

Method.	Description.
a	Wheeled skips—pushed by hand
b	Skips or buckets standing on transfer car—pushed by hand
c	,, ,, ,, powered transfer car
d	,, ,, ,, roller conveyor—pushed by hand
e	,, ,, ,, gravity roller conveyor
f	,, ,, ,, powered roller conveyor
g	,, ,, ,, turntable—rotated by hand
h	,, ,, ,, powered turntable or circular bogie track
j	Container supported from monorail—pushed by hand
k	,, ,, ,, —powered
p	Travelling scales on car—pushed by hand
q	,, ,, ,, —powered
r	,, ,, monorail—pushed by hand
s	,, ,, ,, —powered

Fig. 23 illustrates the case where a fixed weighing machine is provided at the foot of a skip hoist having an integral skip. When the skip is in its lower-most position it rests on the platform of the weighing machine which is tared to read zero when the skip is empty. Features of this method are that

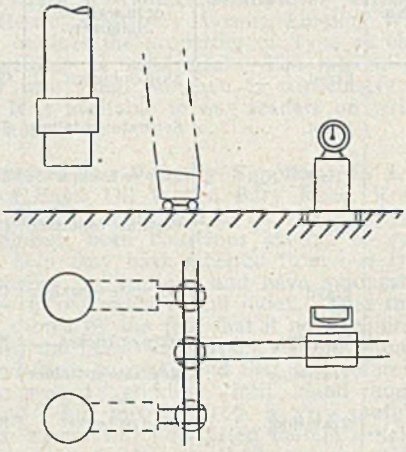


Fig. 27.—*Charge Weighing Method* (3*a*) *as Applied to Hoists, Figs.* 9 *and* 11 (*Similarly for Figs.* 10, 12 *and* 13).

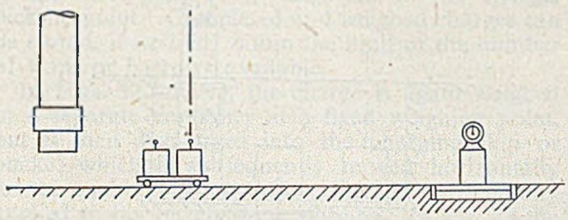


FIG. 28.—*Charge Weighing Method* (3*b*) *or* (3*c*) *as Applied to Chargers, Figs.* 16 *to* 22 *inclusive.*

(*a*) each component of the metal charge may be weighed individually as it is loaded into the skip, and (*b*) making-up and weighing cannot be proceeded with while the hoist is in operation so that the charging cycle is necessarily longer than in most other cases.

Fig. 24 shows the same weighing method as applied to a bucket-charger employing removable buckets. In this case, the weighing machine platform is large enough to accommodate two buckets, the machine being tared to zero with one empty bucket on the platform. Thus consideration (*a*) mentioned in respect of Fig. 23 applies, but in this case one bucket can be loaded and weighed while another is on the charger. Further loaded stand-by buckets can be stored on ground level adjacent to the weighing machine if desired.

Figs. 25 and 26 illustrate methods which are similar to the two previously described except that the charge is weighed in a separate container or " batch weigh hopper " which is carried on the weighing machine. This hopper may have a hinged bottom plate (as in Fig. 25) or drop-bottom or clam-shell type doors (as in Fig. 26) the operation of which allows the completed charge to fall into the charging skip or bucket. In this case, again, each component of the metal charge may be weighed individually and one charge can be made-up and weighed while another is being taken to the cupola. Storage of completed charges after weighing is, however, not possible.

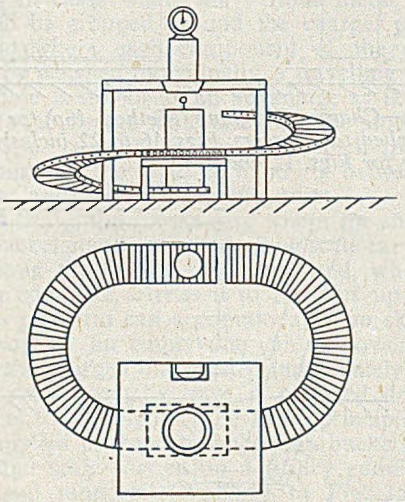


FIG. 29.—*Charge Weighing Method* (3*e*) *as Applied to Chargers, Figs.* 16 *to* 22 *inclusive.*

Figs. 27 to 29 illustrate methods in which the charge is weighed in the charging skip or bucket at a fixed weighing point, the skip or bucket then needing to be moved in a substantially horizontal direction to the pick-up point for the hoist or charger. Fig. 27 illustrates the case where the charge is weighed in wheeled skips which are removable from the hoist and which are pushed by hand from the scales to the hoist. The skips may run on rails, *via* turntables or points if necessary, or may have flat-treaded wheels for running over hard, smooth ground, this condition, however, being difficult to maintain in a foundry yard.

In Fig. 28, the charging buckets or skips are carried on a separate wheeled transfer car between the platform scales and the pick-up point. This car may be pushed by hand but is preferably propelled by an engine or motor. The car platform should accommodate two buckets so that the charger may lower an empty bucket on to it and immediately pick up the loaded one. With the arrangement shown in Fig. 28 the scales are tared to zero when the transfer car carrying one empty bucket is standing on the platform. In an alternative arrangement, the scale platform may be just to one side of the transfer car track and not in line with it. In this case the platform carries a short length of powered roller track while the transfer car has two short lengths of idle rollers, each large enough to accommodate a bucket. When a charge is completed in a bucket on the scale platform, rotation of the powered rollers moves the bucket on to the empty section of rollers on the transfer car. The car is moved slightly so that the empty bucket can be pushed on to the rollers on the scale platform, the car then moving with the loaded bucket to the pick-up point. This arrangement means that the scales need not have a capacity large enough to take the weight of the transfer car which, in the case of a powered car, may be substantial, and the accuracy of charge weighing is thus improved.

Fig. 29 shows a charge weighing method in the same category as Figs. 27 and 28 although at first sight it may appear very different. In the case illustrated the bucket being loaded stands on a section of roller track on the scale platform. Materials are fed into the bucket through a funnel-shaped aperture in an elevated platform known as the " make-up platform." This method of loading has been applied mainly to larger installations where materials are brought by a magnet on an overhead crane direct from the stock piles and dropped into the charging bucket, the scale dial being in such a position that it may readily be observed by the crane

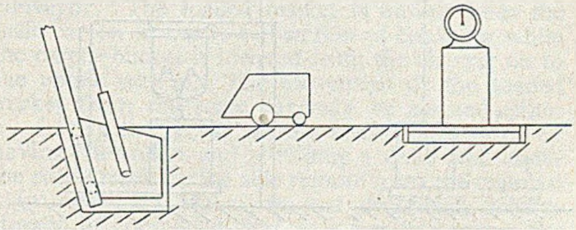


FIG. 30.—*Charge Weighing Method* (4*a*) *as Applied to Hoists, Figs.* 9 *and* 10.

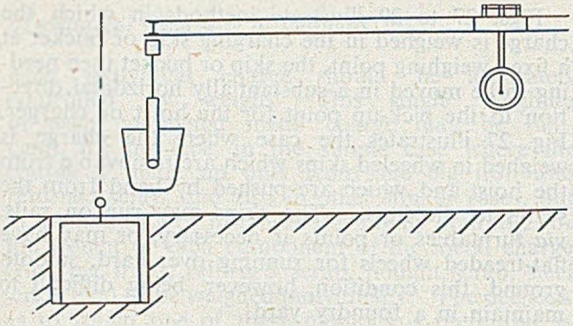


FIG. 31.—*Charge Weighing Method (4f) or (4k) as Applied to Chargers, Figs. 14 to 22 inclusive.*

operator. The make-up platform only accommodates small amounts of charge materials for the final trimming of the charge weight. When the charge is completed, the loaded bucket is moved on to the inclined roller track and so travels along to the charger pick-up point. Empty buckets are lowered from the charger on to the upper gravity roller track and so automatically move back to the weighing point. Suitable stops are located at appropriate points in the roller track.

With the weighing methods just described, particularly Figs. 27 and 29, it is possible for a number of completed charges in skips or buckets to be held in reserve between the weighing and pick-up points, if desired.

With the weighing methods Figs. 27 and 28, and where the charge materials are not stored close to the pick-up point, there are two alternative positions for the weighing machine; (*a*) at a central point convenient for the stock-piles, in which case each component can be weighed individually, or (*b*) adjacent to the pick-up point so that only the total weight of the charge may be checked as the skip or bucket passes over the platform.

While Figs. 27 to 29 only indicate certain methods of moving the loaded skips or buckets horizontally, other cases may be visualised involving the use of idle or powered horizontal roller track or of turntables, while in other instances there may be different arrangements of the levels so that, for instance, the make-up platform in Fig. 29 may be at ground level.

Figs. 30 and 31 show weighing methods which are similar to those shown in Figs. 27 and 28 except

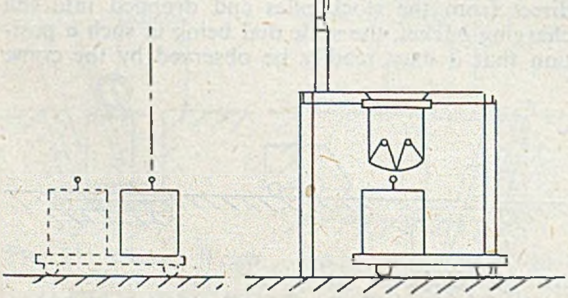


FIG. 32.—*Charge Weighing Method (5b) or (5c) as Applied to Chargers, Figs 16 to 22 inclusive.*

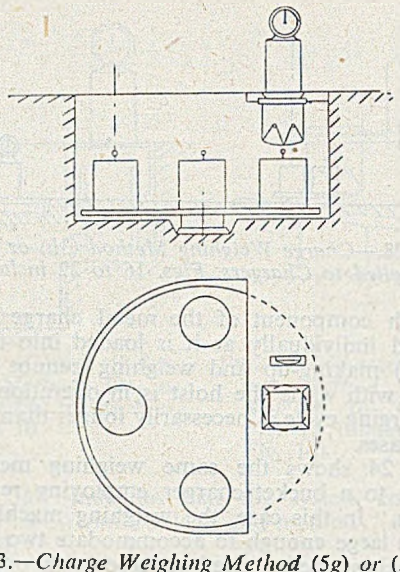


FIG. 33.—*Charge Weighing Method (5g) or (5h) as Applied to Chargers, Figs. 16 to 22 inclusive.*

that the charge is made up and weighed not in the charging skip or bucket, but in a separate container which, after final weighing, is moved horizontally and then discharged by gravity into the skip or bucket. In Fig. 30 the container is in the form of a simple tilting skip which is pushed by hand from the scale platform to the hoist loading point. Ordinary wheelbarrows can, of course, be employed in the same way. In Fig. 31 the container, which may be of the tilting or drop-bottom type, is carried on a monorail in which is incorporated a static monorail type weighing machine. In either of the two cases just described, as for Figs. 27 and 28, the weighing machine may be (*a*) at a central position relative

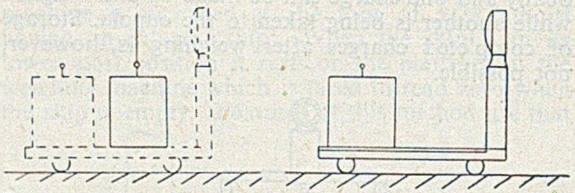


FIG. 34.—*Charge Weighing Method (6p) or (6q) as Applied to Chargers, Figs. 16 to 22 inclusive (Similarly for Figs. 12 and 13).*

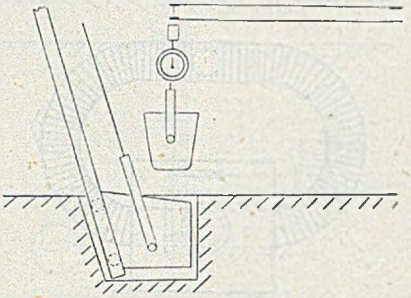


FIG. 35.—*Charge Weighing Method (7r) or (7s) as Applied to Hoists, Figs. 9 and 10.*

to the stock-piles or (*b*) adjacent to the charger pick-up point. Completed and weighed charges can be stored, if desired, within the limit of the number of skips or barrows available.

In Figs. 32 and 33, the charge is again weighed in a separate container at a fixed weighing point, but is then discharged into the charging skip or bucket which is subsequently moved horizontally to the pick-up point. This method is generally applied to bucket charging systems. In Fig. 32 the charge is weighed in a batch weigh hopper incorporated in an elevated make-up platform and is then dropped into the charging bucket which is carried on a transfer car. Fig. 33 shows another arrangement of the same method in which the weigh hopper has been brought down to ground level and horizontal movement of the buckets is effected by means of a turntable. Other arrangements in which the horizontal movement of the buckets is effected by idle, powered, or gravity roller conveyor are, of course, possible. With most of the arrangements of this weighing method some storage of loaded charging buckets is possible.

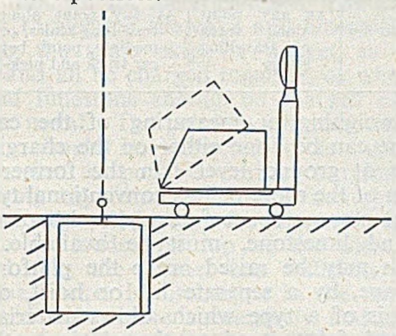


FIG. 36.—*Charge Weighing Method* (7*p*) *or* (7*q*) *as Applied to Chargers, Figs.* 14 *to* 22 *inclusive.*

Figs. 34 to 38 all show weighing methods which involve the use of some form of travelling weighing machine as distinct from the weighing being done at a fixed point as in all the cases previously described. In cases where the various metal stocks cannot all be grouped around the charger pick-up point and where each component of the charge needs to be weighed individually, a travelling weighing machine is obviously an advantage as it, itself, transports the charge materials from the stock-piles the whole, or part, of the way to the pick-up point, thus eliminating the separate handling between the stock-piles and a fixed weighing point.

Fig. 34 shows the simple case where the charging skip or bucket stands on a travelling scale car which moves along the line of stock bins and, when the charge is complete, carries it to the pick-up point. The scale platform can accommodate two skips or buckets so that an empty one can be lowered on to it and the charged one hoisted immediately. The scale car will normally have a powered drive in view of its total weight. The same principle may also be applied in the case where the buckets hang from a dial scale carried on a trolley running on an overhead monorail (similarly to Fig. 35). In this case, however, the bucket, on arrival at the pick-up point, needs to be lowered on to a support or on to the ground so that it can be disengaged from the scale and picked up by the charger hook. Due to the low total moving weight and the easier running of the trolley along the monorail, the buckets can generally be pushed along by hand. The monorail can sometimes conveniently be arranged in a loop with the stock-bins arranged inside and/or around it, so that the trolleys always move round in the one direction and a complete charge is made up at every circuit. The number of loaded buckets which can be stored in reserve with this weighing method will depend mainly on the type of charger adopted.

Figs. 35 and 36 illustrate a charge weighing method which is similar to that shown in Fig. 34 except that the charge is made up and weighed in a separate container permanently attached to the scales instead of in the charging skips or buckets themselves. The completed charge is then dropped into the charging skip or bucket which is in position for hoisting. Fig. 35 shows a monorail arrangement where the weighing container may have a tilting mechanism or be fitted with drop-bottom doors to allow the contents to be discharged readily. Fig. 36 shows the same principle applied to a travelling scale car.

With this weighing method, completed charges cannot conveniently be stored unless the hoist or charger is of a type which has removable skips or buckets and which can move them from the pick-up point to some other convenient location on ground level or on the charging platform.

In the weighing method shown in Figs. 37 and 38, the travelling scales carry the completed charge only part of the way towards the pick-up point, the remainder of the horizontal movement being performed in one of the ways described in conjunction with previous methods. Fig. 37 shows one example of this method applied to a pair of cupolas served by a skip hoist with bifurcated chute. During loading, the skip stands on a short length of rails on the platform of the travelling scale car. The car runs along the line of stock-bins until the charge is completed and then moves to the position which allows the loaded skip to run on to the rails leading to the foot of the hoist. The car then moves to the second set of rails and collects an empty skip which has previously been removed from the hoist. The scale car will normally be power driven but the skips pushed along by hand.

Fig. 38 shows a similar arrangement as applied to a radial monorail crane charger, the movement between the scale car and the pick-up point being performed, in this case, by means of gravity roller conveyor. The loaded bucket is moved from the scale car on to the lower section of conveyor while the empty bucket is lowered from the charger on to the upper section. The movement of the loaded bucket from the scale car may be assisted either by driving the rollers on the scale platform or by having idle rollers and providing a small jack under the roller track on the side remote from the cupolas.

In either of the cases just described, reserve storage of completed charges is possible within the limits of the number of skips or buckets available

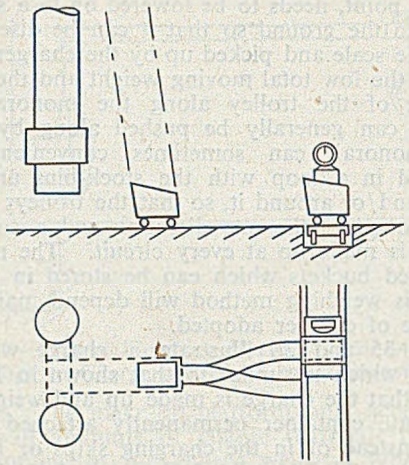


FIG. 37.—*Charge Weighing Method* (8*pa*) *or* (8*qa*) *as Applied to Hoist Fig.* 10 (*Similarly for Figs.* 9, 11, 12 *and* 13).

and the length of rails or roller track. Similar arrangements involving the use of a suspended monorail weigher can be visualised, the skips or buckets being lowered and disengaged from the scale in order to be moved to the pick-up point by one of the relevant methods.

Charging of Coke and Limestone

It is also of the highest importance in good cupola practice that the amount of coke and limestone in each charge should be carefully controlled. This is best carried out by weighing, although in many cases sufficiently good results may be obtained by measuring these materials by volume in a container of suitable size and shape which may,

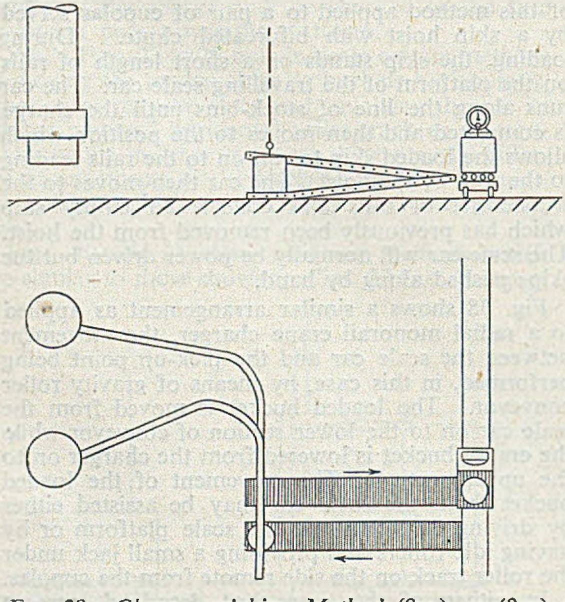


FIG. 38.—*Charge weighing Method* (8*pe*) *or* (8*qe*) *as Applied to Charger Fig.* 18. (*Similarly for Figs.* 16, 17, 19, 20, 21, *and* 22.)

in fact, be the charging skip or bucket itself. The measuring container should be filled to a marked or easily recognisable level and the weight of material corresponding to this level should be checked at regular intervals. As the total weight of coke and limestone is relatively small in proportion to the weight of metal to be melted, the handling of it does not present a problem of such magnitude. Nevertheless, with suitable arrangements, the amount of labour involved can be kept down to a minimum.

TABLE IV.—*Location of Point at Which Coke and Limestone Charges are Weighed and Fed into Charging System.*

Metal charge weighing method No.	Coke and limestone charges weighed on	
	Metal scales.	Separate scales.
1, 2 (Figs. 23 to 26)	At metal scales	At metal scales
3, 4, 5 (Figs. 27 to 33)	At metal scales	At metal scales, at pick-up point or at any intermediate point
6, 7 (Figs. 34 to 36)	At any point along track of travelling scales	
8 (Figs. 37 to 38)	At any point along track of travelling scales	At any point along track of travelling scales, or any intermediate point between scale car track and pick-up point

The weighing or measuring of the coke and limestone can be done either on the charging platform or at ground level. In the former case, a platform of the more or less conventional type, with sufficient storage space for, say, at least one day's coke and limestone, must be available. The materials may be raised on to the platform by a yard crane, by a separate lift or hoist, or if the charger is of a type which allows materials to be discharged from it on to the platform then this may be used for hoisting coke and limestone during the periods in which it is not charging the cupola. The charging procedure will normally be that the coke from the stock-pile is forked into the container in which the coke charge is to be weighed or measured, the coke then being tipped direct from this container into the cupola, limestone being dealt with similarly. An alternative method is for the measured quantities of coke and limestone to be tipped into a bucket holding a metal charge while it is momentarily stopped just below the platform during its ascending movement. If the materials are weighed then the scales can be of low capacity, compared with that required if the same scales are used both for coke and for metal, and the accuracy of weighing will be correspondingly high. If the handling arrangements are good and if the cupola is not large then the charging of coke and limestone may not be sufficient to engage the attention of one man full-time. Thus the loading of coke from the platform may be most economical in cases where the charger needs to be controlled from platform level or where there are other duties to be performed such as the adding of small amounts of ferro-alloys, the charging of skips containing completed metal charges stored in reserve on the platform, etc.

In very many cases, however, it is most satisfactory for the coke and limestone charges to be

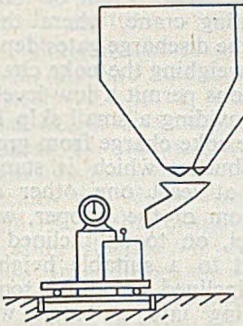


FIG. 39.—*Coke and Limestone Hoppers discharging into Charging Bucket at Fixed Weighing Point.*

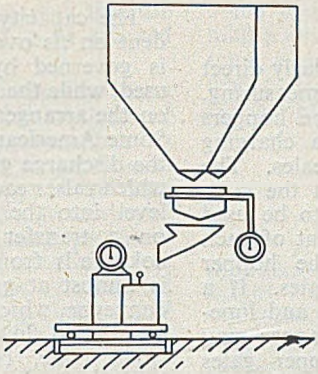


FIG. 40.—*As Fig. 39, but with the Addition of a Separate Batch-weigh Hopper for the Coke and Limestone.*

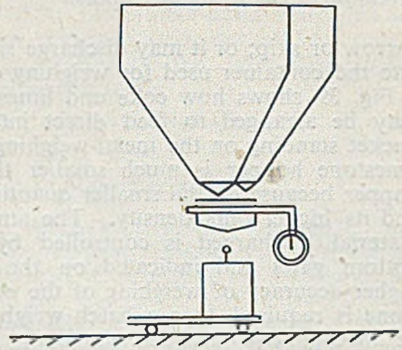


FIG. 41.—*Coke and Limestone Hoppers Located between a Fixed Metal-weighing Point and the Pick-up Point.*

weighed or measured at ground level and introduced into the cupola by means of the hoist or charger used for the metal charges. The point then arises as to whether the coke and limestone can be put into the same skip or bucket as a metal charge, and all be charged together, or whether the coke and limestone should be charged separately from the metal. The primary consideration is that the coke should be subjected to as little impact and abrasion as possible during charging. Thus when using any form of bottom-discharge bucket, it is normally satisfactory for the coke and limestone to be loaded on top of the metal charge provided that the bucket has sufficient capacity. When the bucket is discharged in the cupola, the metal and coke leave successively and the layer formation is retained in the cupola. The coke should not be placed in the bottom of the bucket as it would then be subjected to additional impact when the metal charge is loaded on top of it. The coke and limestone can, of course, be charged separately from the metal if necessary or if preferred.

With side- or top-discharge skip hoists it is generally desirable to charge the coke separately from the metal so as to avoid any abrasion of the coke by the metal as the skip is tilting and discharging, although it may not be necessary if the coke is of good quality. When coke is charged on top of metal in a skip or bucket, it is not possible accurately to assess the weight of coke in the charge by visual inspection and some form of weighing or separate measurement is virtually essential.

If it is assumed that the coke and limestone charges are to be weighed, this being the ideal method, then the weighing can be carried out either on the same scales as are used for the metal or on smaller scales where the weight of coke and limestone to be controlled is a higher proportion of the capacity of the scales and the accuracy of weighing is correspondingly higher. For instance, the weight of a limestone charge is commonly about 3 per cent. of the weight of a metal charge and thus may be only 1 per cent. of the capacity of the scales used for weighing the metal charge, particularly if the tare weight carried by the scales is high. Thus there is much to be said for the use of separate smaller scales for weighing the coke and limestone.

The location at which the coke and limestone charges are weighed and fed into the charging system depends on the metal charge weighing method and on whether the metal scales or separate scales are used for weighing these materials. If the metal scales are used then obviously the coke and limestone are fed into the system at this point, but if separate smaller scales are employed then there may be alternative weighing locations. Table IV summarises the possible locations according to the charge weighing method and scales employed.

Coke and Limestone Storage Hoppers

In the majority of foundries the normal practice is for all coke and limestone stocks (except, possibly, for relatively small quantities on the charging platform) to be on ground level with retaining walls on not more than three sides. If means can be provided for lifting coke and limestone in bulk to a relatively high level then these materials can be stored in a container with retaining walls on all sides—namely, a hopper—and can be withdrawn from the lower end for use. The hopper can be similar to the "shovel-out" type of hopper used for sand, the coke or limestone being forked or shovelled out by hand into the weighing or measuring container; it may have its outlet, controlled by a bottom gate, just above ground level so that the materials may be discharged direct into a wheel-

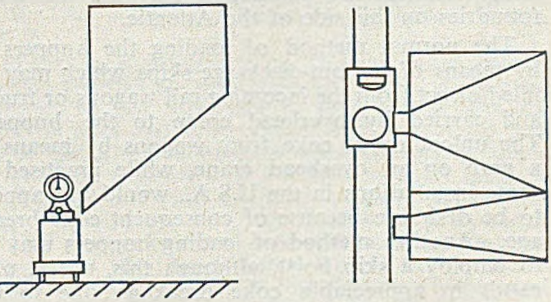


FIG. 42.—*Coke and Limestone Hoppers arranged along Track of Travelling Scales.*

Mechanical Charging of Cupolas

barrow or skip; or it may discharge similarly direct into the container used for weighing or measuring.

Fig. 39 shows how coke and limestone hoppers may be arranged to feed direct into a charging bucket standing on the metal-weighing scales. The limestone hopper is much smaller than the coke hopper because of the smaller quantity to be used and its higher bulk density. The amount of each material discharged is controlled by the hopper bottom gates and indicated on the scales. If a higher accuracy of weighing of the coke and limestone is required, then a batch weigh hopper may be incorporated between the main hopper gates and the charging bucket, as shown in Fig. 40. In this case, the weight of coke and limestone is indicated by the scales carrying the small batch weigh hopper. When the correct weight is shown, the hopper gates are closed and the bottom gates on the weigh hopper opened to allow the material to fall into the charging bucket.

While the hopper arrangement shown diagrammatically in Figs. 39 and 40 illustrates the metal charge weighing system shown in Fig. 28, similar arrangements are applicable to most weighing systems involving a fixed weighing point for the metal. The hoppers or delivery chutes may, however, interfere to some extent with the loading of metal into skips or buckets and so, in those cases where the completed metal charge needs to be moved horizontally from the metal scales to the pick-up point, it may be more convenient for the coke and limestone hoppers to be located along this line of travel, as indicated in Fig. 41. In such a case it is necessary for separate means to be provided for weighing or measuring the coke and limestone, such as the batch weigh hopper shown.

Where the metal charge is made up on a travelling scale car, the hoppers may be arranged at any convenient point along the line of travel as indicated in Fig. 42. In this case, the car moves to each of the discharge gates in turn, the weight of each material being shown on the car scale. For greater accuracy of weighing, a batch weigh hopper for the coke and limestone can be incorporated, as in previous illustrations. Coke and limestone hoppers have been used to a much greater extent in the U.S.A. than anywhere in Europe and, while they may have limitations for the average British foundry, it would certainly appear that they could usefully be developed for use in more foundries on this side of the Atlantic.

The normal method of loading the hoppers is by means of bottom-discharge skips which may be filled direct from the incoming rail wagons or trucks and carried by overhead crane to the hoppers. The unloading of coke from wagons by means of a grab on an overhead crane, while practised in some installations in the U.S.A., would not appear to be desirable because of consequent coke breakage. Another method of loading hoppers may be to employ a skip hoist, although this, again, may result in appreciable coke breakage due to the fall from the skip when the hopper is relatively empty.

The capacity of the hopper is obviously dependent on its overall height. The height of the top is governed by the loading crane, where this is used, while the height of the discharge gates depends on the arrangements for weighing the coke charges. Some American installations permit a low level for the discharge gates by providing a small skip hoist which raises each separate coke charge from ground level into the charging bucket which is standing on a transfer car. In at least one other case, coke falls from the bottom of the hopper, which is almost at ground level, on to an inclined belt conveyor which raises it to a suitable height to allow it to flow over an inclined screen, to remove small coke, before falling into a batch weigh hopper.

More information appears to be required in this country about the detailed design of coke hoppers for use in cupola charging. It would seem that there must be some relationship between the lump size of the coke, the size of the bottom gates, and the minimum controlled quantity of coke which can be discharged at one time. It may be, for instance, that when using a coke of large size, the minimum weight that can be controlled with a sufficient degree of accuracy by the bottom gates is higher than the weight of coke charge normally required by small and medium cupolas. The design

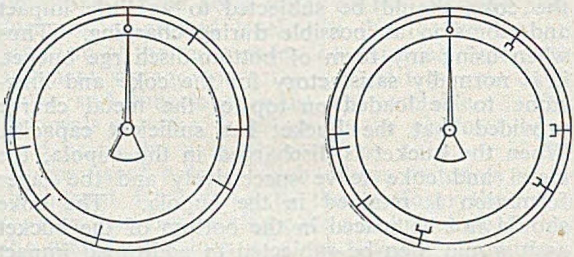


FIG. 43.—*Use of (a) Single and (b) "Tolerance" Pointers on Dial Scales for the Making-up of Cupola Charges.*

of the bottom gates should be such that the minimum of coke breakage is caused during closing. Both manual and pneumatic operation of the hopper gates is practised in the U.S.A. The bottom gates of batch weigh hoppers can, of course, be operated by hand. The sloping sides of the hoppers need to be at an angle which will result in satisfactory flow of the materials, probably at least 45 deg. to the horizontal.

Weighing Machines for Cupola Charges

The prime requirement of weighing machines for weighing metal charges is that they should be extremely robust in order to withstand the shock loads so often imposed on them. This requirement applies even more in the case of travelling scales where the mechanism needs to withstand the vibration imposed by the movement of the machine. If this robustness and reliability can only be obtained at the expense of some accuracy or sensitivity, then probably this is not a very serious matter as a high degree of accuracy, such as is required by the Weights and Measures Regulations, is not essential in the cupola. The design should be such that the knife-edges or bearings do not need to be relieved while the platform is being loaded.

Weighing machines giving their indication on a circular dial are very much preferable to those of the steelyard type. It is not to be expected that the actual weight of a number of pieces of pig iron in a charge, for instance, will be exactly the nominal weight as shown on the charge sheet; the dial type of scales will show whether the actual weight is within reasonable distance of the nominal one—an indication which is not readily obtained on steelyard scales. In addition, the dial scales are simpler and more fool-proof in operation.

Scale dials carrying an outer ring on which small pointers may be fixed in any desired positions are used to an appreciable extent. The pointers are fixed in positions to indicate the desired weight of each component of a charge to be weighed on the scales. Thus the diagram on the left-hand side of Fig. 43 indicates how the pointers might be arranged in a case where a metal charge is to be made up in a charging bucket standing on the scales, the coke and limestone charges being added on top of the metal. The seven pointers shown may, for example, reading clockwise from the zero point, indicate the desired weights of steel scrap, pig iron A, pig iron B, returned scrap, bought scrap, coke, limestone.

However, it is often not possible to ensure that the exact weight of any charge component is obtained every time and it is not reasonable to expect the man making up the charge to decide how much more or less than the nominal weight is permissible. This should be the responsibility of the technical staff. When the appropriate amounts are decided upon, they can be indicated on the scale dial as shown on the right-hand side of Fig. 43. If the case illustrated is assumed to be that mentioned in the previous paragraph, then it will be seen that the tolerance is fairly small on the weight of steel scrap and of total pig iron but that larger tolerances have been allowed as between the two grades of pig iron and as between the returned scrap and the bought scrap. The total weight of the metal charge is closely controlled so that the weight of coke and limestone may be assessed accurately also.

A further desirable characteristic in charge weighing machines is that, after each addition to the platform, the weight indication should be reached quickly but the movement should be sufficiently damped to prevent wide oscillations of the pointer. A tare adjustment to allow the pointer to read zero when an empty weighing container is standing on the platform is most desirable and in this connection the tare weights of all skips or buckets used for weighing should be made the same and checked regularly. Recording weighing machines are desirable from the points of view of costing, stock control, etc., but their use, as with other types, needs to be effectively supervised in order to prevent any abuse.

Finally, it should be pointed out that, from the point of view of all concerned with the charging of the cupola—both manual and technical staffs—the system of graduating weighing machines in multiples of 100 lb., rather than hundredweights and tons, is to be preferred and should be adopted where the co-operation of the other departments concerned can be obtained.

(To be continued)

Personal

Mr. G. R. Wester, consulting engineer, past-president of the London branch of the Institute of British Foundrymen, is at present on a business visit to Finland.

Sir John Cockcroft, director of the atomic research station at Harwell (Berks), will open a joint Dutch-Norwegian atomic pile at Kjeller (Norway) on November 26.

After 20 years' service with the Brightside Foundry & Engineering Company, Limited, Sheffield, Mr. T. J. Makin will retire from the post of secretary at the end of the year. He will be succeeded by Mr. R. Ivor Slater, assistant secretary of the company.

Mr. W. Briggs has retired after more than 40 years with Clifton & Baird, Limited, manufacturers of machine tools, Johnstone. He is to be entertained at a social gathering in the town this week, when he will receive presentations from directors of the firm and fellow-workers. Mr. Briggs is an ex-Provost of Johnstone.

Mr. A. J. Budd, development engineer of the motor engineering department of Metropolitan-Vickers Electrical Company, Limited, since 1949, has been appointed assistant superintendent of the motor department. He joined the company as a college apprentice in 1943, subsequently becoming a junior engineer on the staff of the motor engineering department.

Mr. Jean Lobstein has been promoted to the grade of Officer of Legion of Honour. Mr. Lobstein has a wide circle of friends in this country, as he presided over the International Committee of Foundry Technical Associations from 1939 to 1945. He holds the positions of honorary president of both the *Syndicat General des Fondeurs de France* and the *Association Technique de Fonderie*. Mr. E. G. Laffly, president of the light-alloy section of the *Syndicat*, has been created a *Chevalier* of the *Légion d'honneur*.

Mr. J. C. Carr, C.B.E., has been appointed to the Board of Thomas Summerson & Sons, Limited, of Darlington, on his retirement from the post of principal assistant secretary in the Ministry of Supply. After an engineering apprenticeship Mr. Carr took his degree in mathematics and entered the administrative civil service in 1912, in the then local government board. After war service he returned to the newly-formed Ministry of Health, where he was private secretary successively to Sir John Anderson, C.B., and to Sir Robert Mount, K.C.B.

In 1920 he transferred to the Treasury and in 1934 to the import duties advisory committee, where, as assistant secretary to that committee he dealt mainly with the tariff on steel and other metals, and engineering products. Since 1939 he has been in the Ministry of Supply as assistant secretary and principal assistant secretary dealing with the same group of materials, but particularly with iron and steel. He acted for a short period in 1946 as iron and steel controller, and since the termination of the iron and steel control has been concerned mainly with the nationalisation of the steel industry under the Iron and Steel Act, 1949. He was created a C.B.E. in 1949.

British Cast Iron Research Association

Annual Meeting Report

The annual general meeting of the British Cast Iron Research Association was held in London on November 14, with Dr. J. E. Hurst presiding.

After the adoption of the minutes of the previous general meetings, the chairman, presenting the Annual Report and Accounts, said the operational team had attracted considerable interest in the industry. More than 125 visits had been made, or were envisaged and plans were now in progress to strengthen the team to double the rate at which visits could be made.

For the immediate future they hoped to see a number of items completed for the year 1952, and the director had advised him that he hoped that they would be able to have them ready for the Council Members' visit which they had planned for an early date in July. Several extensions were now in progress, particularly a laboratory for chemical and spectrographic analysis, and a sands laboratory which would house the high-temperature dilatometer for sand testing. In addition stores for heavy materials would enable them to make further use of their small experimental foundry and would enable them to clear the site for an additional furnace building. Those items had been approved.

The present spectrographic laboratory was needed to house the Quantometer unit which many members would be pleased to see they were about to acquire. Assuming a sample was ready for testing, the analysis of cast iron containing five elements could be recorded by the Quantometer in one minute and ten elements in two minutes, and the time taken to estimate the elements in a bath of molten metal, including casting a test piece should be within five minutes.

The motion was seconded by Mr. R. S. Darby and the Report and Accounts were unanimously adopted.

Then followed the re-election of the president, Dr. J. E. Hurst, J.P., the vice-presidents, members of Council, *en bloc*, as well as the auditors who were commended for the services rendered.

Proposing that the warmest thanks of the meeting be accorded to the Council, committees and subcommittees for their work during the year, Mr. V. C. Faulkner said that having served for a number of years on the Council and being cognisant of the work on the average put into that task by the delegates, he was well able to voice the appreciation of the members. They were very well satisfied with the work, which had been done. Mr. F. A. Wilson seconded and the motion was carried with applause.

A vote of thanks to the chairman for presiding at the meeting was proposed by Mr. N. P. Newman and seconded by Mr. Colin Gresty.

The final item on the agenda the chairman took upon himself; it was a proposition that their sincere appreciation of the activities of the director, and his staff, should be recorded. The Association had grown enormously over the thirty years during which it had been operating. It was only necessary to refer to their operations in connection with matters like the foundry atmospheres and ventilation committee and their activities in connection with the operational research team as an indication of the enlightened work which was in hand. This proposition was supported by Mr. J. J. Sheehan and carried with applause, after Mr. Kenneth Marshall had added his tribute on behalf of the staff of the Joint Iron Council. This concluded the meeting.

A SHORTAGE OF PIG-IRON forced Bonds Foundry Company, Tow Low (Co. Durham), to give a week's notice to 60 workers.

Obituary

CHIEF DRAUGHTSMAN of Newton Chambers & Company, Limited, engineers and ironfounders, of Thorncliffe, near Sheffield, MR. COLIN A. P. COPLEY has died at the age of 71. He had been with the company for 52 years.

MR. JOHN PUNTON ANDERSON, a local director and engineering manager of Cammell Laird & Company, Limited, the Birkenhead shipbuilders, who retired three years ago after 26 years in the company's service, died recently.

MR. C. W. JONES (60) a foundry manager, of Bunns Lane, Dudley was found drowned in the river Severn near Stourport, recently. He had left his house only 24 hours before his body was found. He was an associate member of the Institute of British Foundrymen having joined in 1946.

MR. ARTHUR ATHERTON, aged 69, vice-chairman of Herbert Morris & Company, Limited, lifting machinery engineers, Loughborough, died on November 14. He had been associated with the firm since 1905, and opened the firm's first branch office at Manchester; later he became responsible for other branches in England and agencies abroad. In 1949 he was elected vice-chairman of the Company.

THE DEATH is announced in his 71st year, after a brief illness, of MR. F. M. SELSON, who had been managing director of the Selson Machine Tool Company, Limited, since 1938. He died suddenly on November 7, 1951. In consequence, Mr. D. W. Cooper has now been appointed managing director, and Mr. J. Simpson, who is a director, will discharge the duties of general manager. Mr. Cyril M. Cohen remains chairman.

MR. G. C. WILSON, who has died, aged 80, in hospital at Haddington, was well known in the Scottish ironfounding trade. He was a former managing director of Carmuirs Iron Company, Limited, Falkirk, and a director of the firm until his death. When he retired in 1947 from active duty as managing director, he took up residence at Yarrow Dene, North Berwick. A native of Falkirk, he entered the service of Carmuirs Iron Company in 1899. For many years he was the firm's traveller until he became managing director. His son is at present managing director of the firm.

Woodworking Machinery in United States

Mr. F. Wood, works manager for Metalclad, Limited, sawmill engineers, of Leeds, has recently arrived back in this country from America, where he has been acting as secretary to a productivity team of woodworking-machinery engineers. He said the team visited manufacturing plants of "varying efficiency" in the United States; where productivity was higher than in this country was largely in plants laid out for mass production and catering for a huge market. Commenting on conditions generally in the United States Mr. Wood said the cost of meat in that country was so high that it was virtually rationed by price—a nice piece of steak cost around 12s. a lb. Margarine was also displacing butter, not only in the homes of artisans, but of factory executives. Although in the view of the Americans meat and butter were expensive, Mr. Wood was inclined to consider prices not prohibitive when compared with the earning capacity of the U.S. workers, who enjoyed a higher standard of living than workers did here. Nevertheless, Mr. Wood said it was a fact that more American married women went out to work and many Americans had two jobs so as to expedite the acquisition of such things as refrigerators, television sets, and motor-cars on hire-purchase terms.

Joint Iron Council Annual Dinner*

FOLLOWING its annual convention in the afternoon, the members of the Joint Iron Council and their many distinguished guests assembled for the annual dinner in the evening of November 13 at the Dorchester Hotel, London, under the presidency of Mr. F. Scopes.

Following the Loyal Toast, MR. N. P. NEWMAN (vice-president of the Council) said the guest of honour was Sir Archibald Forbes, president of the Federation of British Industries, who had been chairman of what was formerly the Iron and Steel Board. He had to say "what was," although it might be "what is." Another welcome guest was Mr. A. C. Boddis, the secretary of the former Iron and Steel Board, and who had now retired from the Civil Service. It was a matter for regret that Sir Leonard Browett, the director of the National Union of Manufacturers, was unable to be present on that occasion. On the other hand, it was a pleasure to welcome Mr. C. F. V. Williams as representing the N.U.M.

Speaking of the other guests in groups, Mr. Newman mentioned those from the United States; the representatives of other organisations in the foundry industry; those of the steel industry and, finally, representatives of His Majesty's Government, of whom there were five present on that occasion, including Sir Wavell Wakefield, who was also on the executive of the N.U.M.

SIR W. WAVELL WAKEFIELD, M.P., whose name was coupled with the toast, responded on behalf of the visitors, saying that he had read with very great interest the seventh annual report of the executive of the J.I.C., which the director had kindly sent him, and it had impressed him as being really full of life. He was sorry that it was marked "Confidential: Not for Publication," for he hoped that the Council would see to it that certain parts of it at any rate might be given the widest possible publicity. He had been particularly interested in the statement on the work of the Development Panel. The idea had grown up that the making of profits was something of a shady business, that the word "profits" should not be mentioned except in a guarded undertone. Indeed, in far too many people's minds, profits were linked with black-market racketeering, low wages and sweated labour, instead of with good housing, progress and prosperity. It did not seem to be sufficiently realised that in a free economy, when a business was badly managed, the results would be low wages and costly products, as well as a loss, or at best, a small profit. Sir Wavell, concluding, reiterated his thanks to the J.I.C. for its generous hospitality to its guests.

"Joint Iron Council"

SIR ARCHIBALD FORBES, who proposed "The Joint Iron Council," said the development of British industry as a whole had been hampered in recent times by shortages, not only of raw materials, but also of such essential services as fuel, power and transport. That situation, therefore, was not unique so far as the iron-making and ironfounding industries were concerned. Coming back to their own particular difficulties, he felt there was some danger of a misconception in the uninitiated mind about the inter-relationship of pig-iron and scrap. Before the war this country had had to import, in support of the lean ores which were found here, some of the rich iron-bearing ores from abroad, or scrap; in those days, large quantities of scrap were obtainable. During the period immediately following the war it had been possible to obtain very substantial quantities of scrap from Germany. But looking to the future, in his judgment it would be unwise to plan upon any basis other than that the iron-using industries of this country should look for supplies of iron manufactured in this country, plus internal supplies of scrap.

Fundamental Weakness

Increased capacity for the manufacture of pig-iron and, indeed, any development in regard to ironfounding or steelmaking, brought us back to the most fundamental weakness in this country's economy to-day, and that was the failure sufficiently to increase the output of the one raw material which lay to our hand; that was coal. An increase of coal production was absolutely fundamental, not only for the maintenance of a high standard of industrial activity in this country, but also to assist to redress the adverse balance of overseas trade by enabling us to pay for imports of essential raw materials and foodstuffs. One was interested to note from the Council's annual report that the output of iron castings in the first six months of this year had reached an all-time record; and Sir Archibald congratulated the foundry side of the industry. He was extremely glad to see from the Report that development and modernisation was still proceeding steadily in the foundry industry, and he was equally glad to see that attention was still being given to the provision of amenities and to the improvement of conditions of working.

Expressing hearty agreement with Sir Wavell Wakefield concerning the need for education in regard to profits, Sir Archibald emphasised that education should begin at home. There was too much in the way of a desire to show large transfers to reserve after allowance for taxation and reasonable dividends. Nothing could be more harmful to industry in these times.

The PRESIDENT (Mr. F. Scopes) responded on behalf of the executive committee of the J.I.C. and of all the members, who were well represented on that occasion. He thanked Sir Archibald sincerely for the toast he had proposed, for the way in which he had proposed it and for his confidence in the J.I.C., which they hoped to continue to justify. As Sir Archibald had said, somehow they must find a way of lifting iron and steel out of the arena of political controversy, and he appealed to all of them to use their united efforts in industry and as citizens to ensure that end.

Speaking of the all-time record output of the castings industry, on which Sir Archibald had expressed congratulations, and on which the president extended his personal congratulations to all concerned, he said the figures were not received with quite the enthusiasm which might have been evidenced if they had felt that the supply of raw materials made it likely that they would be able to maintain and improve on that record.

SAMUEL OSBORN & COMPANY, LIMITED, Clyde Steel Works, Sheffield, announce the following appointments to the board of directors:—Mr. L. Halpin, who has been with the company for over 30 years. For 15 years he represented the company travelling extensively in Spain, Portugal, South America, and the United Kingdom. In 1944 he became sales manager and in January, 1951, was appointed a local director. Mr. J. H. Osborn, elder son of the late Mr. S. E. Osborn, was educated at Rugby and Cambridge and, after serving overseas with H.M. Forces, joined the company in 1947. He became a local director in January, 1951, and is also a director of the Osborn Foundry & Engineering Company, Limited.

* Briefly reported in last week's issue.

Saving Scarce Materials

Institute of Metals Discussion

ANXIETY HAS LONG BEEN SHOWN for the increasing cry of shortages of certain metals and the need to find substitutes. During an introductory address, at a one-day discussion on "Metal Economics" sponsored by the Institute of Metals last month, the president of the Institute, Prof. A. J. MURPHY, said that there are two major questions to be answered:—What quantity of workable resources remains untapped and what are the prospects of the rate of winning metals from the earth (and the sea) keeping pace with the soaring demands? There are those who believe that there will be a critical shortage among the common metals of today so that lead, zinc and copper are destined to move into the category of relatively-scarce elements, whereas metals such as iron, aluminium, magnesium and, perhaps, titanium will last much longer. However, others do not foresee the exhaustion of our staple metals but believe that under normal peace conditions the ordinary price mechanism will provide the incentive for mineral exploration and the exploration of new sources and improved processes of extraction of metal. It is important for the metallurgical industry of today to arrive at a sound appraisal of the forces influencing the future trend of supply and demand of the basic metals. Both the technical and theoretical metallurgist must be prepared to forecast the useful compositions and treatments of unfamiliar alloys which are likely to be available when perhaps better-known materials have become scarce and unobtainable in the desired quantities. The problem, Prof. Murphy said, can be expressed in the form of three questions:—(1) What can we do to improve our supplies? (2) How can we make better use of what we have? (3) What substitutes can we use?

Substitute Alloys

MR. A. SIDERY (Ministry of Supply), reading a Paper on "The Scope for Conservation of Metals, Ferrous and Non-ferrous," by C. A. Bristow, Dr. H. Sutton and himself, claimed that the economic production in the metals industry calls for the closest collaboration between designer, production engineer, and metallurgist.

As regards the choice of alloy, experience gained during the last World War in the use of low-alloy steels should, he believed, assist greatly with progress of their utilisation now. These steels in view of the availability of the different ferro-alloy additions will certainly help to relieve the difficult position of some metal markets. The use of low-tungsten high-speed steel is a notable example. The value of titanium as a stabiliser together with the practicability and efficacy of low carbon content are well recognised by metallurgists but possibly not sufficiently appreciated by engineers. Titanium is about 65 times as abundant as copper in the earth's crust. It possesses good corrosion resistance and general mechanical properties and many of its alloys possess properties comparable with those of high-tensile steels. Production is increasing rapidly in America where important research work is well advanced. In view of the limited availability of niobium, it is important that this metal should be used only in essential applications such as special types of heat-resisting steels and alloys, and of welding materials. In the gas-turbine field, substantial economies have already been achieved in alloying metals by the use of ferritic materials for discs.

Influence of Specifications

The influence of specification and design on productivity and the economic utilisation of metals was the subject of a paper by MR. F. HUDSON (Mond Nickel Company, Limited). Maximum productivity, in conjunction with the most efficient use of available raw materials, can be obtained only by careful consideration of the greater use of simplification, standardisation and specialisation methods so that manufacturing operations can be properly planned. It should be endeavoured to plan production so that a minimum number of standard metals and alloys is required per day. He gave as an example the British Standard 970:1947 for wrought steels in which 137 different steels are listed. Are all of these really necessary? Users of metal articles should also endeavour to simplify their requirements. While it is not always possible to reduce the variety of finished products, many components making up the whole can often be made identical.

Further factors important in obtaining increased productivity with limited metal supply are design and quantity control. Specification details are based on the quality of the metal in a test-bar which is of limited value to the engineer in designing a structure composed of rolled, forged, stamped or cast components. Mr. Hudson spoke of the need, for example, for greater attention to be given to the quality of castings and for research on the relation between test-bar and casting. Designers and engineers to-day appreciate that neither integral, nor separately-cast test-bars, normally exhibit mechanical properties representative of the casting. In many instances the properties of castings are below those obtained from test-bars. When designing castings the engineer therefore increases section to ensure an adequate factor of safety. This obviously increases the weight of the casting and the amount of metal required. The production of castings of highest quality, and of known properties, will enable designers to reduce both section and weight, and lead to a substantial economy in the use of metal.

Where design, production and supply conditions permit, consideration could usefully be given to the greater use of high-strength alloys for the production of wrought and cast articles for the purpose of reducing weight and the amount of metal required.

(Continued on page 610)

Saving Scarce Materials

General Comments

Opening the discussion, Prof. W. R. Jones (retired professor of geology, Royal School of Mines) referred to the misinterpretation of the term "mineral reserves." There are many mines, he said, which 50 years ago had foresaw only four or five years' supply of ore but which have been in constant operation for 50 years and still have mineral reserves for five years, some even longer. He also reported that extensive progress had been made in developing the high-grade iron ore around Quebec.

Some conclusions of the recent meeting of the Joint Sub-committee on the Utilisation of Manganese, Nickel, Cobalt, Tungsten and Molybdenum were reported by Mr. E. H. Bucknall (Mond Nickel Company, Limited), who is the chairman. Ore reserves now being worked, at the rate of present-day working, will not supply sufficient metal to satisfy demand. This is becoming more evident every year and probably the most effective means of increasing availability of these metals was by improved scrap salvage. Return of scrap to the original producers of the material, the committee felt, is the most efficient means of recovery and in the shortest time. Also, consideration should be given to the possibility of limiting the use of certain metals in circumstances where they become completely unsalvable.

In his contribution to the discussion, Mr. G. L. Bailey (British Non-Ferrous Metals Research Association) thought the question of substitute metals should be divided into two parts:—(1) Substitution on a long-range basis, *i.e.*, certain metals will become more plentiful with consequent effect on the price factor and will, possibly, permanently replace certain other metals which are in use at the present time, and (2) substitution on a short-range basis in which a temporary replacement is considered.

Much caution in economic arguments should be shown by metallurgists thought Mr. D. A. Oliver (B.S.A. Research Centre), who had little confidence in statistics. He endorsed the statements of Mr. Sidery's paper that close collaboration between designer, production engineer and metallurgist is necessary for economic use of metal. The oxygen-lance technique in the production of steel was saving considerable quantities of alloying elements, which were lost in the old methods.

Dr. U. R. Evans (University of Cambridge) showed concern at the control of the use of some non-ferrous metals as protective coatings of steel for corrosion resistance. He believed that greater care with choice and application of protective coatings, whether metallic or non-metallic, would contribute to metal conservation, and is as important as the proposed organisation of the return of scrap.

Extensive damage was caused by fire on November 16 to the premises of Primrose & Company, Limited, ironfounders, 52, Jane Street, Leith. A large area of the roof of the new core shop was burned and extensive damage was caused to the patternshop. Outbreak was under control within an hour. Arrangements have been made to continue with business as usual.

News in Brief

The Daily Mail Ideal Home Exhibition of 1952 will be held at Olympia from March 4 to 29.

British Tyre & Rubber Company, Limited, announce the appointment of Mr. P. W. Howard as managing director.

The British Standards Institution has recently published B.S.1785:1951, Thermal insulating materials for buildings, price 2s. 6d.

Busby Bros., engineers and patternmakers, of Blaby, Leics, are to build a single-storey factory of 2,000 sq. ft. floor space, in Leicester Road, Lutterworth, Leics, and on completion of the new factory the Blaby works will be closed.

Mr. J. Hill, mechanisation superintendent at Ley's Malleable Castings Company, Limited, Derby, gave a lecture to 30 members of the Derby section of the National Trades Technical Societies, entitled "Some Aspects of Foundry Mechanisation."

Sixty-four students gained prizes at the Stanton Ironworks Company's annual prize distribution, on November 10. These were presented by Mr. F. Bray (permanent under-secretary to the Ministry of Education). The training officer, Mr. W. S. Matthews, reported that the past year had been a record for students' successes.

The British Aluminium Company, Limited, announce that the former offices of this company have now been de-requisitioned by the Government and that, as from December 1, 1951, all correspondence should be addressed to Norfolk House, St. James's Square, London, S.W.1 (Telephone number: Whitehall 7868. Telegraphic address: "Britalumin, Piccy, London").

An installation has been made at the Ohio State University which is claimed to be the most modern sand preparation and distribution system of any university foundry laboratory. The system, to be used in conjunction with several modern moulding machines, is valued at $70,000, and was given to Ohio State's foundry laboratory by 20 industrial firms in five states.

At Leeds Assizes, last week, a Bradford workman, Joseph Watts, failed in his claim for damages for the loss of an eye against his employers, Enfield Rolling Mills (Aluminium), Limited, Bowling Back Lane, Bradford. Breach of statutory duty and negligence was alleged. On Watt's behalf, it was stated that he had been employed by the Company since May, 1948, as an aircraft stripper, his work entailing the dismantling and breaking up of old aircraft engines. While Watts was dismantling an engine in April, 1950, a particle of metal flew off and struck him, necessitating the removal of an eye in hospital. The breach of duty alleged was that the firm failed to provide goggles or a protective screen. Judgment was given for the Company with costs.

A colour film showing the wide selection of tools which are produced in their Speedicut works, has been prepared by the staff of the Brown-Firth Research Laboratories. Brief glimpses are given of the manufacture and heat-treatment of a variety of their products, with particular reference to the increasing demand for high-speed cutting tools including all types of saws, shear blades, cutting knives, chisel cut files, and drills. A short length of the film deals with the production of the hard-metals division where Mitia tool tips are manufactured. The film concludes with examples of the use of the products in industry. Features of interest to foundrymen are dust-extraction from incoming air for the workshops, the multiple machining operations with tipped tools on cylinder-head castings and the 100 per cent. inspection to which the products are subjected.

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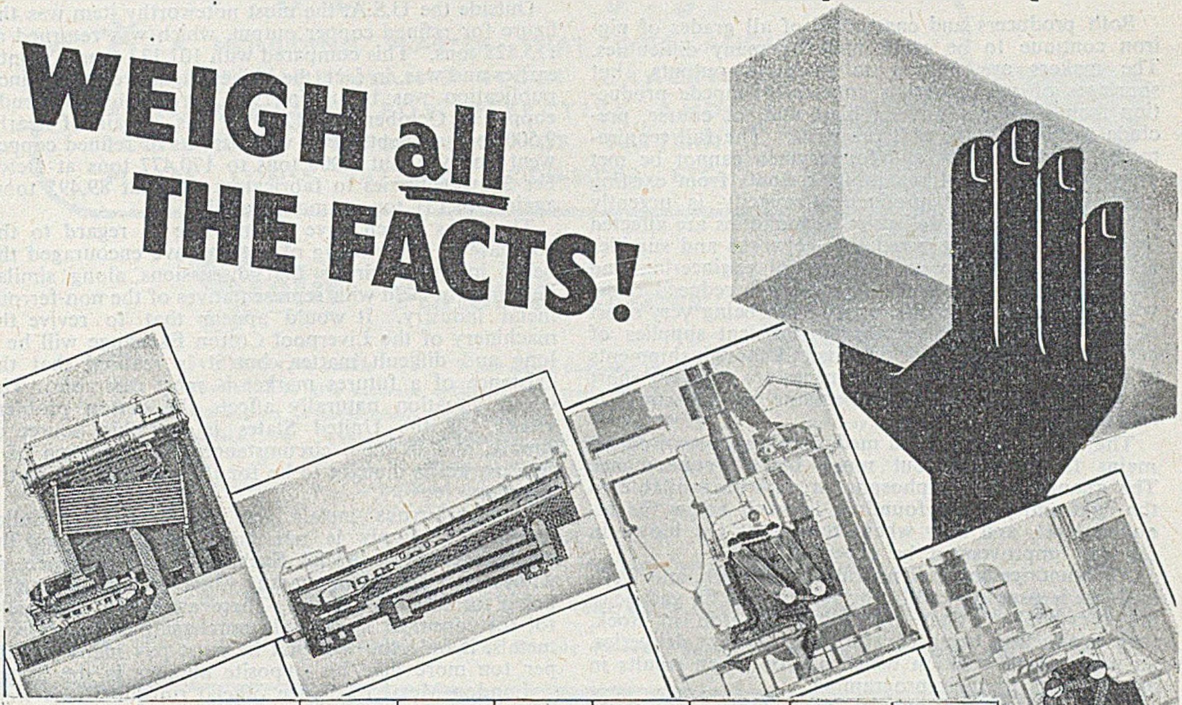

CHEMICAL ANALYSIS	Glenboig "A1"	Glenboig "A1" Crown	Glenboig	Glenboig Crown	Castlecary	Dykehead	Gem
Silica (SiO_2)	52·36%	52·36%	57·32%	57·32%	57·93%	58·49%	60·28%
Titanic Oxide (TiO_2)	1·24%	1·24%	1·15%	1·15%	0·88%	0·98%	1·04%
Alumina (Al_2O_3)	42·52%	42·52%	37·08%	37·08%	37·24%	36·28%	34·38%
Ferric Oxide (Fe_2O_3)	2·27%	2·27%	2·56%	2·56%	2·04%	2·34%	2·42%
Magnesia (MgO)	0·20%	0·20%	0·22%	0·22%	0·10%	0·13%	0·18%
Lime (CaO)	0·56%	0·56%	0·58%	0·58%	0·56%	0·62%	0·58%
Alkalies (Na_2O, K_2O)	0·60%	0·60%	0·98%	0·98%	0·90%	1·06%	0·94%

PHYSICAL PROPERTIES

Refractoriness	Seger Cone 34 (1750°C)	Seger Cone 34 (1750°C)	Seger Cone 32/33 (1720°C)	Seger Cone 32/33 (1720°C)	Seger Cone 32/33 (1720°C)	Seger Cone 31/32 (1700°C)	Seger Cone 31/32 (1700°C)
Refractoriness U/L of 2 kilos/sq. cm.	1630°C	1610°C	1610°C	1580°C	1600°C	1580°C	1580°C
Refractoriness U/L of 50 lb./sq. in.	1580°C	1530°C	1530°C	1510°C	1520°C	1510°C	1510°C
Thermal (Reversible) Expansion—mean co-efficient X 10.⁵	0.568	0.522	0.584	0.540	0.562	0·624	0.623
Porosity—Total Percentage by Volume	18/20	24/26	18/20	24/25	16/20	16 18	16 20

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Raw Material Markets

Iron and Steel

Both producers and consumers of all grades of pig-iron continue to be confronted by many difficulties. The makers are striving to maintain outputs, but shortages of raw materials constantly impede production from furnaces now in blast and, of course, preclude the blowing in of fresh units. The full requirements of steelmakers and foundrymen cannot be met even on the basis of maximum outputs from existing units, and increased productive capacity is urgently needed. At present, deliveries to foundries are affected by the priority being given to steelworks and supplies of hematite pig-iron to the general engineering and speciality foundries are thus on a much reduced scale, while refined-iron makers, apart from being very short of scrap, are unable to obtain sufficient supplies of hematite to increase their outputs. Although shipments of ore have improved, some furnaces are still very short of supplies, and outputs of hematite are consequently restricted.

The supply of low- and medium-phosphorus iron remains fairly steady, but much below requirements. The quantity of high-phosphorus pig-iron available to the light and jobbing foundries is much below the required level, and only when fresh units are blown in can any improvement be expected.

All foundries are well provided with work, and fresh business is usually readily forthcoming to fill vacancies in order-books. They have little pig-iron in stock, their production being dependent on current deliveries, an unfortunate position which all too often results in interruptions to their programme.

Foundry coke continues to come forward regularly and in sufficient quantities for immediate needs, but there is little opportunity to augment stocks, which are generally not up to the permitted quantity. Under the winter allocations, provision is made for up to two weeks' stock at the end of April next based on the winter rate of consumption.

Heavy demands are made for cupola scrap in both cast iron and steel, but supplies are insufficient to satisfy all requests. Full supplies of ganister, limestone, and firebricks are available. Users of ferro-alloys are generally able to secure their requirements without delay.

Prospects of the re-rollers show no improvement, operations continuing to be seriously affected by shortage of steel. Practically all mills are working short time. Re-rollers of sections, bars, and strip are severely hit by shortage of billets, blooms and slabs, particularly the smaller sizes of billets, while re-rollers of sheets badly need increased supplies of sheet bars. Home supplies of prime steel semis are totally inadequate to meet present needs, and the reduced production at the steelworks inevitably cuts the arisings of defectives and crops.

An Order increasing the price of spiegeleisen from £18 15s. 9d. to £22 a ton came into effect on Monday.

Non-ferrous Metals

From New York come details of the world's activities in copper during October, the figures being shown separately for the United States and countries outside the U.S.A. As usual, the information is supplied in short tons of 2,000 lb. Crude copper output in the U.S. in October was 87,824 tons, against 74,165 tons in September, while refined copper production rose to 104,148 tons in October from 74,354 tons in the previous month. Deliveries of refined copper to American domestic consumers amounted to 125,286 tons, compared with 121,629 tons. Stocks of refined copper in producers' hands rather surprisingly increased from 62,093 tons at the end of September to 78,192 tons at October 31.

Outside the U.S.A. the most noteworthy item was the figure for refined copper output, which was returned at 115,825 tons. This compared with 101,133 tons a month earlier and was, in fact, the highest figure recorded since publication was begun in 1947. Production of crude copper in October was 122,970 tons, a gain of nearly 9,500 tons on September, while stocks of refined copper went up by about 7,000 tons to 170,477 tons at October 31. Deliveries to fabricators stood at 89,495 tons, against 74,131 tons a month earlier.

The talks which have taken place in regard to the purchase and marketing of cotton have encouraged the belief in metal circles that discussions along similar lines may be held with representatives of the non-ferrous metal industry. It would appear that to revive the machinery of the Liverpool Cotton Exchange will be a long and difficult matter, but it is realised that the existence of a futures market is most desirable. The dollar situation naturally affects the cotton problem vitally, for the United States is our chief source of supply, and in these circumstances the operation of a free market is thought to be for the moment out of the question.

In non-ferrous metals our dependence on dollar sources of supply is not nearly so marked and the machinery of the Metal Exchange is in existence, as witness the active tin market which has now been in being for fully two years. There are many drawbacks for the consumer in the bulk purchasing of non-ferrous metals, if only the fact that he must pay many pounds per ton more than his opposite number in the States.

London Metal Exchange official tin quotations were as follow:—

Cash—Thursday, £990 to £1,000; Friday, £997 10s. to £1,000; Monday, £990 to £995; Tuesday, £990 to £995; Wednesday, £995 to £1,000.

Three Months—Thursday, £960 to £965; Friday, £960 to 965; Monday, £952 10s. to £957 10s.; Tuesday, £955 to £957 10s.; Wednesday, £957 10s. to £962 10s.

Copper and Zinc Ban Extended

The Minister of Supply, Mr. Duncan Sandys, has made a new Order extending the list of articles in which the use of copper, zinc, and their alloys is banned. The Order, which came into effect on Tuesday, covers goods in the following categories, as well as a number of miscellaneous articles:—

Agricultural and garden requisites; electrical and gas equipment and fittings; builders' hardware and fittings; furniture and equipment; household appliances; equipment in passenger transport vehicles; and air conditioning equipment.

The additions to the prohibited list take account of the agreement made by O.E.E.C. member countries to prohibit the manufacture of articles containing these metals in order to conserve them for rearmament purposes.

Manufacturers holding copper or zinc or their alloys in a fabricated or partly processed state at the date of the Order will be allowed to use them until February 1, next year, for the manufacture of articles which have now been added to the prohibited list.

The existing arrangements for licensing for exports will apply to these additional articles, except that in the future, no licences will be issued for the manufacture of the prohibited items for export to other O.E.E.C. member countries.

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

(Delivered, unless otherwise stated)

November 21, 1951

PIG-IRON

Foundry Iron.—No. 3 Iron, Class 2:—Middlesbrough, £11 10s.; Birmingham, £11 4s. 6d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £13 0s. 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, £13 12s. 3d.

Scotch Iron.—No. 3 foundry, £13 1s., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £15 7s.; South Zone, £15 9s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £15 17s.; South Zone, £15 19s. 6d.

Cold Blast.—South Staffs, £17 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, £12 17s.; Scotland (Scotch iron), £13 3s. 6d.; Sheffield, £13 13s. 6d.; Birmingham, £14 0s. 6d.; Wales (Welsh iron), £13 3s. 6d.

Spiegeleisen.—20 per cent. Mn, £22.

Basic Pig-iron.—£11 15s. 6d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered.)

Ferro-silicon (6-ton lots).—40/55 per cent., £40 15s., basis 45% Si, scale 15s. 6d. per unit; 70/84 per cent., £56 2s. 6d., basis 75% Si, scale 16s. per unit.

Silicon Briquettes (5-ton lots and over).—2lb. Si, £48 5s.; 1lb. Si, £49 5s.

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

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

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

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

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

Ferro-chrome (6-ton lots).—4/6 per cent C, £74, basis 60% Cr, scale 24s. 6d. per unit; 6/8 per cent. C, £70, basis 60% Cr, scale 23s. 3d. per unit; max. 2 per cent. C, 1s. 8¼d. per lb. Cr; max. 1 per cent. C, 1s. 8¾d. per lb. Cr; max. 0.15 per cent. C, 1s. 9½d. per lb. Cr.; max. 0.10 per cent. C, 1s. 9¾d. per lb. Cr.

Chromium Briquettes (5-ton lots and over).—1 lb. Cr, £78 9s.

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

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

Ferro-manganese (blast-furnace). — 78 per cent., £40 8s. 9d.

Manganese Briquettes (5-ton lots and over).—2lb. Mn, £50 6s. 6d.

Metallic Manganese.—96/98 per cent., carbon-free, £215 per ton.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—Basic: Soft, u.t., £21 11s. 6d.; tested, 0 08 to 0.25 per cent. C (100-ton lots), £22 1s. 6d.; hard (0.42 to 0.60 per cent. C), £23 19s.; silico-manganese, £29 15s.; free-cutting, £24 15s. 6d. Siemens Martin Acid: Up to 0.25 per cent. C, £27 16s.; case-hardening, £28 4s.: silico-manganese, £30 16s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £25 15s.; basic, hard, over 0.41 up to 0.60 per cent. C, £26 15s.; acid, up to 0.25 per cent. C, £28 4s.

Sheet and Tinplate Bars.—£21 16s.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £25 6s. 6d.; boiler plates (N.-E. Coast), £26 14s.; chequer plates (N.-E. Coast), £26 15s. 6d.; heavy joists, sections, and bars (angle basis), N.-E. Coast, £23 15s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested. £27 11s.; flats, 5 in. wide and under, £27 11s.; hoop and strip, £28 6s.; black sheets, 17/20 g., £35 15s. 6d.; galvanised corrugated sheets, 17/20 g., £49 18s. 6d.

Alloy Steel Bars.—1-in. dia. and up: Nickel, £44 17s. 3d.; nickel-chrome, £65 2s. 9d.; nickel-chrome-molybdenum, £72 10s. 3d.

Tinplates.—52s. 1½d. per basis box.

NON-FERROUS METALS

Copper.—Electrolytic, £227; high-grade fire-refined, £226 10s.; fire-refined of not less than 99.7 per cent., £226; ditto, 99.2 per cent., £225 10s.; black hot-rolled wire rods, £236 12s. 6d.

Tin.—Cash, £995 to £1,000; three months, £957 10s. to £962 10s.: settlement, £1,000.

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

Lead.—Good soft pig-lead (foreign) (duty paid), £175; ditto (Empire and domestic), £175; "English," £176 10s.

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

Other Metals.—Aluminium, ingots, £124; antimony, English, 99 per cent., £365; quicksilver, ex warehouse, £73 10s. to £73 15s.; nickel, £454.

Brass.—Solid-drawn tubes, 25d. per lb.; rods, drawn, 32⅞d.; sheets to 10 w.g., 29⅝d.; wire, 31¼d., rolled metal, 28⅜d.

Copper Tubes, etc.—Solid-drawn tubes, 26d. per lb.; wire, 254s. 9d. per cwt. basis; 20 s.w.g., 281s. 9d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £250 to £280; BS. 1400—LG3—1 (86/7/5/2), £260 to £300: BS. 1400—G1—1 (88/10/2), £330 to £360; Admiralty GM (88/10/2), virgin quality, £330 to £360 per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £340 to £370; L.P.Bl, £295 to £315 per ton.

Phosphor Bronze.—Strip, 38¼d. per lb.; sheets to 10 w.g., 40⅜d.; wire, 42¾d.; rods, 38d.; tubes, 36¼d.; chill cast bars: solids 4s., cored 4s. 1d. (C. Clifford & Son, Limited.)

Nickel Silver, etc.—Ingots for raising, 2s. 7d. per lb. (7%) to 3s. 6¾d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 3s. 1d. (7%) to 4s. 0¾d. (30%); to 12 in. wide × .056, 3s. 1¼d. to 4s. 1d.; to 25 in. wide × .056, 3s. 3¼d. to 4s. 3d. Spoon and fork metal, unsheared, 2s. 10d. to 3s. 9¾d. Wire, 10g., in coils, 3s. 6¼d. (10%) to 4s. 6⅝d. (30%). Special quality turning rod, 10%, 3s. 5¾d.; 15%, 3s. 10½d.; 18%, 4s. 2¾d. All prices are net.