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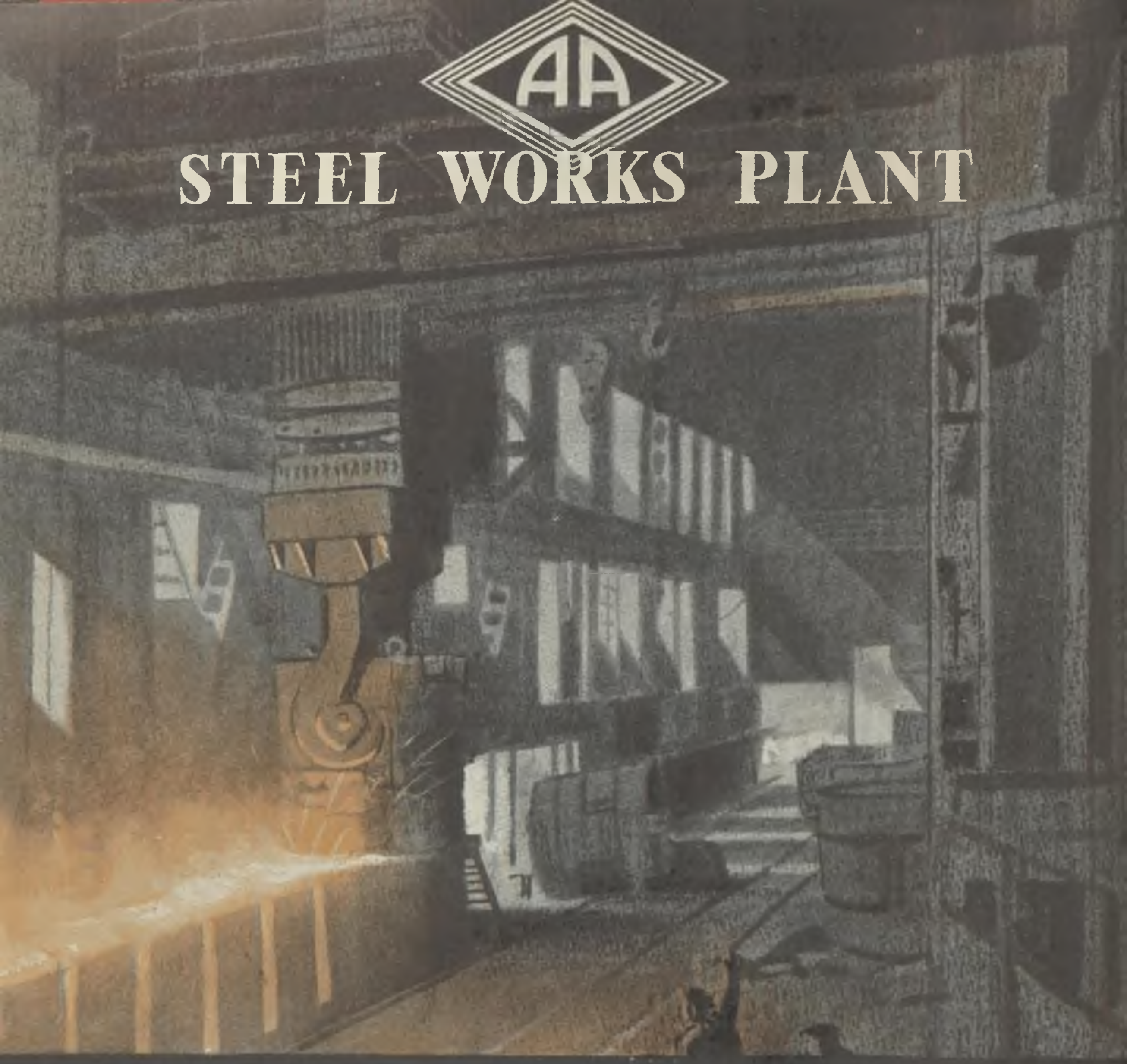
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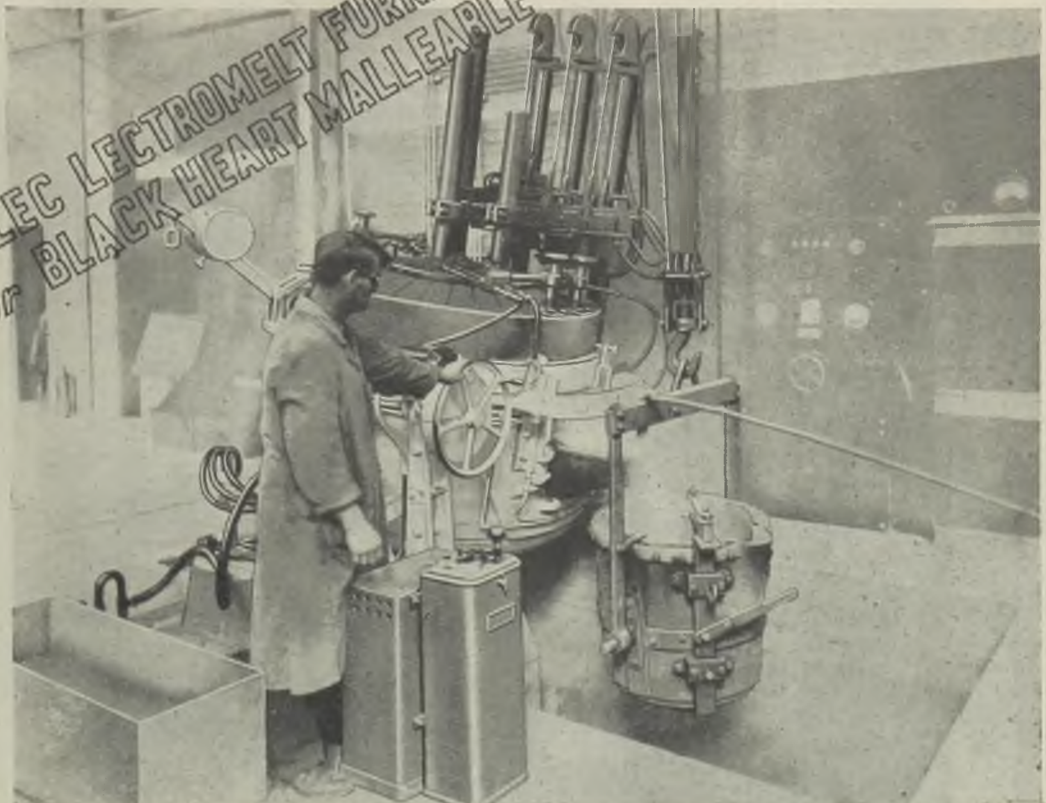

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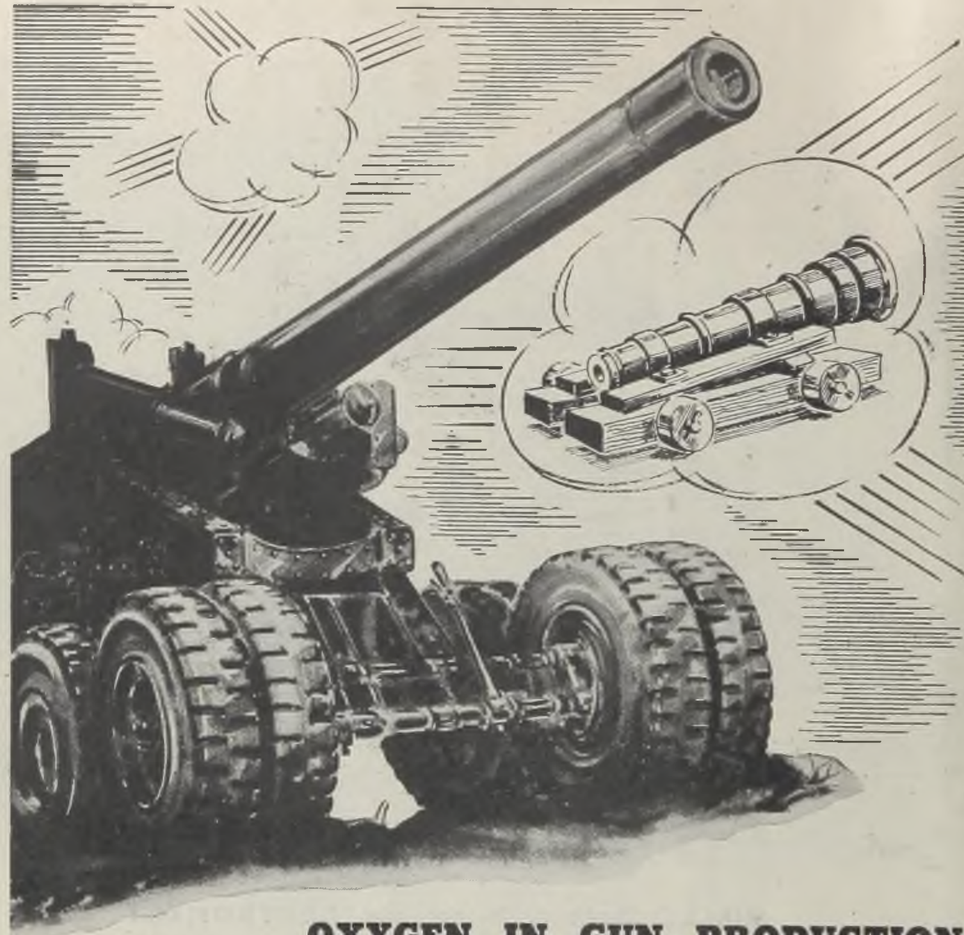

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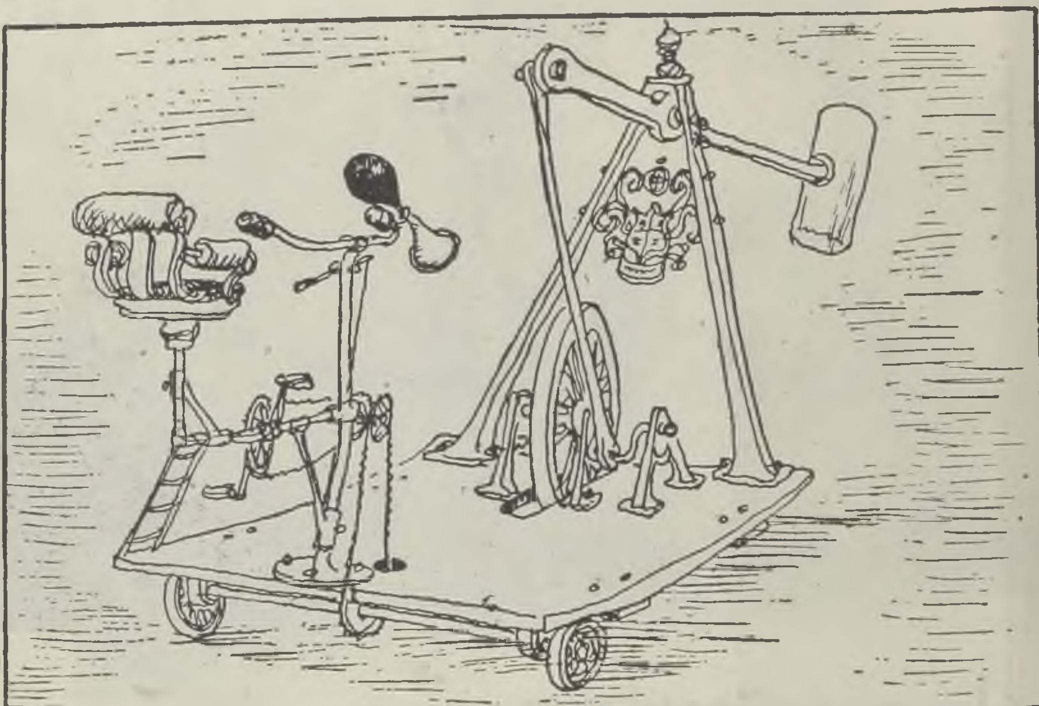

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A Splendid Lead

Whether Birmid Industries, Limited, have been a little premature in the launching of a cut-and-dried apprenticeship scheme is debatable, in view of the general changes as envisaged by the Education Bill now before the House of Lords. The scheme is set out in a well-illustrated brochure from which all wartime activities have been specifically excluded. There are many features in the scheme, which is based on a five-year period, of a wholly satisfactory character. Outstanding amongst these is a flexibility which allows the "bright" apprentice not to end by being a tradesman, but a technician qualified to occupy the most prominent position on the executive staff. By limiting the dates of entry to three fixed times each year, an attempt is made initially to stagger holidays and to facilitate the actual organisation of the shops.

Because Birmid Industries is to-day such a very large organisation, it can offer a wide range of trades and executive positions. It has already made arrangements with the Smethwick Municipal School to give the necessary theoretical instruction. The scheme envisaged is essentially a sandwich course, embracing three terms, two of which are spent in the works and one at school, where a thirty-hour week technical course is to be provided. This will enable cultural activities to be undertaken and, what is to our mind most important, to enable evening class study to be undertaken throughout the period. It presents an ideal means for determining which apprentices are suitable for receiving specialised training and which can be safely regarded as being the makings of good craftsmen. The legal agreement, which is set out in the brochure, is couched in terms easy of understanding by the average youth. It insists on a few essentials, and it would be as well if the apprenticeship master were to issue a set of additional "hints" to new-comers, covering personal hygiene, safety measures and the dangers boys usually encounter when entering a large industrial establishment, of which gambling is not the least.

The rewards offered by the scheme set out are extremely attractive. The brightest boys are promised a course at the Foundry School, or at the Universities of London or Birmingham. The idea of presenting all this information in an illustrated brochure is specifically designed to capture the imagination of schoolboys. This is nowadays regarded as essential, as some other competitive industries carry their own very superficial glamour. Though this booklet is intended for the youths living near to the works, we are sure that Birmid Industries will make it available for manufacturing concerns which are now thinking around the same subject. Provided that the scheme satisfies the provisions of the new Education Bill, which we believe it does, then there is presented to the metallurgical industries a clear-cut case of how the foundry can ensure an adequate supply of staff, both of the skilled workman and executive type, in the post-war period. Moreover, both types are catered for in the same scheme, which to our mind is an excellent feature.

According to a statement issued by the Geological Society of London, the total number of British geologists wholly engaged in a professional capacity in pre-war years was probably less than 600, nearly one-quarter of whom were occupied in the teaching of the science, principally in the Universities. To some extent this high proportion of geologists engaged in academic spheres is due to the fact that large classes of technical students in mining, metallurgy, civil engineering, and agriculture require tuition in geology as a part of their professional training. Within two years after the cessation of hostilities it seems likely that considerably more than 100 recruits will be called for to fill gaps and augment the ranks of professional geologists.

Contents

CENTRIFUGAL CASTING METHODS

Centrifugal casting is used in cases where soundness and cleanliness of metal are required. NATHAN JANCO describes modern practice in the "Iron Age" for March 30. The methods used in the industry are divided into three different types. The first is true centrifugal casting such as is used for bushes and liners. A centre core is not used and the direction of solidification is from the outside of the casting towards the axis of rotation. The second is semi-centrifugal casting such as is used for odd shaped castings which are spun about their own axis, but which have cooled in two directions rather than in one direction only. The third method is called the pressure method of centrifugal casting in which the castings are arranged about the centre of rotation like the spokes of a wheel.

According to the article, the equipment used in centrifugal castings falls into two general classes, those with vertically rotating moulds and those with horizontally rotating moulds. The former are generally used when the diameter of the casting is large compared with the length, or when the semi-centrifugal or pressure methods are used. The metal yield by these methods varies from 60 to 100 per cent., depending upon the type of casting and the gates required. Horizontal machines are used for castings in which the length is great as compared to the diameter, and in which the bore is cylindrical in shape. The metal yield obtained is approximately 100 per cent.

Both sand moulds and permanent moulds are used for centrifugal castings. The former are used where the outside shape of the casting does not permit a metal mould to be used or where only a few castings are required. Permanent moulds are usually made of iron, steel or graphite, the most popular material being an alloy cast iron of about 22 tons per sq. in. tensile strength. The moulds must be free from defects, especially at the surface which contacts the casting, and it must be well balanced about the axis of rotation. Generally, the use of a refractory wash, uniformly sprayed on to the hot mould, increases the life of a permanent mould. Metal moulds are usually preheated to 150 to 200 deg. C. before casting to ensure that they are perfectly dry. Higher pre-heat temperature may be used in some cases to avoid laps or cold shuts.

Casting Temperatures

Higher casting temperatures are used for centrifugal castings than for static casting, especially when metal moulds are used. The rate of pouring and the spinning speeds used are very important and considerable data are given.

The absence of gates or risers in centrifugal casting simplifies the operation and makes for improvement generally. On the other hand, this type of casting has defects of its own which may not occur in static casting. For instance, if the spinning speed of a horizontal mould is too low, or the metal is poured in too fast, "raining" will occur. Metal falls from the top of the mould to the bottom, oxidising as it does so and causing bad castings or an excessive amount of dross in the casting. The "raining" occurs because the metal has not been accelerated to the speed of rotation of the mould. Longitudinal cracks in castings may be prevented by reducing the spinning speed so that the hoop stress does not exceed the hot strength of the casting. Flanges at the end of castings cause circumferential cracks by preventing longitudinal contraction, unless moulding sand of low hot strength is used. Holes on the outside surface of a casting are usually caused by water or volatile matter present in the sand. Pits on the inside of a casting occur when the proper conditions necessary for directional solidification from the outside towards the axis of rotation do not exist. This may be caused by the mould being too hot at the start, by air circulation through the core of the casting, or by the casting wall being too thick. The remedy in the latter case may be to use a metal mould, reduce considerably the pouring rate of the last half of the metal, or to introduce into the bore of the casting after pouring an insulating material or pipe eliminator, which may be of an exothermic type in extreme cases.

IRONFOUNDRY FUEL NEWS—XIII

Next to the cupola, the biggest fuel-consuming unit in the ironfounding industry is the drying stove, and founders operating mould and core-drying stoves should therefore be sure that the process is carried out efficiently. As the amount of fuel required to dry or bake a ton of sand cannot readily be fixed within a certain range as can the amount of coke needed to melt a ton of iron in the cupola, it may well be that numbers of ironfounders do not realise that their stove drying is not as efficient as it might be. It is therefore intended to mention in the next few articles in this series a few points which, from the experience of the Regional Panel members of the Ironfounding Industry Fuel Committee, should help in reducing fuel consumption.

As when investigating the efficiency of any other fuel-consuming process, the first step is to know exactly how much fuel is being used. The amount of, say, coke delivered to the stoves over a certain period will, of course, be known, but an endeavour should also be made to record weekly the amount used by each stove. It is not always convenient to do this by weighing, but a very good estimate can be made by carefully recording the number of barrowsful taken to each firebox. Incidentally, it is interesting to note that some firms have found that very definite savings have resulted simply from this measurement of the fuel being used, all other factors having apparently been unchanged!

Multi Metals, Limited, is being wound up voluntarily. Mr. W. J. Watt, 20, Essex Street, London, W.C.2, is the liquidator.

Mr. A. V. Alexander, First Lord of the Admiralty, has rejected the Tyneside conference committee's proposal that two shipyards at Jarrow and Wallsend should be reopened.

SANDSLINGER MOULDING PRACTICE*

The Sandslinger as a general-purpose machine

By W. Y. BUCHANAN

All moulding operations require the ramming of a quantity of sand into a space of irregular shape with the object of producing a uniform degree of ramming on all surfaces of the pattern. This is usually necessary also throughout the body of the mould itself, although occasionally there is some attempt to produce higher permeability in the centre of rammed masses of sand employed in moulds or cores. This improvement in permeability is theoretically obtained by lighter ramming in parts away from the mould's face, but this is usually obtained more in theory than in practice.

There are several well-defined methods of obtaining the desired results in moulds and cores, for example:—(*a*) Hand ramming; (*b*) jolt ramming; (*c*) squeeze ramming; (*d*) blowing; and (*e*) Sandslinger. The last method is under consideration here.

Hand Ramming

Hand methods have certain fields of application and also certain limitations. Hand ramming, when well done, consists of the ramming of small quantities of sand at a time, using a rammer of small surface area, which can be directed into very restricted spaces. The rammer head, *i.e.*, the flat or rounded area at right angle to the direction of the ramming force, is always kept covered with a surplus of sand during the operation, and the rammer is progressively lifted so as to incorporate more and more loose sand into the body of rammed sand in the mould or core.

Under ideal conditions the results by this method should be very good, but the main objection to hand ramming is that the results depend entirely on the diligence of the workman and to a less extent to his skill, particularly in green-sand work. Moreover, the work is laborious and slow. Then, again, the process of ramming with a metal rammer, no matter how small its ramming surface, tends to make a series of little partings which can actually be demonstrated. This in turn gives considerable variations in degree of ramming or mould hardness from below the rammer face to the position of the rammer face at the last blow.

Another defect in this method of ramming is that if the sand be rammed too near the pattern, this local hardness already described is a very fruitful source of sand defects, such as scabs, constituting one of the few definite causes of scabs. Similarly, uneven ramming through the rammer being moved at too big intervals results in swelling of the casting due to liquid pressure, producing a wavy surface which is particularly undesirable in most types of castings left unmachined. The main advantage is that the first cost of the ramming machinery is precisely nil and, of course, readily portable. Hand ramming has, of course, a long record of generations of successful application, which cannot be lightly set aside in any purely technical discussion.

Jolt Ramming

Jolting consists of raising the mould or corebox filled with sand and allowing it to fall under the influence of gravity, thus obtaining a sudden jar on impact of the lifting table with the solid base of the machine. This action produces a movement of the loose sand towards the surface of the base on which the impact takes place.

When the surface of the pattern is horizontal, conditions for effective ramming are ideal and the effectiveness of jolting becomes less as the angle of the pattern changes towards the vertical. Ramming on vertical surface is therefore obtained as a result of that property of sand known and measured as flowability.

Re-entrant angles are usually avoided because of the necessity of drawing the pattern from the sand, but where they have not been blocked out, such projections of the mould itself cannot be rammed without special procedure of a nature entailing hand ramming of this particular part of the box. For example, in ramming the top-part moulding box having bars of the usual vertical shape, the finished top part shows lines of softness under each bar.

This can only be prevented by hand ramming either before jolting or after finishing jolting. This finishing operation takes more time than the jolting itself. This method of ramming tends to give a greater hardness on the flat parting or wide horizontal surfaces of the pattern with a gradual reduction of the degree of ramming from the surface upwards. For this reason flat top parts of considerable area are always difficult to jolt-ram owing to the tendency for large surfaces of the mould face to drop out.

This defect is encouraged by low green-strength, while at the same time higher green-strength is often accompanied by poor flowability under these conditions. Jolting is, of course, very successfully applied to small flat work, particularly where the boxes are carried off by hand and also to larger boxes where the contour of the pattern is followed out to some extent by specially shaped bars.

The defect is not nearly so troublesome in dry-sand moulds, for these are invariably finished and handled in all subsequent operations with the parting upwards in such position the tendency to softness behind the mould face may assist venting, and is therefore very desirable, provided it stops short of allowing swelling. At the same time, the tendency to swelling is not troublesome in moulds which are subsequently dry.

* Paper read at the Forty-first Annual Meeting of the Institute of British Foundrymen. The Author is Foundry Manager, John Lang & Sons, Limited.

Sandslinger Moulding Practice

Squeezing

Squeezing is applied to relatively small boxes because of the high total pressure required. When the force is applied from the top of the mass of sand, the degree of packing tends to decrease in a downward direction, resulting in soft ramming, particularly in small pockets in the pattern face. The best results are obtained on light castings of a flat nature, which can be made in very shallow boxes.

The depth of the box which can be rammed by squeezing is therefore limited to little more than 6 in. with plain patterns and even less in certain cases. Squeezing machines, because of the very simple operation, *i.e.*, probably only one movement of the piston in the making of each part, last a long time without needing major repairs, in contrast to jolting machines with their very rapid movements.

Squeezing cannot conveniently be applied to boxes having ribs or bars, and a considerable strength is required in the box part itself to prevent sides being pushed outwards by the force of the squeezing action. This results in a robust design of boxes, at the same time increasing their weight.

A combination of jolting and squeezing is very successfully applied on small boxes, particularly where even ramming on the mould face is obtained by jolting, and the tendency to softness in the upper part of the mould corrected by squeezing after jolting is completed. Where the depth of the box does not exceed 7 or 8 in. a fairly uniform degree of ramming can be obtained throughout the complete section.

This combination of squeezing and jolting cannot be applied to very large boxes, owing to the enormous pressure required to effect the squeezing, but each box jolted up is invariably finished by flat ramming on the top, either by hand, or in some cases with pneumatic rammers. The piston pressure required to produce a reasonable degree of hardness by steady squeezing is evidently much greater than the same energy applied in any form of blow. Machine operators quickly find this out for themselves, and most squeezing machines are operated more like steam hammers.

Core Blowing

Core blowing, as the name implies, is applicable to cores only or blocks of oil sand used for relatively small moulds, although there is no theoretical reasons why boxes cannot be rammed up in this way if necessary. The use of air under pressure as the carrier for the sand tends to give a very uniform degree of ramming, free from close packed layers in any particular zone. Although some foundrymen are of the opinion that in the act of core blowing, the large grains go to the centre and smaller material to the surface, thus giving an enhanced permeability in the centre—so much desired in core making practice. All the energy used in the ramming in this case is employed in moving the sand only, and thus the power required will compare very favourably with such methods as jolting, particularly ramming the larger moulds.

Sandslinger

This method of ramming resembles the action of throwing a small handful of loam into the mould, as in loam moulding. The force of the throw is very great, and ramming is obtained by the impact of the sand itself moving at a very high velocity. The mechanism consists of a rotating impeller having only one cup-shaped blade or vane throwing or delivering sand to the mould or core.

The stream of bonded moulding sand is fed into the path of the cup travelling at a very high speed, where it is caught up in quantities similar to a handful once in each revolution, and expelled from the rammer head in a downward direction into the mould. The velocity of this small handful of sand is such that impact with the sand already in the box actually penetrates and packs on, and so builds up a mass of uniformly rammed sand.

This is probably the nearest thing to placing grains of sand in a mould individually, and should be easily equal to hand ramming when done properly. The obvious advantages of this method of ramming is that all the power is expended on packing the grains, and that the moving parts of the machine itself are very small. This is particularly noticeable when trying to ram boxes 10 ft. long by jolting, in which case the mass of materials lifted on each jolt consists of box parts, table piston, and large mass of sand amounts to, say, 6 to 7 tons. This advantage applies to a lesser extent with smaller boxes.

One important advantage of the Sandslinger ramming is the aeration which goes on during the process. This has a very beneficial effect on any moulding sand, more particularly if the primary preparation is not what it should be. This, in turn, tends to give much more uniform mould surfaces and a better permeability for equal mould hardness than is the case in moulds made by other methods.

For example, in jolt-squeeze machine making green sand castings with flat surfaces in the drag, it has been found necessary to avoid jolting drags, otherwise scabs usually result. This means that the drags referred to are squeezed only, and are relatively soft on the mould face. Using the same sand which is largely Erith loam and ramming with the Sandslinger, which in turn rams much harder, no trouble is experienced with scabs.

It has been said that the general purposes machine is a myth. This is usually taken as an axiom by well-informed founders, and applies without doubt to all machines coming under the previous categories. Most machines are eminently suitable for the type and size of castings or box for which they were designed.

The truth of this axiom becomes painfully obvious to foundrymen who have at one time or another tried to demonstrate to their own satisfaction that there are some exceptions. Thus, the jolt roll-over machine intended for 30-in. square patterns is not properly employed making boxes either bigger or smaller.

On the one hand, the machine is overloaded, and tends to wear out rapidly, while, on the other, the effort required on the mechanical operation is out of proportion to the results obtained. For example, turnover boards made to fit 30-in. boxes are both too big and too heavy for any smaller sizes of boxes, and the manual effort has a discouraging effect on timeworkers.

The Sandslinger can, however, be called a general-purpose machine, since it will ram moulds or cores within a range practically covering all foundrywork. It can, of course, work in conjunction with any size or type of stripping machine provided there are no high projections which interfere with the travel of the rammer head over the moulding box.

"Isofirms"

Fig. 1 illustrates the hardness which results from hand ramming. The spacing of the line indicates the degree of densification. With this method of ramming the variations of this ramming pattern is theoretically unlimited, although, of course, it is obvious from everyday experience that good saleable castings can be made from moulds which are well removed from perfectly uniform ramming.

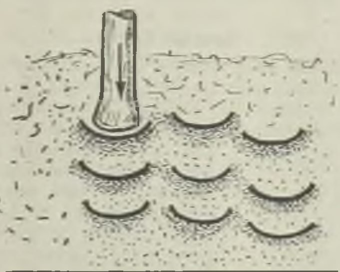

FIG. 1.—"ISOFIRMS" RESULTING FROM HAND RAMMING.

It is well known that there is a useful range of ramming, and that radical variations from this range are easily detected by placing the finger-tips against the face of the mould—the most elementary and commonest method of judging hardness or degree of ramming, or it may be better described as a test for soft spots.

Fig. 2 shows a distribution of hardness in moulds or cores rammed by jolting only. In order to obtain the ideal ramming illustrated here, *i.e.*, horizontal straight lines of equal hardness or "Isofirms" as they may be called, the moulding sand would have to be introduced into the box evenly, as for example, through a fine riddle in a well-aerated condition, and also by means of a suitable sand frame to keep a good head of surplus sand above the top of the box itself.

Fig. 3 shows diagrammatically the distribution of ramming density in a mould made by squeezing in one direction. The depth of the sand, which can be rammed by squeezing is limited, first of all by the total pressure available and also by the surface area of the box. For instance, as the box becomes narrower, the friction on the sides tends to increase, although this factor only appears when the depth is greater than the width—a condition which is unlikely to occur in the making of moulds, except when deep patterns are moulded in very small boxes. Thus the pattern is close to the side of the box.

Experimental Data

These theories have a habit of breaking down in practice. Therefore, to check these conclusions, a series of experiments were carried out. A box, 12 in. square and 9 in. deep, closed top and bottom, was used. For ramming, the top was removed. It was replaced after ramming and the side taken away, so

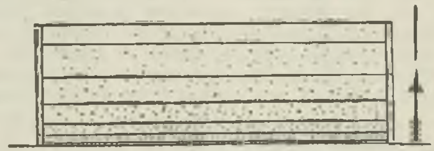

FIG. 2.—"ISOFIRMS" FROM JOLTING.

as to allow hardness testing at regular measured intervals from top to bottom of the mass of rammed sand.

Rows of tests were made at 1-in. interval, that is, commencing 1 in. from the bottom and finishing 1 in. from the top. The hardness tests were taken by Dietert's surface hardness tester, measuring indentation hardness in thousandths of an inch and the author's wire penetration ramming test. The average of each row of six hardness tests was used to represent the hardness at these levels.

One size of box was used to limit the extent of these experiments, although the size chosen was not equally suitable for all types of ramming, for example,

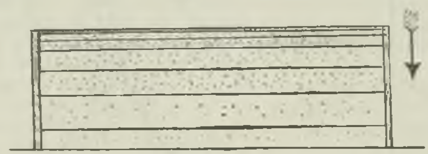

FIG. 3.—"ISOFIRMS" FROM SQUEEZING.

the Sandslinger does not show at its best because the area presented is smaller than usual, and the box rams up so fast that the operator has little time for manœuvring the rammer head. On the other hand, it is practically ideal for ramming by jolting.

The results illustrated in Fig. 4 show a series of hardness tests, each graph giving the average hardness at varying levels from top to bottom of the box rammed by various means. The heavy black lines indicate the average of each group—thus graph No. 1, the Sandslinger, indicates that the degree of hardness improves slightly towards the top, giving a reasonable uniformly hard rammed mould.

Graph No. 2 is the average of the group of test

Sandslinger Moulding Practice

moulds rammed up by jolting only, and this indicates a very rapid falling off in hardness towards the top, *i.e.*, from "hard" at the bottom to "soft" at the top.

Graph No. 3 is the average of the group of test moulds rammed by squeezing only, and this indicates a corresponding falling off in hardness from top to bottom, *i.e.*, "soft rammed" moulds to "very soft," a condition which is quite useless for any form of moulding. The poor showing of the squeezing machine is due to the fact that this box is much deeper than can be handled. If, however, the box is refilled and the squeeze operation repeated, making three times in all, the hardness of the mould is raised to the hard rammed zone, as shown in graph No. 5.

The hardness zones marked out at the bottom of the graph in Fig. 4 are quoted from Dietert thus:—

Very soft rammed moulds	30
Soft rammed moulds	40
Medium rammed moulds	50
Hard rammed moulds	70
Very hard rammed moulds	85

This point is stressed here because there is sometimes a tendency for individual foundrymen to set their own interpretation on these figures. Should there be any tendency to controversy on the point, it is hoped that the free discussion of the members will help to clear up the matter.

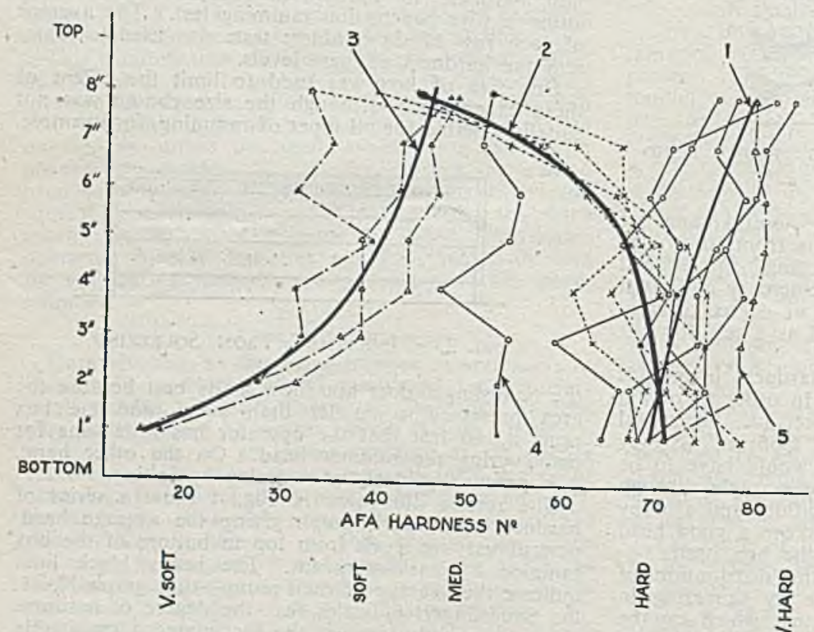

Fig. 4.—Mould Hardness as shown by: 1, the Sandslinger; 2 by Jolting; and 3 and 5 by Squeezing. No. 4 is from an Ill-Adjusted Sandslinger.

Reference has been made, in a Paper* to the Institute in 1933, to the wire penetration method of measuring hardness devised by the author, not as an alternative to the one developed by Dietert, but because no known method was available to the author at the time. As outlined in a series of tests carried out to try out these methods together on the same series of rammed sands, Dietert's measures a skin hardness because it only penetrates to a distance of about one sixteenth of an inch.

It is sometimes advantageous to be able to measure hardness on a surface of very limited depth, and for this purpose it is eminently suitable, at the same time it is subject to greater experimental error on that account, but it can be repeated very easily. The wire penetration method measures over the region immediately behind the surface equivalent to the active facing of a mould.

The graphs in Fig. 5 show this difference in interpretation of the degree of ramming in the experiment rammed by jolting. There is evidently a slight looseness near the sides of the box an inch below the top surface; this does not represent the average hardness of the top layer itself.

Special Test

The foregoing experiments have demonstrated that, whereas a simple square box of depth 9 in. cannot be evenly rammed by jolting or squeezing without some manipulation, the same box was not an adequate test to demonstrate the abilities of the Sandslinger in this respect. A box was therefore designed so as to be particularly difficult to ram. There were four distinct sections in this box, each 9 in. deep and 6 in. long, but having breadths 6 in., 4 in., 1 in. and ½ in., as shown in Fig. 6.

A number of experiments were carried out by ramming this box without the lower ½-in. section; the straight side was then removed and hardness measured at regular intervals over the surface from the top of the 6-in. section to the bottom of the 1-in. section.

It was intended to carry out a series of experiments to show the effect of flowability, etc., on the even distribution and average hardness obtained, and so to measure the effect of common variables such as grain size, moisture, and bond strength. However, after a number of such experiments,

* Foundry Trade Journal, Vol. XLVIII. Pages 171 et seq., 191 et seq.

it became evident that a wide latitude in the sand itself was possible, that is, any moulding sand reasonably fit for moulding by hand-ramming or any other mechanical method will ram equally well.

As an example, the sand used in the test in Fig. 6 consisted of: 97 per cent. floor sand, 2.4 per cent. rock sand and mixed in a Simpson mixer, 0.6 per cent. Distribond. This gave a sand having the following properties:—Moisture, 5 per cent.; green strength, 7.8 lbs. per sq. in.; permeability, 60; deformation, 46 thousandths on 2 in.; dry strength, 64 lbs. per sq. in.; and flowability, 84 per cent.

The distribution of hardness is shown to be very uniform, coming into the range known as "very hard rammed moulds." This degree of hardness seems eminently suitable, as it produces castings with a very good skin, true to pattern, and very flat on large straight surfaces. The figures from sections of 6 in., 4 in. and 1 in. are typical of a number of such experiments.

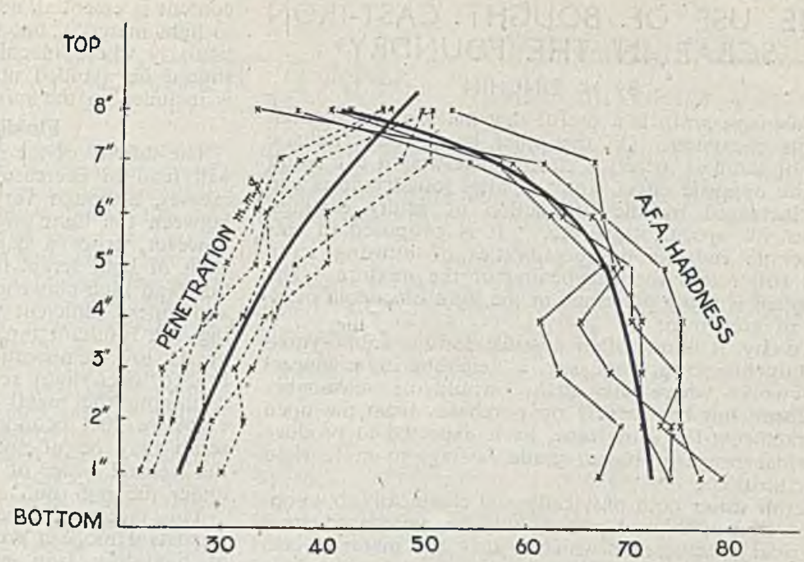

Fig. 5.—Relative Mould Hardnesses as Determined by the Wire Penetrating Test.

Some experiments were tried with the additional ½ in. section attached, and it was demonstrated that hard ramming could be obtained even in this apparently impossible space, *i.e.*, at a depth of 36 in. from the top. However, the amount of sand required to fill this minute space is so small that it tends to become erratic when using such a large machine. As shown in Fig. 6, one side is soft owing to the rate of feed of the machine, but the hardness obtained in most of this section is very good.

In general it may be said, however, that wet sticky sand does not tend to slide or move well on any mechanical conveyor or shaker, or for that matter in any mechanical handling device. This is due to the clay bond adhering to metal surfaces.

Men accustomed to hand-moulding usually work with sand too high in moisture, because this facilitates patching and finishing of moulds, and usually has to be kept mixed for a considerable time. In this respect un-milled sand is worse, particularly if the once common procedure of spraying the sand with clay water during hand mixing is used.

The Sandslinger works best on sand that is on the dry side, and in any case patching of moulds should be eliminated by attention to pattern design and condition, as it is a constant source of avoidable expenses in most foundries working with large wooden patterns.

(*To be continued.*)

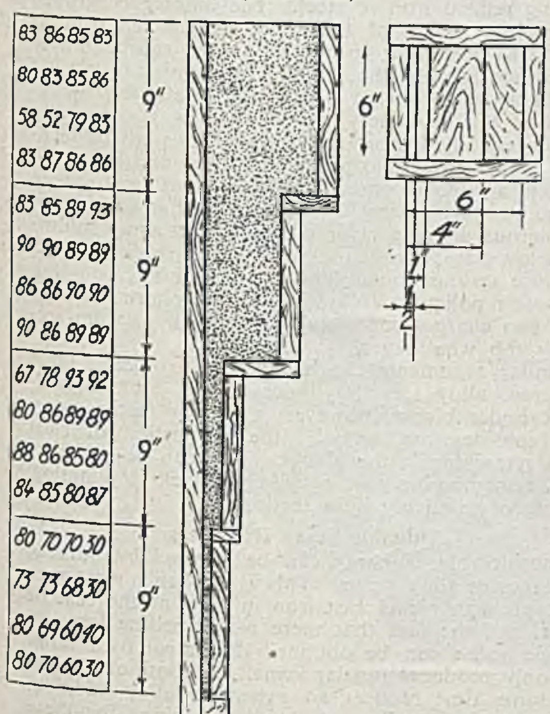

Fig. 6.—Test Box and Mould Hardness Results Obtained from the Sandslinger Method of Ramming.

SAVE WASTE PAPER

THE USE OF BOUGHT CAST-IRON SCRAP IN THE FOUNDRY*

By H. PINCHIN

Cast-iron scrap is a useful raw material on account of its cheapness. On the other hand, indiscriminate use of scrap as merely a cheap make-weight can result in the opposite effect, and the total foundry costs can be increased by the production of faulty castings, melts off specification, etc. It is proposed in this Paper to indicate the possibilities of utilising scrap and still retain the cheapening of the mixture. The problem is being presented in the light of cupola melting of grey iron.

To-day, it is not often possible for the foundryman to buy his scrap from, say, a neighbouring engineering works where the quality would be reasonably uniform, but has to rely on purchases from the open market. At the same time, he is expected to produce a wider range of higher grade castings to more rigid specifications.

Scrap varies both physically and chemically, but supplies of normal scrap can only be purchased to a physical specification which places the material into three main categories, light, medium and heavy. It is left to the user to compute his own chemical compositions. The following percentage analyses are considered fair averages and are given with the possible variations that may be found.

Light:—Si, 2.5 to 3.0—average 2.7.
Mn, 0.3 to 0.5—average 0.4.
S, 0.07 to 0.10—average 0.09.
P, 1.2 to 1.6—average 1.4.

Medium:—Si, 1.7 to 2.6—average 2.3.
Mn, 0.4 to 0.7—average 0.5.
S, 0.08 to 0.12—average 0.10.
P, 1.0 to 1.5—average 1.2.

Heavy:—Si, 1.0 to 3.0—average 2.0.
Mn, 0.4 to 0.8—average 0.6.
S, 0.08 to 0.16—average 0.12.
P, 0.5 to 1.4—average 1.0.

Generally speaking, the heavier the scrap, the wider the variations to be expected. This is aggravated in the remelt by the number of pieces per charge becoming progressively less as the weight increases, thereby lessening the averaging effect of mixing. It is reasonable, therefore, to suggest that where a good proportion of scrap is included in a small metal charge, light or medium scrap only should be used, or where heavy scrap is essential, it should be broken into small pieces and mixed well. Secondly, the heavier the scrap, the higher is the likely sulphur content, although coupled with this will be a tendency for the manganese content to be correspondingly higher. Sulphur content can be assessed in some cases by inspection. For instance, if a parcel of scrap consists of a majority of machined castings, then it is reasonable to assume that the sulphur content is not excessive. It is well known that, for thin section work, a low manganese content is essential, and so the type of scrap is limited to light material, but for heavier section castings, particularly where machinability is required, light scrap should be avoided unless a high manganese pig-iron is included in the mixture.

* An entry for a Short Paper Competition organised by the East Midlands Branch of the Institute of British Foundrymen.

Fluidity of the Remelt

The fluidity of the remelt, other factors being equal, will tend to decrease as the weight of the scrap increases, although very little difference will be found between the light and medium grades. Against this, however, arises a danger when melting high proportions of light scrap, in that, by virtue of its light section and high-phosphorus content, it is quick melting, and unless sufficient coke is used to retard the melting, the resultant tap may be sluggish simply because of its low temperature. This effect is often overlooked when light scrap is used for the purpose of "thinning the metal down," and ideas centre round excessive fuel economy. On the other hand, heavy scrap may be of such section to warrant reversing the normal order of charging, and putting the scrap under the pig-iron.

This factor of ease of melting leads on to an all-important modern problem regarding the manufacture of high-duty iron using refined pig-irons or steel. Under no consideration should light scrap, and rarely medium scrap, be used in a high-duty iron mixture bearing refined iron or steel. The difference between the melting points of the scrap and refined iron or steel is so great that no control can be exercised over the composition of the remelt. Such mixtures should invariably carry heavy scrap and preferably heavy scrap of the machinery type.

It is equally important to realise this where high-duty and normal phosphoric mixtures are being put through a cupola consecutively. It is often forgotten in the struggle against contamination that, in spite of a generous dividing layer of coke, light scrap following a low-phosphorus mixture will melt readily enough to cause serious contamination. For this reason it is the safest policy to follow a low-phosphorus mixture with two charges containing no light or medium section scrap whatsoever.

Similar arguments can be applied to special types of scrap, alloy scrap, cylinder blocks, etc. Regarding cylinder blocks, however, a further factor enters into consideration, namely, the proportion of steel parts remaining in the blocks. This can be considerable, remembering that a cylinder block is a hollow casting of relatively light section.

Valuable Scrap Resources

Considerable economy can be effected by utilising resources in alloy scrap. This is probably most pronounced with nickel cast iron in view of the cost of nickel and the fact that there is no melting loss. A double value can be obtained if control over scrap not only produces regular remelt composition, but at the same time reduces an expensive alloy addition. It is therefore well worth while searching for these valuable scrap resources and spending time over a little thought to incorporate them in the mixture.

MESSERSCHMITT HEADER TANK*

Examination of materials used in enemy aircraft

Detailed examination has now been made of the materials used on, and methods of construction of, captured enemy aircraft; the following extract deals with a header tank from the Messerschmitt 109. A general view of the header tank is given in Fig. 1, while Fig. 2 shows one half of this tank with a side cut away and also a cross-section through the swill chamber of the other half tank. The tank shell is constructed from aluminium alloy panels, welded together. The dished panel indicated by arrow "A" in Fig. 1 is 12G, and the front panel "B" is 14G. The remaining panels are 16G thick. The swill chamber, an extension of which forms the inlet pipe, is a light alloy casting, welded to the shell and to the outlet pipe. The outlet pipe is formed from welded light alloy sheet, and is also welded into the shell at its exit from the tank. The attachment of the balance valve, relief valve and vent pipes is also made by welding. Fig. 3 shows one of these welds and the method of attachment of the pipes. The light alloy material has not been given any protective treatment other than a coating of paint on the outer surface. A slight amount of corrosion of the inner surface of the sheet in a few isolated areas can be observed.

* Extracted from a Report made by the staff of the Metallurgical Division of the Royal Aircraft Establishment and supplied by the Ministry of Aircraft Production.

Chemical Analyses

Chemical analyses have been made on the sheet material and on a portion of the swill chamber casting. The results are given in Table I.

TABLE I.—*Chemical Analyses of Materials Used.*

		Sheet material.	Swill chamber casting.
Silicon	per cent.	0.86	5.36
Magnesium	" "	0.79	0.56
Manganese	" "	0.49	0.50
Iron	" "	0.22	0.33
Copper	" "	Nil	0.07
Titanium	" "	0.02	0.02
Nickel	" "	Nil	Trace
Aluminium	" "	Remainder	Remainder

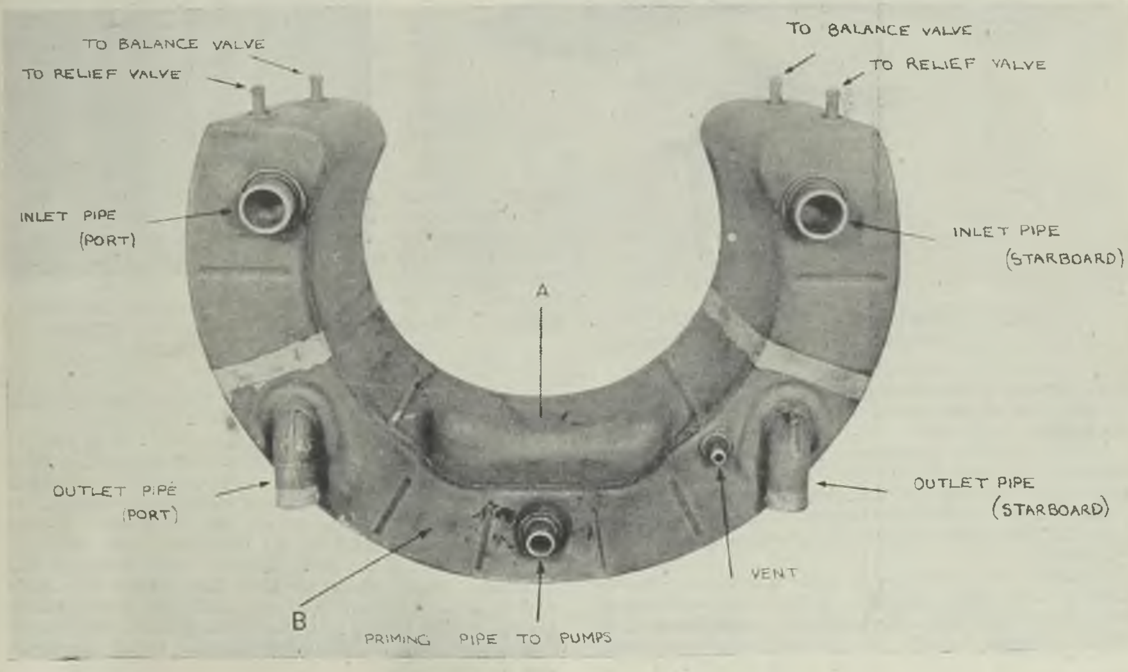

FIG. 1.—HEADER TANK FROM MESSERSCHMITT 109.

Messerschmitt Header Tank

The sheet material is "Anticorodal." Soft aluminium alloy sheet of this composition is covered by specification D.T.D.346. The 5 per cent. silicon-aluminium alloy of which the swill chamber casting is made has no British equivalent; the American alloy known as No. 43 is similar.

Mechanical Tests: (1) Hardness Tests

Sections of the parts and various welds have been subjected to diamond pyramid hardness tests (HD/5), which gave the following results:—

Sheet material.—Hardness figures of the order of 90 to 110 are recorded on the material away from the welds. The hardness of the sheets falls rapidly towards the welds to a minimum of 45. This softening of the alloy of the sheets occurs in the regions of all the welds.

Swill chamber casting.—The hardness values obtained vary from 45 to 50. There appears to be a very slight increase in hardness near the welds.

Outlet pipe.—Hardness figures obtained vary from 45 to 50, the higher figures being obtained away from the welds.

Balance valve, relief valve, and vent pipes.—All the pipes are of similar hardness of the order of 75 to 80 away from the welds and falling to a minimum of 45 near the welds.

Welds.—The hardness of the welds varies very little, being between 45 and 50.

Microscopical Examination

Sections were prepared from various parts of the tank and examined microscopically. The results of the examination are classified under the following headings:—

Sheet material.—All the panels of the tank examined appear to be of alloy of similar composition to the one chemically analysed, although the 12G sheet seems to have a slightly higher silicon content. The banding of the hard particles suggests a greater amount of rolling in the direction of the maximum strength. The absence of appreciable amounts of magnesium silicide together with the mechanical properties would suggest that the sheet has been solution heat-treated and aged at an elevated temperature. The welds are sound, and appear to have been made with a filler rod of similar composition to that of the sheet. The corrosion of the inner surface of the tank has resulted in very slight pitting.

Swill chamber casting.—The structure is typical of a sand casting of a 5 per cent. silicon-aluminium alloy in the modified state and not subsequently heat-treated. Unsoundness is present as gas blow-holes and also as shrinkage cavities throughout the material. These holes are up to 0.02 in. in diameter. The welds at the junctions of the swill chamber with the shell and the outlet pipe appear to have been made with filler rod of the Anticorodal type, and are fairly sound though not as sound as those encountered in the sheets.

No corrosion of the swill chamber or of the welds can be observed.

Pipes.—The outlet pipe which is formed from sheet

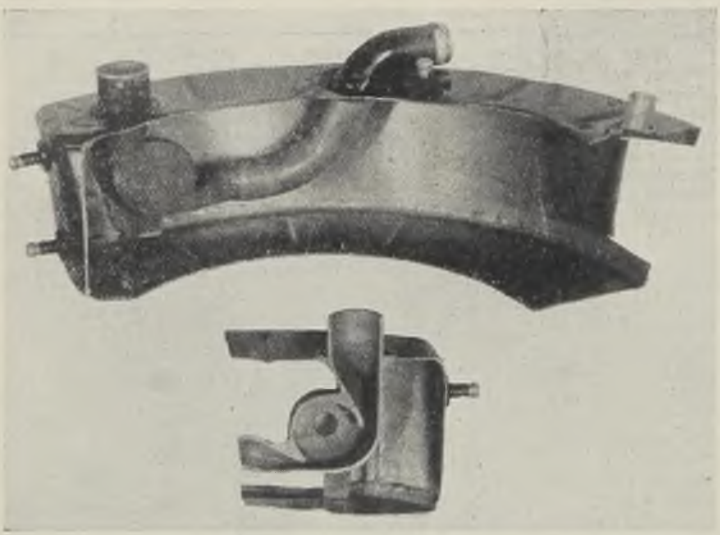

Fig. 2.—Shows the Header Tank and Swill Chamber Casting After Sectioning.

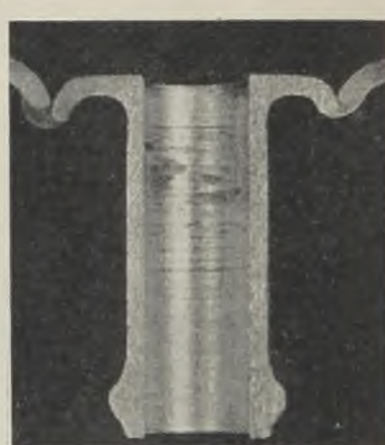

Fig. 3.—Showing the Method of Attaching the Pipe by Welding. × 2.

appears to be made in alloy of the Anticorodal type. The welds in the pipe are sound, though one of the seam welds at one point is defective and contains non-metallic inclusions. At this point the weld is discontinuous and leakage of the coolant into the tank or *vice versa* must have occurred in service. The balance valve, relief valve, and vent pipes have similar structure to that of the Anticorodal. The macrostructure, as shown in Fig. 3, shows that these pipes have been machined from bar. The welds are sound, but the penetration is considered to be poor.

Discussion of the Welding

Visual examination of the welds, together with the apparently extended heating of the sheets, as shown by mechanical tests at either side of the welds, would suggest that gas-welding has been used throughout. The welding rod has been of the Anticorodal type. The shell has been welded from the outside and the penetration is considered to be good. The thickness of the welds is much greater than is usual in British practice, and is probably the result of "heavy" welding with a thick welding rod. Apart from a little hammering of the inner surfaces of some of the sheet welds, the welds have not been dressed.

Comments and Conclusions

The tank shell has been constructed from aluminium alloy sheet, panels of the material having been butt welded together. The material is the alloy known as Anticorodal, which in the form of softened sheets is covered by specification D.T.D.346. The sheet material has been solution heat-treated and aged. The outlet pipe and the smaller pipes are also made in alloy of the Anticorodal type.

The swill chamber and the inlet pipes are in the form of a single sand casting in 5 per cent. silicon-aluminium alloy. The casting is very unsound.

Gas-welding using a welding rod of alloy of the Anticorodal type has been used throughout. The penetration and the soundness of the welds are fairly good. but the welds are much heavier than those normally allowed in good British aircraft practice. The method employed to join the smaller pipes to the tank shell, as shown in Fig. 3, is simple and efficient. The joint would have been further improved, however, by a higher standard of welding.

Mechanical tests reveal extensive softening of the alloy during welding. The welding of light alloy sheet in the heat-treated and aged condition is not practised in this country.

The materials of construction of the tank have not a high resistance to corrosion, the welds being particularly susceptible to intergranular breakdown under the accelerated corrosion test. In service, however, only slight pitting of the sheets in a few isolated areas has occurred.

The quality of the castings and the standard of welding are considered to be rather below those generally obtaining in British aircraft practice, although the behaviour of the tank in service has evidently been satisfactory. Higher tensile properties and greater

(*Continued at foot of next column.*)

(*Continued from previous column.*)

resistance to corrosion would have been obtained if the complete tank had been heat-treated. Even without heat-treatment, however, a stronger tank has resulted from the use of heat-treated sheet than would have resulted from the use of half-hard or soft aluminium.

CORRESPONDENCE

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

TEST-BARS

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I notice in the February 3, 1944, issue, page 88, correspondence on test-bars and castings, and also comment on this on the preceding page by, I presume, the editor of THE FOUNDRY TRADE JOURNAL. I merely wish to say that the keel block test-bar, print of which is enclosed,* is the one we use for all non-ferrous metals, other than the light alloys. I had some cable correspondence recently with a firm in England in an endeavour to get certain high physical results in phosphor bronze under British Standards Specification 2-B-8. After trying the recommendations that a cast-to-size test-bar would give better results, we finally found that once again the keel block gave the highest physicals of any bar.

The block gives three test-bars, all of which closely agree, and provides for tensile, compression and Izod tests. The fact that it is a large block of metal may give more confidence to inspectors, as there is no attempt to obtain any benefit from skin strength, etc. For thirty years, I have used this keel block, and have many times tried other forms of test-bars, but have always gone back to the keel block in the final result. While I do not claim originality for the keel block, it was introduced to the Canadian Non-Ferrous Casting Advisory Committee, to which reference is made in your article by the writer.

Yours, etc.,

HAROLD J. ROAST, Managing Director.

Canadian Bronze Company, Limited,
999, Delorimier Avenue, Montreal, Canada.
June 13, 1944.

BRITISH STANDARDS INSTITUTION

We are informed by the British Standards Institution that a revised standard, No. 735, 1944, has been issued covering the sampling and analysis of coal and coke. It costs 5s., and can be had by writing to 28, Victoria Street, London, S.W.1. Available on loan are a number of aircraft material specifications that have been developed by the U.S.A. Society of Automotive Engineers. They include bronze castings (4845B); manganese bronze castings (4862A); aluminium bronze castings (4870); and pearlitic malleable iron castings (5310).

* Illustration enclosed is the same as Fig. 1 ofr the article "Canadian Practice for the Casting of Non-Ferrous Test-Bars" on page 78 of our issue of January 27 last.—EDITOR.

MOULD AND CORE SURFACES AT POURING TEMPERATURES*

Mould and core surface properties at pouring temperatures as determined with the dilatometer, recently described and illustrated in our columns, are:—(1) volume change; (2) spalling; (3) collapsibility; (4) hot strength; (5) hot deformation; (6) glazing; (7) hot permeability; and (8) heat conductivity.

Volume change is the result of:—(1) Hot expansion of sand grains; and (2) hot shrinkage of fine materials, such as fluxes and bonds.

Spalling is the result of:—(1) An unequal volume change of the sand or core sectional areas or layers; (2) a low ductility of sand or core surface which is unable to accommodate the hot expansion or hot shrinkage; (certain sands which possess high ductility—high hot deformation—will not spall when high expansion is present); (3) a large difference in hardness of adjacent sectional areas or layers causing great differences of volume change between the two areas; (4) a large difference in the rate of heating of two adjacent sectional areas; (well demonstrated by a poorly dried dense mould or core surface. The dense surface heats up rapidly and expands. The damp layer of sand or core underneath the dense surface heats up slowly, reresulting in a great difference in temperature or unequal growth); (5) a lack of void spaces between the sand grains to allow for the growth of the sand grains; and (6) a lack of refractoriness resulting in a high volume change due to a high hot shrinkage.

Collapsibility is the result of:—(1) The oxidation of the binders present in mould or core surface by high temperature; and (2) a composition change of the binder to a non-binding material on being subjected to elevated temperature.

Hot Strength is the result of:—(1) Development of a pyro-strength of binders, such as clays, bentonite or silica flour; (2) a composition change of the binder to some stable ceramic material at elevated temperatures; and (3) the melting of one or more materials to form a viscous liquid at elevated temperatures.

Hot Deformation is the result of:—(1) The formation of a limited quantity of viscous glasses, liquids or semi-plastic materials at elevated temperature from the binders and other ingredients present in the sand.

Glazing is the result of:—(1) The formation of glasses at the surface of the mould or core at elevated temperatures; and (2) the inclusion of fluxing ingredients in the sand or core.

Hot permeability is the result of:—(1) Maintaining open connected pore spaces through the sand or core at elevated temperatures; and (2) the quantity of gas that is generated at elevated temperature which must be vented through the pore spaces in addition to mould cavity gases that must be vented.

Heat conductivity is the result of:—(1) Heat transfer by the hot air and gases travelling from the mould or core face surfaces to other section of the mould or core—classed as heat by convection; and (2) heat transfer by heat travel from sand grain to sand grain—classed as heat transfer by conduction.

Methods for Reductions

Volume change of moulding material is reduced by creating greater void spaces between sand grains. This is secured by addition of combustible materials such as:—(1) Many cereal binders are effective as a rule; and (2) coal dust, pitch, straw, sawdust additions are effective. The reduction of flowability increases void spaces. It can be secured by:—(1) Addition of coarse sand grains; (2) an increase in clay content; (3) an increase in green strength; and (4) an increase in green deformation. Reduction or ramming if such be permissible will also reduce volume change, as will also the use of special low expanding grains, for example, sillimanite grains also offer a solution.

Spalling is reduced by:—(1) Arranging to secure equal volume change of adjacent sectional areas or layers of sand. This may be accomplished by:—(*a*) Possessing sufficient hot permeability; (*b*) obtaining equal heat input into the mould by spreading ingates; (*c*) obtaining equal hot deformation; (*d*) obtaining equal controlled hot strength by proper selection of ingredients; and (*e*) obtaining controlled hardness; (2) obtaining a surface possessing a conservative hot deformation avoiding lack of ductility; and (3) using a moulding material which possesses sufficient void spaces at elevated temperatures.

Collapsibility is retarded by:—(1) Increasing hot strength; (2) decreasing grain size; (3) increasing silica flour; (4) addition of iron oxide to clay free or low clay content core mixture; (5) reduction of combustible binders; and (6) increasing baked strength.

Hot strength is reduced by:—(1) Increasing grain size of moulding material; (2) reducing ramming when permissible; (3) reducing moisture when permissible; (4) reducing silica flour additions; (5) selecting binders that are combustible; and (6) selecting binders that possess low hot strength. The order of hot strength at elevated temperature, from low to high hot strength, is substantially as follows: bran, cereal binder, sawdust, resins, oil, coal dust, pitch, iron oxide, southern bentonites, northern bentonites, clays, combination of northern bentonites and certain clays, fine sand and silica flour. The last possesses the power to increase hot strength to very high values.

Hot deformation is reduced by the selection of binders possessing low hot deformation.

Glazing is reduced by:—(1) Using moulding materials possessing high refractoriness; and (2) increasing sintering point B of moulding materials.

Hot permeability is reduced by a reduction in grain size of the moulding material; research work is in progress determining factors affecting hot permeability of both sands and cores.

Heat conductivity is reduced by:—(1) A reduction of hot permeability of the moulding material; (2) choosing moulding materials of low heat conductivity as measured by conduction; (3) increasing the moisture content of the moulding material; (4) additional research work must yet be done on this subject matter to reveal method of controlling heat conductivity.

* From "Foundryman's News Letter," the House Organ of the H. W. Dietert Co.

MECHANICAL HANDLING IN FOUNDRIES

REPORT BY THE MECHANICAL DEVELOPMENT SUB-COMMITTEE OF THE TECHNICAL COMMITTEE

The major stages in the handling of materials for the production of castings

(*Continued from page* 238.)

VIII.—FETTLING SHOP

Jobbing Foundries

In jobbing foundries where the castings produced are of a more varied character with regard to their weight and bulk, undoubtedly the best method of handling them to the fettling shop is by the use of an overhead crane. When the moulding and fettling shops are not in the same bay, the castings may be transferred from one bay to another by a bogie.

Heavier castings are usually fettled and cleaned on the floor and the only handling facilities required are those which enable the casting to be turned over to give access to other faces. For this duty the overhead crane is widely used, but the wall-type jib crane having a travelling hoisting unit fitted enables the fettler to obtain quick lifts and gives him a comparatively wide area of floor space in which to work. Where the fettling shop is some distance from the foundry, castings may be transported from one to the other on wagons hauled by locomotive or on petrol or electrically operated trucks.

Mechanised Foundries

Mechanical handling methods of conveying castings from the foundry to the fettling shop in mechanised foundries where a big quantity is to be handled may be classified under two headings:—(*a*) Batch type; and (*b*) continuous type. Into the former category may be placed the following:—Hand barrow; overhead crane; and hand- or power-operated truck.

The latter category consists of:—Roller track; flat belt conveyor; scraper or push plate conveyor; slat or apron plate conveyor; and overhead chain conveyor.

With the batch-type method of handling castings it is necessary to use skips or baskets, and these may be placed at the operator's side, where the first process in the fettling shop is to be carried out.

If this method is to be continued through the fettling shop, each operator must have a full skip and an empty skip at each operation, and in order that an operator need not wait between batches it is essential that the skip conveying equipment is primarily designed above its normal capacity.

The flat belt conveyor may be used for transporting quantities of small castings, but is not suitable for handling big castings. Another disadvantage of this conveyor is that it can be damaged by very hot castings.

The scraper or push plate conveyor is used for conveying small castings, but with this type the castings may be loaded direct from the knockout in the hot condition. Maintenance costs are higher than with the belt conveyor.

The slat or apron plate conveyor is widely used for carrying castings to the fettling shop and a rough inspection may be made of the castings by operators picking off the castings and replacing after inspection. There is, however, a danger of castings escaping inspection and this should not, therefore, be considered as any more than a rough check to remove obvious waste castings.

Roller track may be employed and, depending on whether the castings will present a fair face to the rollers, it must be decided whether or not trays or skips shall be used.

The overhead chain type of conveyor is a very satisfactory method of conveying castings to the fettling shop, since the castings may be loaded at the knockout and taken by almost any route to the unloading station. With this type of conveyor the castings may be hooked on to the carriers or may be loaded into skips or trays suspended from the carriers. Very effective cooling of the castings may be obtained so that at the unloading station the first cleaning operation may proceed immediately.

A further development of the overhead chain conveyor is the dual-duty conveyor, in which the chain has attachments which push the trolleys along a rolled steel section supported below the chain runner. The trolleys from which the trays or skips are suspended may then be pushed by hand, or mechanically, off the live track by pre-selective switches on to dead lines which serve as storage stations for process operations. When the particular process has been completed, the castings may be reloaded to travel to the next process station, where again the pre-selective switch diverts the trolley and load on to the dead line. An advantage with this type of conveyor is that, if a particular casting or batch of castings does not require a certain operation carried out, the trolley, or trolleys, may bye-pass one or a number of the dead line cleaning stations.

IX.—INSPECTION DEPARTMENT

General Considerations

Many of the technical considerations which have to be taken into account in the selection of mould, core or sand conveyors, do not apply to the conveying of castings in the inspection department. Economy in handling and accessibility to the castings to be inspected are the main objects to be aimed at, but successfully to achieve these objects the following factors have to be considered.

General Lay-out of the Plant.—In an existing foundry, and also to a less extent in a new foundry, the general lay-out of the inspection department and therefore of the conveyors which serve it, must be influenced by:—(*a*) Area and shape of the available space, and (*b*) situation of the fettling shop, of the enamelling or painting department (if any) and of the

Mechanical Handling in Foundries

despatch department. Provision may have to be made for a proportion of the castings to be transported to a special test, and in some foundries for some or all of the castings to pass through a dipping or enamelling room.

Amount of Inspection Necessary.—A general or preliminary inspection for the detection of major faults may be carried out in the fettling shop, simultaneously with the operation of fettling. In the inspection department castings of simple design, or where inspection requirements permit, may be inspected on the conveyor as they pass from fettling to enamelling or despatch. Where a more detailed inspection is required, removal on to a viewing or jigging bench may be necessary.

Maximum and Minimum Weights of Castings.—Castings from 10 to, say, 50 lbs. weight may be transferred from conveyor to bench by hand. The benches should be close to the conveyor as, in the case of roller conveyors, this permits of the larger castings being rolled over on to the benches. The transfer to the benches of castings of 50 lbs. weight and upwards should be effected by pulley block. When a pulley block is employed, it is not so necessary for the benches to be adjacent to the conveyor; in fact, a space is sometimes an advantage, to provide working space for the operator.

Small castings of a few lbs. weight or less should be conveyed in containers or skips, which can be lifted off the conveyor by a pulley block. When the output of the foundry consists entirely of castings weighing from a few ounces to a few pounds, the employment of a conveyor would not be justified unless the number of castings to be handled was very considerable. If these conditions do not apply, castings may be handled in skips transported by a power-driven truck, to which trailers may be attached if necessary.

Quantity of Castings to be Handled.—This factor will determine the size of the department and the number of conveyors which are required. This quantity and the size of the castings determine the size of the conveyor and the total weight which it has to support.

To Ensure that no Castings Fail to be Inspected.—This condition may not always be fulfilled when mechanically-operated continuous conveyors are used, but arrangements can be made to avoid this. The requirement can be met satisfactorily by the use of roller conveyors, where the castings are pushed along manually, or by the employment of two conveyors, one along which the castings arrive from the fettling shop and another along which they depart to the next department. The latter arrangement is satisfactory when inspection is carried out on benches which should be placed between the two conveyors.

Types of Conveying Apparatus

Roller Conveyor.—The roller conveyor, manually operated, has already been described, and is the most generally useful type for the conveyance of castings through the inspection department. The top of the conveyor should be of a suitable working height to facilitate inspection on the conveyor or transfer to inspection benches, which should be at approximately the same height. If arrangements in the fettling shop are such that loading has to be done from ground level, loading may be effected by a short length of inclined roller conveyor, which may be operated mechanically. Alternatively, the castings may be pushed up the inclined conveyor by hand. Smaller castings can be loaded by hand. Roller conveyors are not suitable for the transport of castings which are so small or of such a shape as to be liable to stick between the rollers.

Belt Conveyor.—As castings are liable to damage the fabric or rubber, this type of conveyor (previously described) should only be used for small castings. In general, the type of castings for which belt conveyors are suitable will be handled more easily and satisfactorily in skips.

Pendulum Chain Conveyor.—The general remarks on this type of conveyor when used for mould carrying also apply when pendulum conveyors are used for transporting castings. The carrying plates or trays are used for small castings, and for large castings the plates are replaced by hooks on which the castings are hung. Automatic loading and unloading of the tray type can be arranged. When visual inspection only is necessary, it can frequently be carried out more successfully on the pendulum conveyor than on the roller type, due to greater accessibility of all parts of the casting when suspended than when laid flat.

When painting, spraying, or dipping is necessary, a pendulum conveyor may be employed to convey the castings from the inspection department, through the spraying and drying rooms, and thence to storage or shipping. If dipping be required instead of spraying, a drop in the overhead track may be arranged immediately over the dipping tank, so that the castings are lowered into the tank and raised out of it after dipping.

Power-Operated Trucks.—When power-operated trucks are used for transporting skips of castings, space may be saved at storage points by using a truck of the elevating platform type to facilitate stacking the skips.

Transport to Special Test.—The testing apparatus may be situated near to the inspection benches or near to the exits from the inspection department. The latter is usually preferred. It will usually be necessary to provide a pulley block and in some cases a short overhead runway to effect transfer of castings from the conveyor or inspection bench to the testing apparatus and back to the conveyor.

X.—STORAGE AND DESPATCH

Distinction must be drawn between the temporary storage of castings which are awaiting despatch and storage of stocks or warehousing.

Temporary Storage

The ideal arrangement is one in which arrival, sorting, weighing and despatch are so synchronised that little or no storage is necessary. This is difficult to attain in practice, and provision must be made for temporary storage pending despatch. Methods of storing are:—

Skips which may be placed on the floor, on benches or in racks. This is the most satisfactory method for castings up to a few lbs. in weight.

Fixed bins or racks of metal or wood may be used as an alternative, but this method is less flexible than the use of skips and is more suitable for the stock warehouse. Floor storage is quite suitable for castings from a few lbs. weight upwards.

Racks designed for individual types of castings can be used for standard lines, such as cylinder blocks. Stacking in the racks of castings too heavy to be lifted by hand may be carried out by lifting truck-pulley block and overhead runway or overhead crane, the choice of method depending upon the weight and quantity.

The gravity roller rack consists of a nest of gravity roller conveyors arranged in tiers. Castings are placed in the rack at the side corresponding with the upper end of the conveyors and roll down the tracks to the other side of the rack, where they are withdrawn as required. The advantage is that castings are always placed in the rack at the loading position and are always available for withdrawal at the unloading position, even though there is only one casting in stock.

Warehouse Storage

When a stock of castings is carried either for delivery to customers or to other parts of the works for processing, the problem of storage becomes one of warehousing, and a special warehouse or separate department should be provided. Racks, bins, etc., are used as for temporary storage, but a greater quantity would be required.

Despatch Department

Despatch of castings will be by one of the following methods:—

Rail.—A loading bay should be provided and constructed so that the floors of the trucks are approximately level with the floor of the building. This can often be achieved by taking advantage of the varying levels of the site, but if this is not practicable, the railway siding should be run down a slope to the required level.

Road Vehicles.—A loading bay for road vehicles should also be provided. The foregoing remarks on levels also apply.

Power-operated Trucks and Trailers.—These are used only when castings are to be transported short distances, usually to another part of the same works for processing. Conveying appliances in the despatch department should permit of considerable flexibility. Castings have to be sorted, weighed and distributed to rail or road vehicles in other parts of the building, and to attempt to carry out these operations by the employment of a rigid system of conveyors may result in congestion and so miss the object being aimed at. The conveyor from the inspection department or from the paint or enamelling shop should enter the despatch department and may be continued along one side of the building. Distribution of castings is carried out by:—

Overhead Runway.—Runways can be arranged to give considerable flexibility, and they do not interfere with free movement on the floor.

Overhead Crane.—Desirable for handling castings exceeding 3 to 5 cwts. each. An overhead crane is also useful for stacking and for handling heavy packing cases for overseas shipment.

Power-operated Truck.—The power-operated truck is the most flexible of all appliances suitable for the despatch department, and can be applied extensively to the movement of castings of all weights up to the maximum load of the truck or trailer. Loading of larger castings can be carried out by overhead crane or pulley block and runways, which need only be provided over a limited area of the floor space. Small castings are conveyed in skips, which may be loaded by hand or by pulley block and runway.

APPENDIX.

The following data indicate the capacity, speeds, etc., of various handling units. Wide variation of these figures will be found in general engineering practice, but they are typical of foundry applications.

Belt Conveyor.
- Speed 100-150 ft. per min.
- To handle 15 tons of sand per hour, 18 in. wide belt.

Elevator.
- Speed 200 ft. per min.
- To handle 15 tons of sand per hour, 12 in. buckets, 15 in. pitch.

Tilting Bucket Conveyor.
- Speed 20-25 ft. per min.
- To handle 15 tons of sand per hour, 14 in. buckets.

Push Plate Conveyor.
- Speed 30-50 ft. per min.
- To handle 15 tons of sand per hour, 18 in. wide trough.

Mould Conveyor.
- Speed up to 18 ft. per min.
- Loads up to 2 tons per plate.

Apron Plate Conveyor.
- Speed 30-50 ft. per min.
- To handle 15 tons of sand per hour, 18 in. wide plates.

Drag Link Conveyor.
- Speed 30-50 ft. per min.
- To handle 15 tons of sand per hour, 20 in. wide links.

Slat Conveyor.
- Speed up to 80 ft. per min.

Overhead Chain Conveyor.
- Speeds from 1-5 ft. per min.
- Load per trolley 150 lb.

Roller Track.
- Load carrying capacity of each roller varies between 50 and 100 lb.
- Incline for free running up to 5 per cent.

Walking Beam Conveyor.
- Moulds up to 20 tons may be handled.

NEWS IN BRIEF

Mr. C. K. Everitt, presiding at the annual meeting of Edgar Allen & Company, Limited, Sheffield, said that it would help those responsible for the conduct of industry to know exactly what part the Government proposed that the State should play in its future control and direction, more particularly in regard to the export trade. The present uncertainty had a negative effect on the making of plans.

Speaking at Wednesbury recently, Mr. John Brown, general secretary of the Iron and Steel Trades Confederation, said that the iron and steel industry had probably the least to fear of any industry so far as unemployment in the immediate post-war era was concerned. He envisaged a much bigger demand eventually than the demands the industry had been called upon to fulfil under wartime conditions.

The directors of Ransomes & Rapier, Limited, engineers and ironfounders, propose to increase the capital to £395,000, by creating 115,000 5 per cent. cumulative "B" preference shares of £1 each. The money is required owing to the increased scale of the company's operations. Treasury consent to the issue has been given and, subject to stockholders' approval, the new shares will be offered at par, *pro rata* to stockholders registered on July 12.

At the annual meeting of Mellowes & Company, Limited, held recently at Sheffield, Mr. Henry A. Mellowes (chairman) said that although the company, with its subsidiary, had been largely engaged for the last four years on Government contracts of many kinds, it had nevertheless maintained an ever-growing proportion of its original manufactures of patent glazing, metal windows, and lead products. The directors believed that, thanks to the experience of wartime production, they would be enabled to implement their normal activities by manufactures in sheet steel and alloyed metals, plastics, die-castings, etc.

At a recent meeting at Newcastle-upon-Tyne, representatives of engineering concerns on Tyneside, Wearside and Tees-side approved in principle a plan for the development of the light engineering industry in the North-East. There was an attendance of about 120 at the meeting. Mr. D. G. Brown, of the Redheugh Iron & Steel Company, Limited, chairman of a committee appointed by the Northern branch of the Engineering Industries' Association which has investigated proposals drawn up by Mr. R. W. Mann, of Charles Crofton & Company (Engineers), Limited, Wallsend, outlined the preliminary suggestions to the meeting. At the outset, it was stated, it was intended to set up a capacity exchange office which will investigate the productive capacity of each member firm, and also ascertain the requirements of every purchaser in the district. A committee representing engineering firms throughout the district was appointed to draw up a practical scheme. Lord Ridley, who presided, said the scheme could not come to anything during the war, but everything should be ready to be put into operation when it was over.

PERSONAL

Mr. E. W. Steele and Mr. T. Fraser have been elected directors of the Metropolitan-Vickers Electrical Company, Limited.

Mr. W. Killingbeck, director and general manager of the Barrow Hematite Steel Company, Limited, has been appointed a J.P. for Barrow.

Mr. W. Haynes, director and secretary of Ruston & Hornsby, Limited, has resigned his secretaryship after 52 years' service with the company.

Mr. J. T. H. Dixon, lecturer in engineering for 42 years at King's College, Newcastle-upon-Tyne, is to retire, having reached the age limit.

Mr. Brian Colquhoun, Director-General of Aircraft Production Factories of the Ministry of Works, is resigning his post at the end of this month to go into private practice as a consulting engineer.

Mr. A. L. Fletcher, a member of the Wales and Monmouth Branch of the Institute of British Foundrymen, has resigned his position of foundry superintendent at the Tredomen Works of Powell Duffryn, Limited, to take up an appointment in India.

Mr. J. F. Perry, sales manager of the plant department, has recently been appointed to the board of the Metropolitan-Vickers Export Company. After the last war Mr. Perry rendered valuable service to the French Reconstruction Committee in replanning the devastated collieries in the north of France. He has travelled extensively in Australia, Africa and Europe in connection with Metropolitan-Vickers mining interests. The premier award of the Institution of Mechanical Engineers, *i.e.*, the Thomas Hawksley premium, was awarded in 1933 to Mr. J. F. Perry and Dr. D. M. Smith for their Paper on "Mechanical Braking and its influence on Winding Equipment."

OBITUARY

Mr. George W. Smith, London general manager of the Art Metal Construction Company, Limited, died on July 14.

Lt.-Col. N. W. Coe, head of the engineering department of the Technical College, Cardiff, since 1926, has died in Leicester.

Mr. Harrold Harris, of Streetly, died recently in his 76th year. He was appointed senior lecturer in metallurgy at Birmingham University after the last war, retiring in 1936.

Mr. Maurice Nugent, manager and a director of the Hammond Lane Metal Company, Limited, Dublin, died recently. He joined the firm about twelve years, ago, having previously been connected with the steel trade in Sheffield.

Lieut. Jack Firth, youngest son of Mrs. and the late Mr. T. H. Firth, and brother of Mr. Ambrose Firth, of Sheffield, has died from wounds received while serving with the York and Lancaster Regiment. Lieut. Firth, who was 34, joined the Territorials in 1939, and had served in Norway and Iceland. He was a director of Moorwoods, Limited, Harlaston Ironworks, Sheffield.

COMPANY RESULTS

(Figures for previous year in brackets)

Coghlan Steel & Iron—Dividend of 12½%.

Zinc Investments—Dividend of 2½% in respect of the year ended June 30.

Elmores Metal—Loss for 1943, £321 (£322); forward, £12,798 (£13,119).

Greenwood & Batley—Final dividend on the ordinary shares of 10%, making 15% (same).

John Baker & Bessemer—Dividend on the 6% cumulative preference shares for the half-year ended June 30.

International Diatomite—Net profit to March 31 last, £183 (£2,294); forward, £1,267 (£1,084). Directors do not recommend payment of a dividend (3%).

Consett Spanish Ore—Loss to June 30 of £67 (£108), reducing the credit balance brought in to £3,861. No dividend from the Orconera Iron Ore Company, Limited.

William Baird—Trading profit for the year to May 31, £335,502 (£325,303); net profit, £161,762 (£156,293); final dividend of 11%, making 15% (same); forward, £116,177 (£96,236).

Triplex Foundry—Profit for the year ended March 31, 1944, after charging depreciation, £1,015; brought in, £5,847; dividend on the preference shares of 5½%, less tax, £2,062; forward, £4,800.

Australian Iron & Steel—Net profit to November 30 last, £350,345; preference dividend, £75,000; to general reserve, £200,000; interim preference dividend, £37,500; forward, £142,150 (£104,304).

Darwins—Trading profit for the year ended March 31, £101,194 (£140,199); other income, £39; brought in, £26,970; to general reserve, £25,000; dividend on the ordinary shares of 6%, less tax (same), £15,275; forward, £11,982.

Mint, Birmingham—Profit balance, after writing off depreciation and providing for taxation and war damage insurance and including the balance brought forward from March 31, 1943, £16,249; dividend of 10% (same); forward, £9,249 (£5,505).

Spear & Jackson—Net profit for 1943, after E.P.T., £63,212 (£60,515); to reserve for income-tax and N.D.C., £26,856 (£21,123); special A.R.P., £5,418 (£9,787); ordinary dividend of 12½% (same); to reserve, £5,000 (same); forward, £7,503 (£6,240).

Barton & Sons—Gross revenue for 1943, £196,714; E.P.T., £125,000 (£44,000); income-tax, £13,202 (£12,142); capital redemption reserve, £7,466 (£7,323); preference dividend, £7,389 (£7,401); ordinary dividend of 7% (same); forward, £22,147 (£20,115).

John Lysaght—Profit for 1943, including dividends from subsidiaries, £538,565 (£501,205); depreciation, £150,000 (same); preference dividend, £18,000 (same); ordinary dividend of 3s. per share, free of tax, £300,000 (same); forward, £250,623 (£280,058).

A.B.C. Coupler & Engineering—Net profit for year to September 30, 1943, £6,775 (£6,590, after crediting reserve no longer required and debiting provision for tax and contingencies); ordinary dividend of 12½% (10%); to general reserve, £4,000 (same); forward, £1,799 (£1,598).

Manley & Regulus—Profit to April 30 last, £104,619 (£127,842); maintenance and depreciation, £18,716 (£24,779); available, £85,403 (£102,563); ordinary dividend of 10% (same); taxation, £61,636 (£85,070); deferred repairs, £15,000 (nil); war damage, £828 (£981); forward, £41,934 (£41,071).

W. & T. Avery—Net profit for the year ended March 31, £139,377 (£138,150); dividend on the 5% "A" and 5½% "B" preference stock, less tax, £7,510; ordinary dividend of 15% (same); to general reserve, £10,000; to contingency (war) reserve, £45,000; to pensions fund reserve, £10,000; forward, £68,465 (£66,818).

Sheffield Steel Products—Net profit for year to March 31, after taxation and £6,427 for debenture sinking fund, £67,959 (£80,025); depreciation, £35,000 (£25,000); deferred repairs, nil (£20,000); ordinary dividend of 7½% (same); additional debenture sinking fund, £3,489 (same); to general reserve, £20,000 (same); forward, £24,615 (£22,123).

General Electric Company—Profit to March 31 last, after making provision for E.P.T. and for contingencies, £1,812,409 (£1,748,917); depreciation, £460,699; directors' fees, £4,335; pension fund, £106,645; to income-tax reserve, £700,000 (same); preference dividends, £126,000 (same); ordinary dividend of 17½%, including 7½% bonus (same); forward, £865,134 (£817,762).

Hick Hargreaves—Trading profit to March 31 last, after taxation, £52,835 (£47,430); bank interest, less debenture interest, £160 (£98); interest on investments and tax reserve certificates, £1,541 (£300); depreciation, £12,883 (£11,306); war damage, £1,484 (£2,217); net profit, £40,169 (£34,305); dividend of 10% (same); contingencies, £10,000 (same); welfare fund, £5,000 (nil); forward, £4,077 (£5,308).

Glacier Metal—Net profit for the year to February 29, 1944, £78,579 (£49,354, plus £10,000 for E.P.T. recoverable); brought in, £7,262 (£7,674); post-war rehabilitation of factories, £3,000 (£6,000); employees' profit sharing, £6,775 (£5,500); income-tax and E.P.T., £55,337 (£29,141); ordinary dividend of 7½% (same); to special contingency reserve, nil (£10,000); forward, £11,604 (£7,262).

Allied Ironfounders—Total trading profits earned by subsidiary and sub-subsidiary companies during year ended March 31, after depreciation and deferred repairs, £554,857 (£706,848); E.P.T. and income-tax, £343,919 (income-tax £357,083 and N.D.C. £37,267); net profit, £224,748 (£322,130); ordinary dividend of 12½% (same); to general reserve, £75,000 (£72,004); to contingencies and development reserve, nil (£75,000); forward, £223,064 (£214,522).

Johnson, Matthey & Company—Net trading profit for year ended March 31, £536,656 (£406,546); balance, after providing for depreciation, debenture interest, etc., and after paying the fixed dividend of 5% on the preference shares and the interim dividend of 3% on the ordinary shares, £722,869 (£592,227); to taxation reserve, £250,000; written off goodwill, £50,000; final distribution on the ordinary shares of 7%, making 10%, on the basis of a dividend of 6% and a bonus of 4%.

REFRACTORIES — *Will help Rebuild the Roads*

FROM THE overburdened roads of Britain at war will arise the Roads of the Future — broad highways to carry the traffic of post-war reconstruction. To the road-making industry there must flow vast supplies of cement, lime, road-stone, steel, road-making and stone-crushing machinery, equipment and power — all dependent in turn upon adequate supplies of furnace linings. In peace as in war, the G.R. organisation will play a vital part in meeting the national demand for quality Refractories.

FIRE BRICKS · BASIC BRICKS
ACID-RESISTING MATERIALS
CEMENTS & COMPOUNDS
INSULATION · SILICA BRICKS
SILLIMANITE · SANDS

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Raw Material Markets

IRON AND STEEL

In the interests of fuel economy, blast-furnace outputs have been curtailed, but this has synchronised with a reduction of activity in the foundries, and pig-iron production still keeps pace with current requirements. The industrial decline has been most marked in the light-castings establishments, which cater principally for the building trades. Here, of course, transition from war to peace would almost immediately lead to a marked industrial revival. On the other hand, the engineering and allied foundries have still a fairly satisfactory volume of work in hand, and for this class of work the call for low- and medium-phosphorus and refined irons has been further stimulated by the policy of the Control in strictly conserving available supplies of hematite for specially authorised purposes.

Makers of bar iron have enjoyed a period of steady employment, but the flow of new business at the moment is not particularly brisk, and works are open to accept additional commitments for the current period.

A few changes and adjustments have been made in the sources of supply, but in the aggregate the tonnages of billets, blooms, slabs and sheet bars supplied to the re-rolling mills have been well maintained. Good quantities of other re-rolling material, such as defective billets, double-sawn crops, old rails, etc., are also being put through the mills and, despite the high rate of consumption, the encroachments upon reserve stocks of steel semis has been negligible.

Rollers of small bars and light sections probably represent the only branch of the steel industry which is fully booked for the current period. Even the plate mills are rapidly overtaking their commitments and there has been a similar slackening in the flow of orders for sheets. Of course, these departments are not likely to experience an embarrassing decline in their activities such as has overtaken the rollers of heavy joists, channels, etc., and there is no slackening in the demand for rails, chairs, points and crossings for railway use or for arches, roofing bars, props, etc., for colliery maintenance.

NON-FERROUS METALS

The market as a whole pursues a somewhat humdrum course, and increased attention is being focussed on post-war problems. Since December, 1939, price stability has been maintained in copper, lead, zinc and other metals. The general easing of the demand, which must be expected with the close of hostilities, presumably will have some effect on the price structure of the metals. There has already been a great falling off in the values of some types of scrap.

Supplies of copper available to America during 1944 are estimated by the Special Committee investigating the National Defence Programme at 3,385,000 tons. Requirements are placed at 3,378,000 tons; this is an increase of 160,000 tons over the 1943 consumption figure of 3,198,000 tons. It now appears that the U.S. copper supply will cover essential requirements, and leave an appreciable surplus in the hands of the Government. Earlier reports had all stressed the difficulty of the situation, but it now seems that the immediate position is quite well assured.

WAGES OF WELDERS AND DRESSERS IN STEEL FOUNDRIES

The National Arbitration Tribunal has given its award on a claim for certain specified rates of wages for welders, burners, grinders and sandblasters employed in foundries. The parties to the dispute were members of associations federated with the Engineering and Allied Employers' National Federation, and members of the Iron, Steel and Metal Dressers' Trade Society. The dispute arose out of a claim made by the workmen that the wages of the members of the Society employed as welders in foundries should not be less than 5s. a week above the dressers; that the wages of burners employed in foundries should not be less than the same rate as the dressers, and that the wages of grinders and sandblasters should not be less than the dressers.

The Tribunal have awarded as respects workers employed in England and Wales:—

(*a*) That the minimum basic rate for welders in steel foundries working on steel castings shall be 3s. 11d. per week of 47 hrs. over and above the district minimum basic rate for dressers; (*b*) that the minimum basic rate for burners in steel foundries working on steel castings shall be the district minimum basic rate for dressers; (*c*) that the minimum basic rate for sandblasters in foundries (whether steel, iron, or non-ferrous metal foundries) who are required to work inside the sandblast chamber shall be the district minimum basic rate for dressers.

The Tribunal found against that part of the claim which related to grinders and have awarded accordingly.

NEW COMPANIES

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

Leeds Welding Company, 3, Fleece Lane, Leeds—£4,000. R. & L. Archer.

Parrock Curry & Company, 81, Highgate Road, Sparkbrook, Birmingham, 12—Engineers. £1,000.

Cox Engineering Company, 14, Park Lane, Sheffield, 10—£3,000. G. C. and E. F. O. Alton and Chas. E. Gray.

Ingram Engineering—£3,000. C. G. F. Ingram, "Arrochar," Dyke Road, Hove, Sussex, and E. B. Sandhagen.

CURRENT PRICES OF IRON, STEEL AND NON-FERROUS METALS

(Delivered, unless otherwise stated)

Wednesday, July 26, 1944

PIG-IRON

Foundry Iron.—CLEVELAND NO. 3: Middlesbrough, 128s.; Birmingham, 130s.; Falkirk, 128s.; Glasgow, 131s.; Manchester, 133s. DERBYSHIRE No. 3: Birmingham, 130s.; Manchester, 133s.; Sheffield, 127s. 6d. NORTHANTS No. 3: Birmingham, 127s. 6d.; Manchester, 131s. 6d. STAFFS No. 3: Birmingham, 130s.; Manchester, 133s. LINCOLNSHIRE No. 3: Sheffield, 127s. 6d.; Birmingham, 130s.

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

Hematite.—Si up to 2.25 per cent., S & P 0.03 to 0.05 per cent.; Scotland, N.-E.Coast and West Coast of England, 138s. 6d.; Sheffield, 144s.; Birmingham, 150s.; Wales (Welsh iron), 134s. East Coast No. 3 at Birmingham, 149s.

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

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

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

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

Cold Blast.—South Staffs, 227s. 6d.

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

FERRO-ALLOYS

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

Ferro-silicon (5-ton lots).—25 per cent., £21 5s.; 45/50 per cent., £27 10s.; 75/80 per cent., £43. Briquettes, £30 per ton.

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

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

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

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

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

Ferro-chrome.—4/6 per cent. C, £59; max. 2 per cent. C, 1s. 6d. lb.; max. 1 per cent. C, 1s. 6½d. lb.; max. 0.5 per cent. C, 1s. 6¾d. lb.

Cobalt.—98/99 per cent., 8s. 9d. lb.

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

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

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

SEMI-FINISHED STEEL

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

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

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

FINISHED STEEL

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

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

Bars, Sheets, etc.—Rounds and squares, 3 in. to 5½ in., £16 18s.; rounds, under 3 in. to ⅝ in. (untested), £17 12s.; flats, over 5 in. wide, £15 13s.; flats, 5 in. wide and under, £17 12s.; rails, heavy, f.o.t., £14 10s. 6d.; hoops, £18 7s.; black sheets, 24 g. (4-ton lots), £22 15s.; galvanised corrugated sheets (4-ton lots), £26 2s. 6d.; galvanised fencing wire, 8 g. plain, £26 17s. 6d.

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

NON-FERROUS METALS

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

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

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

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

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

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

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

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

Phosphor Bronze.—Strip, 14½d. per lb.; sheets to 10 w.g.; 15½d.; wire, 16½d.; rods, 16½d.; tubes, 21½d.; castings, 20d., delivery 3 cwt. free. 10 per cent. phos. cop. £35 above B.S.; 15 per cent. phos. cop. £43 above B.S.; phosphor tin (5 per cent.) £40 above price of English ingots. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 10d. to 1s. 4d. per lb.; rolled to 9 in. wide, 1s. 4d. to 1s. 10d.; to 12 in. wide, 1s. 4½d. to 1s. 10½d.; to 15 in. wide, 1s. 4½d. to 1s. 10½d.; to 18 in. wide, 1s. 5d. to 1s. 11d.; to 21 in. wide, 1s. 5½d. to 1s. 11½d.; to 25 in. wide, 1s. 6d. to 2s. Ingots for spoons and forks, 10d. to 1s. 6½d. Ingots rolled to spoon size, 1s. 1d. to 1s. 9½d. Wire, round, to 10g., 1s. 7½d. to 2s. 2½d., with extras according to gauge. Special 5ths quality turning rods in straight lengths, 1s. 6½d. upwards.

NON-FERROUS SCRAP

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

Returned Process Scrap.—(Issued by the N.F.M.C. as the basis of settlement for returned process scrap, week ended July 22, where buyer and seller have not mutually agreed a price ; net, per ton, ex-sellers' works, suitably packed) :—

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

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

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

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

IRON AND STEEL SCRAP

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

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

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

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

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

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

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SITUATIONS

FOUNDRY MANAGER, age 39, M.I.Brit.F.; ex-Serviceman; practical, technical, commercial training; metallurgist; expert repetition production; hand and power GREY and MALLEABLE light castings; take entire charge all depts., patternshop, annealing; guarantee results; excellent record; free short notice to join Midland Foundry immediate; salary secondary; prospects; keen, energetic, loyal.—Box 588, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

YOUNG METALLURGIST (B.Sc.). with research aptitude and 10 years' experience, seeks position on research or development.—Box 586, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

HEAD FOREMAN, Ironfoundry, seeks re-engagement; in or near London preferred; highest reference.—Box 592, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

FOUNDRY MANAGER required; preferably with experience in steel and bronze founding; degree or higher national certificate essential; age not over 35 years; managerial abilities and sound practical knowledge a condition; applicants to supply full particulars as regard education, positions occupied, and salary required.—Box 576, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

METALLURGIST wanted; experience in manufacture of ferrous and ferro-alloys or with high metallurgical degree. Important permanency for real technician excelling at metallurgical calculative, theory and practice. Birmingham area. Salary £500—£1,200, according to ability.—Applicants should write, quoting F2660XA, to the MINISTRY OF LABOUR AND NATIONAL SERVICE, Room 432, Alexandra House, Kingsway, London, W.C.2, for the necessary forms which should be returned completed on or before 26th August, 1944.

FOREMAN, young man with technical knowledge, to assist Manager of Foundry; output 60 tons per month; preferably with experience of good quality machine tool castings.—Apply in writing, giving full particulars of experience, age, etc., to ASSISTANT REGIONAL CONTROLLER, Ministry of Labour and National Service, 33, Stockwell Street, Glasgow, C.1.

COST CLERK required by non-ferrous Foundry in Midlands. Experience of process costs an advantage. Good post-war prospects. Pensions scheme in operation. Salary £400-£500 per annum, according to ability.

Applications in writing (no interviews), stating date of birth, full details of qualifications and experience (including a list in chronological order of posts held), and quoting reference No. 186, should be addressed to the MINISTRY OF LABOUR AND NATIONAL SERVICE, Appointments Office, 12, Manor Road, Coventry.

FOUNDRY MANAGER wanted for medium size Foundry in Midlands engaged on General Engineering Work up to 8 tons, and also Machine Moulded Castings.—Apply, stating age, experience, and salary required, to Box 584, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

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IT is desired to secure the full commercial development in the United Kingdom of BRITISH PATENT No. 534,756, which relates to Improvements in Method and Apparatus for Casting Metals, either by way of the grant of licences or otherwise on terms acceptable to the Patentee.—Interested parties desiring copies of the patent specifications should apply to STEVENS, LANGNER, PARRY & ROLLINSON, 5 to 9, Quality Court, London, W.C.2.

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SKLENAR Patent Melting Furnaces; coke- or oil-fired; capacity 2 tons, 1 ton, ½ ton, 500 lbs.—SKLENAR PATENT MELTING FURNACES, LTD., East Moors Road,

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