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Rank Bad Business

Arriving in a large Scottish foundry towards lunch time after an all-night journey from London, we found the works virtually closed down owing to one of these all-too-frequent electricity cuts. That meant that in wages alone £200 had gone into fresh air! Before we left in the afternoon, power was cut off for a second time, and there is a good prospect of it becoming epidemic throughout the winter. We are told that in this part of Scotland the domestic power demand has grown out of all recognition since the war, whilst the generating plant is now of less capacity. The outlook indeed presents for industrial Scotland a pretty grim picture.

A possible solution that suggests itself to our mind as laymen in such matters seems to be the provision of private generating stations to take care of a portion of the load. At the moment the contract with the electricity authority is usually of a dual nature. There is one payment for the kilowatt demand and a second to cover the actual electricity used. The former is necessarily based on the peak load. By switching in one's own plant at periods of high load the demand from outside sources could be lowered. The higher cost of generating one's own current would be partly offset by the lowering of the kilowatt demand charge. Following these precepts one firm has halved its former kilowatt demand to equal its normal summertime requirements. Another obvious advantage is that essential services such as operating the cupola and handling the liquid metal can be undertaken from the home-generated supply where there is a total cessation of current from outside.

The cessation of manufacturing is not the only problem involved. There is a risk of damage through magnet-transported loads dropping at random and smashing whatever happens to be underneath. Liquid metal freezes in furnace and ladle, or a bit of scrap may pass over a magnetic separator at the crucial moment and cause damage at later stages of processing. The starting and stopping of a mechanised moulding system is done quite methodically and the omission to switch off some section when in total darkness is also a potential source of trouble, unless special switching gear has been installed. Still worse is the liability of accidents to the staff. Another annoying feature is the supply of low-pressure current. Electric clocks are usually slow during the day, which can be a cause of trouble, but the slowing up of machinery is still worse. Soon after this Government came into office, under the heading of "Popping the Tool Kit" we protested against the export of machine tools, so urgently required at home for the re-establishment of a healthy overseas trade in finished goods. It seems that not only machine tools, but also much generating plant has wended its way across the oceans. Finally, to cap all, there is a scarcity of raw materials. In the earlier leading article referred to we stated that the last thing an out-of-work craftsman did was "to pop his tool kit"; we ought to have said "sold." This export of plant, essential to our industrial recovery, is just one more case of rank bad business.

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Dinners

Worshipful Company of Founders

The Worshipful Company of Founders held a Livery Dinner at the Grocers' Hall in the City of London on Monday last. Among those who accompanied the Master J. L. Wheeler were the Lord Mayor, Alderman Denys Lowson, the Rt. Hon. H. Macmillan, M.P.; Sir Hugh P. Lloyd, K.B.E., Prof. D. M. Hewitt, Mr. S. Vyvian Hicks, Dr. Cecil J. T. Cronshaw, Dr. S. F. Dorey, C.B.E., Mr. R. W. Mountain, Mr. J. E. Swindlehurst, Mr. F. Scopes, Sir James Grigg, P.C., Dr. F. D. Howitt, Mr. A. P. L. Blaxter (immediate past-master), the Rev. Preb. Stanley Eley, Lt.-Col. Dudley Lewis, Mr. J. E. Stinson, Mr. David Thomson, Sir Leslie Brass, Mr. W. H. Gunton, Mr. Percy L. Young (past-master), Mr. Douglas Wood, Mr. Frank Woodward, Mr. R. Brunel Hawes, Mr. Albert L. Parrott, Mr. Hugh S. Stannus (past-master), Mr. A. Stanley Young (past-master), Mr. Francis G. Grierson, Mr. F. Barrow, Mr. H. C. Bradbrook (upper warden), Mr. Sheriff Percy L. Lovely, Alderman and Sheriff Lt.-Col. G. J. Cullum Welch, O.B.E., Major L. E. Cotterell (under warden), Mr. M. W. H. Lanchester, Mr. C. E. Styles, Mr. W. A. Prater, Mr. H. Wilson Wiley (the clerk), Mr. Geo. B. Cotton, J.P., Mr. J. Arthur Taylor (past-master), Mr. R. W. Hatswell (past-master), Mr. F. J. R. Miles (past-master), Mr. L. H. Corbould-Ellis (past-master), Mr. W. G. Fossick (past-master), Mr. R. B. Templeton, Mr. D. D. Prenn, Sir Archibald Forbes, Mr. D. Cherry Paterson, Major Sir Paul M. Booth, Mr. Colin Gresty, Mr. C. C. Booth, Mr. G. B. Judd, Dr. J. G. Pearce, O.B.E., Lt.-Col. R. C. Scott, Mr. S. J. Butler, Mr. K. Marshall, Mr. V. C. Faulkner, Mr. P. C. Fassotte, Mr. J. J. Sheehan, Mr. T. Makemson, M.B.E., Mr. R. F. Ottignon, Mr. F. W. Rowe, Mr. F. Arnold Wilson, Mr. W. G. Buchanan, Mr. H. W. Secker, O.B.E., Mr. A. Carr, Mr. G. Wood, Mr. J. W. Gardom, Mr. P. A. Russell, Mr. N. L. Goodchild, Dr. J. E. Hurst, J.P., Mr. D. H. Wood, Mr. A. Watson, Mr. P. H. Wilson, O.B.E., Mr. D. Graham Bisset, and Mr. N. P. Newman, J.P.

I.B.F. London Branch

Mr. F. E. Tibbenham presided over the annual social function of the London branch of the Institute of British Foundrymen, which was held at the Café Royal, London, W.1, last Friday. Amongst those present were Mr. J. J. Sheehan, Mr. T. Makemson, and Mr. L. J. Tibbenham. The committee responsible for the organisation consisted of Mr. W. G. Mochrie, Mr. Barrington Hooper, Mr. F. Arnold Wilson, and the president. Mr. A. R. Wizard was the Master of Ceremonies.

Craft Training Centre

The Trustees and Management Committee take this opportunity of thanking all those firms who have supported the efforts being made at the National Foundry Craft Training Centre to instruct the trainees entrusted to their care so as to provide the industry with highly skilled craftsmen for which there is such a great and urgent demand.

They extend to all their friends and supporters their appropriate season's greetings and best wishes for the future. They look forward to their continued support with confidence and also to greater encouragement in the future from the industry as a whole.

Book Review

A History of Steel Casting. Compiled and edited by Arthur D. Graeff under the direction of William H. Worrilow, former president of the Steel Founders' Society of America, which body publish the book. Obtainable through the Penton Publishing Company, Limited, 2, Caxton Street, Westminster. Price $2.50 (23s.).

After a good deal of research, the late Mr. W. B. Lake in his presidential address to the annual conference of the Institute of British Foundrymen in 1939, attributed the making of the first steel casting to Jacob Mayer of the Bochum Verein Steelworks about 1851. This book puts forward the claim of Mr. J. C. Fischer, of Schaffhausen, Switzerland, who is stated to have made a steel casting as early as 1845. The answer to the question as to who made the first steel casting in the United States is also somewhat controversial, but its early development was undoubtedly due to Mr. William Hainsworth at the Pittsburg Steel Company. The corresponding question for this country is neither posed nor answered in the book. Moreover, if it were posed, the reviewer would not be able to answer.

It may be wondered why the reviewer has digressed from his task of giving an opinion on the merits of the book, but the truth is that the contents happen to be of the type which raises queries. The book has but little to do with technology. It is what it sets out to be—a history. The compiler has apparently not been able to fit in all the bits of jig-saw pieces into the main picture, and so there is a collection of thumb-nail sketches of the various pioneers who have contributed so much to the American steelfoundry business. Though but a small percentage of the names are truly familiar to British readers, yet the same type of rugged individualist is to be found amongst those who have built up businesses in this country. We stress again that this is not a technical book, but those interested in recent history will find it both interesting and authentic.

V. C. F.

West Riding Power Cuts

Repeated power cuts affected the West Riding of Yorkshire last week. At Shipley, on Wednesday and Thursday, 450 men at J. Parkinson & Son (Shipley), Limited, machine-tool makers, were twice obliged to down tools on account of power cuts (7.30 a.m. to 12.15 p.m. and again at 3.50 p.m. on Wednesday, and three cuts on Thursday, 7.55 a.m. and 10.35 a.m., 11.5 a.m. to 12.5 p.m. and again at 4.10 p.m.). The men were consequently sent home on both days, and Mr. Ernest Parkinson, managing director, said the cuts were having a very serious effect on both production and the men's wages. A further cut was experienced on Friday. The men were paid so long as they remained on the premises, and they were endeavouring to make up some of the loss by working on Saturday. Mr. Parkinson admitted that the authorities were doing their best and thought that, if domestic and other users would economise, the cuts would be unnecessary. At Otley, on Friday, some 300 out of 800 men employed at the printing-engineering firm of Dawson, Payne & Elliott, Limited, as well as 200 from smaller firms in the town were sent home because of power cuts, which began at 7.30 a.m.

AT A LONG-SERVICE CELEBRATION held by Robey & Company, Limited, no fewer than seven people with over 50 years' continuous employment were the recipients of presents from the directors.

Mechanical Testing and Properties of Grey Cast Iron*

By C. K. Donoho

The commonly-used mechanical tests for cast iron are described in light of their usefulness and meaning. Some new test data on section/size effect in grey irons are presented. Tensile, transverse, impact and hardness tests are discussed and the correlations between the different values are developed. Mechanical tests for the evaluation of nodular-graphite cast iron are described and the position of this material in relation to other cast ferrous metals is discussed.

THE EVALUATION of grey-iron castings by testing is difficult, principally because the test values ordinarily obtained often bear little relation to the properties which confer serviceability in the casting. Also, the test values obtained from separately-cast test-bars are an uncertain indication of the properties of the metal in the casting. However, as the mechanical properties of cast iron and the correlations between properties and structures are better understood, logical specification of values to insure serviceability becomes more feasible.

Tensile Tests

The general American specification for grey-iron castings (A.S.T.M. A-48) divides irons into classes based on tensile strength. The test-bars are separately-cast in three standard diameters to allow matching of section size between test-bar and casting. Fig. 1 shows typical test results for three classes of irons in the three standard bar sizes, plus a smaller and a larger bar added to better delineate the trend. Tensile strength typically decreases with increasing section size and also is lowered by increase of carbon, silicon, and phosphorus content. Fig. 2 shows similar tests on a low-carbon, high-silicon iron which shows little change in strength with changing section size. As section size increases, the combined carbon tends to decrease, the grain size increases, and the pearlite becomes coarser. These effects cause the matrix to become weaker as section size increases. However, with an iron that is sensitive to undercooling there is a tendency to form the undesirable, type D,† graphite in the smaller bars where undercooling is most severe. This effect tends to cause strengthening due to better graphite distribution as section size increases. Therefore, increasing section size causes the matrix to become weaker, but may cause the graphite distribution to become more favourable for high strength. Fig. 2 illustrates the fact that these two opposing effects in certain irons may be so nearly compensating that there is little effect of changing section size on tensile strength.

Inoculation (ladle addition of a graphitiser), is often used to eliminate or reduce the undesirable type-D graphite. The high strength iron of Fig. 1 was inoculated with ferro-silicon so that type-D graphite did not form in the smaller bars. The iron in Fig. 2 was not inoculated. It is apparent that inoculation largely eliminates the variable of graphite distribution, thus making the strength more consistent and predictable.

In the A.S.T.M. A-48 specification, the dimensions of the tensile specimens to be machined from each of the standard bar sizes are specified. However, the question often arises as to the effect of diameter of the tensile specimen machined from a larger cast section. Fig. 3 shows tests on tensile specimens varying in diameter from ¼ in. to 1.875 in., but all machined from the centre of 3-in. dia. bars. It is rather surprising that in most cases small specimens from the very centre of the bar are equal in strength to the larger specimens. Schneidewind[1] previously has shown this to be true for test-bars cast in metal moulds and annealed.

Transverse Test

In specification A-48, transverse tests are optional, and this test is often used by agreement in lieu of the tensile test to qualify an iron in its specified class. The transverse test is usually made on the as-cast bar and emphasises the structure and surface of the cast skin. An advantage of the transverse test is that strain measurements (deflection) are made more easily than in the tensile test. It has been pointed out, however, that substantial errors in transverse strain measurement are not uncommon, and that care must be taken to avoid measuring falsely excessive deflection.[2,3,4] Fig. 4 shows transverse strengths, calculated to modulus of rupture, for the four irons of Figs. 1, 2 and 3.

Hardness Tests

The Brinell test is the most commonly-used test to measure hardness of cast iron. Since the surface hardness of a cast-iron test-bar may be considerably different from the hardness at the centre, one point to be clarified is: What is the average hardness of a given cast-iron test-bar? One frequently-used

* A Paper read before the American Society for Testing Materials at a meeting held in San Francisco. The Author is on the staff of the American Cast Iron Pipe Company of Birmingham, Alabama.

† This relates to the American standard classification of graphite size.—ED.

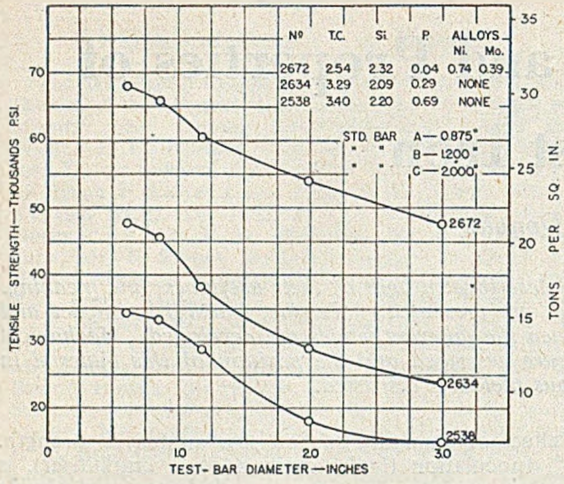

FIG. 1.—*Variation of Tensile Strength with Test-bar Diameter.*

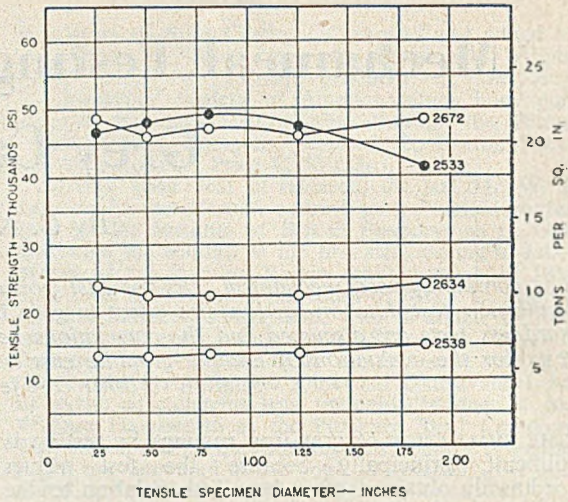

FIG. 3.—*Effect of Diameter of Tensile Specimen Machined from Centre of 3-in. dia. Test-bars.*

convention is to read the hardness on an impression made on a flat surface ground just through the threads of the standard machined tensile bar. This is at about half-way between surface and centre of the as-cast bar. Others have used an average of the centre, quarter, and surface hardness readings. Fig. 5 shows average hardnesses by the latter method for the four irons shown previously. Note the irregularity in the smaller bars cast from the non-inoculated low-carbon iron No. 2533.

Impact Tests

There is no single standard method for rating the impact strength of cast iron. At least three different tests are used to some extent. An Izod-type test was developed in England. This test uses a cylindrical specimen 0.798-in. diameter. and 3 in. long, which is tightly gripped at one end and broken as a cantilever by a single blow in a pendulum-type impact machine. A Charpy-type test is used by the Caterpillar Tractor Company and others. This specimen is a machined or ground cylinder 1⅛-in. dia. and 8 in. long, which is broken as a simple beam on 6-in. span by a single blow in a pendulum-type impact machine. A third type is the Acipco drop test, which is described in the 1933 Report of A.S.T.M., sub-committee XV of A-3[5] on Impact Testing of Cast Iron. This test differs from the first two in that it is a repeated-blow test which measures the energy required to break the specimen after most of the plastic deformation has occurred. The drop test may be performed on the A-48 standard bars A, B and C in the as-cast condition. For the B bar (1.20-in. dia.), a 6-in. span and a 25-lb. hammer are used. The first drop is from 2-in. vertical height and there are successive drops at 1-in. increments to failure. This test has been adapted for pendulum-type machines also.

Correlations between Test Values

Since hardness is one of the easier tests and usually is not destructive, it is most valuable to develop the

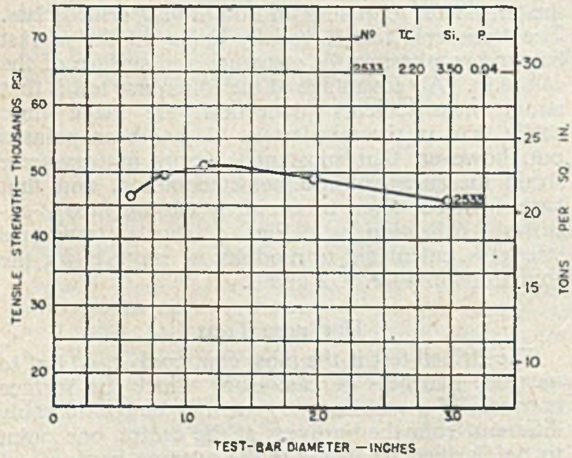

FIG. 2.—*Tensile-strength Variation with Test-bar Diameter for a Low-Carbon Iron—not Inoculated.*

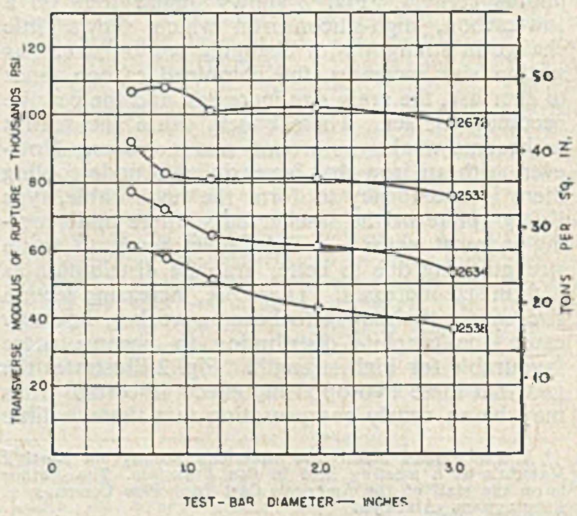

FIG. 4.—*Variation of Transverse Modulus of Rupture with Test-bar Diameter.*

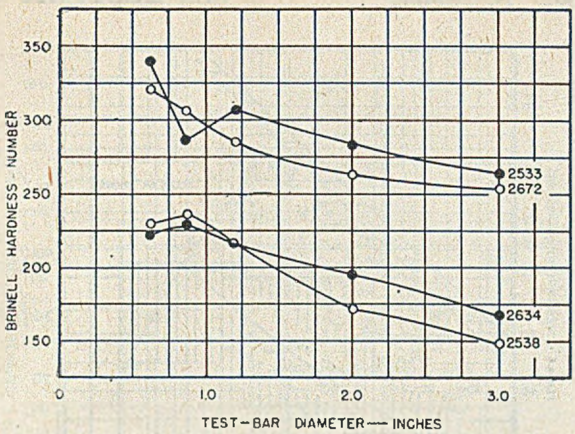

FIG. 5.—*Variation of Brinell Hardness with Test-bar Diameter.*

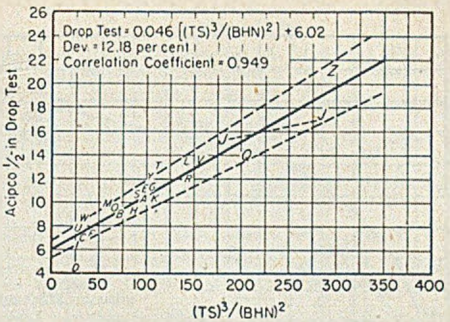

FIG. 7.—*Relation of Impact Strength to a Tensile/Brinell Ratio Factor.*

correlation between Brinell hardness and other properties. In steels, the ordinarily determined tensile strength correlates well with Brinell hardness, so that tables are given showing the approximate tensile strength for each hardness range for carbon and low-alloy steels. In cast irons, the hardness/tensile strength relation is complicated by many other factors, particularly by graphite type which markedly affects strength, but affects hardness to a lesser degree. Consequently, the relation shown in Fig. 6, as developed by MacKenzie[6] from over 1,500 tests, is a rather broad one.

This chart is useful as a gauge of quality of a grey iron. If an iron contains an appreciable amount of type-D graphite, which notably confers poor toughness and poor wear resistance, it will be found to lie in the lower portion of the field for a given hardness level. Conversely, when an iron gives values in the upper part of the field, this is an indication that the graphite form is most favourable for toughness and wear resistance as well as for strength. Inoculated irons in comparison with all irons were shown by MacKenzie[6] to lie in the upper part of the field.

Since transverse strength varies broadly with tensile strength, it is apparent that a relation similar to that of Fig. 6 will be found for transverse strength against Brinell hardness. Since a high ratio of tensile strength to Brinell hardness indicates a graphite form favourable to best toughness, it is to be expected that impact strength will show correlation with some tensile/Brinell ratio. Fig. 7 shows drop-test impact plotted against $T.S.^3/B.H.N.^2$ This abscissa value was shown by MacKenzie[6] to give a higher correlation coefficient with impact strength than either T.S./B.H.N. or $T.S.^2/B.H.N$

When in the transverse test the complete stress/strain curve is obtained, the area under the curve gives the work done in breaking the bar which is expressed as inch-pounds transverse resilience. It has been shown[5] that the single-blow pendulum impact tests give results which follow closely the resilience measured in the transverse test. One strength value which does correlate well with Brinell hardness is the compression strength. The irons from the 1933 Impact Report[7] are plotted in Fig. 10.

Testing Nodular-graphite Cast Iron

Any present-day discussion of grey cast iron is incomplete without consideration of nodular-graphite cast iron. Although in mechanical properties this material more nearly resembles malleable iron or cast steel, compositionally and structurally (except for graphite shape), it is a true grey cast iron. The evaluation of nodular irons by mechanical testing poses some entirely different problems. Since this material may have appreciable ductility and may vary considerably in this property, a simple tensile test for strength is entirely inadequate as a specification test. More information may be obtained from the transverse test when

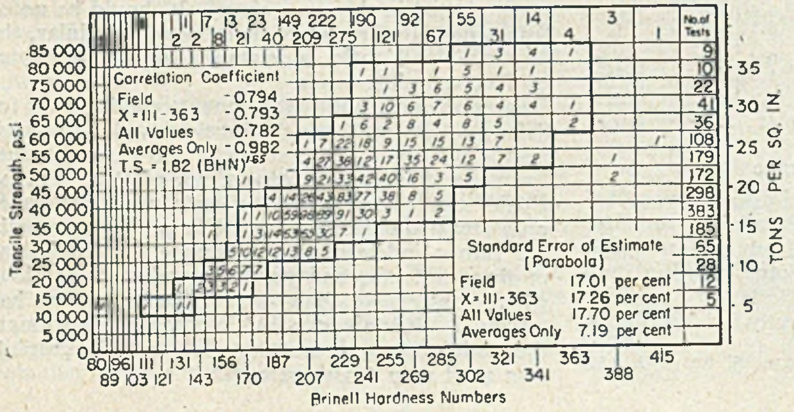

FIG. 6.—*Tensile-strength/Brinell-hardness Relationship for 1553 Grey Irons (MacKenzie).*

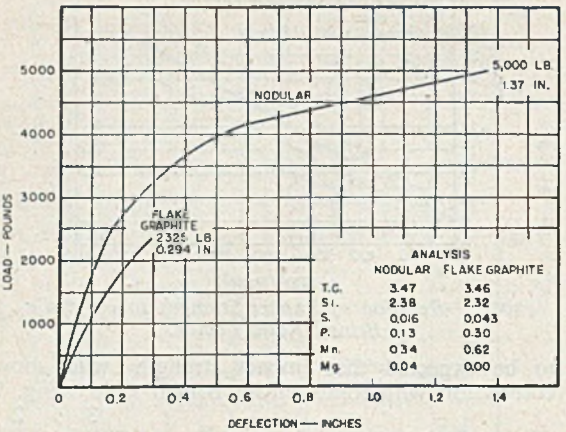

FIG. 8.—*Typical Transverse Stress/Strain Curves for a Flake-graphite Grey Iron and a Nodular Iron.*

deflection values are measured and stress/strain curves plotted. Tests on 1.20 in. dia. transverse bars (A-48, bar B) have been used to evaluate the properties of nodular-graphite irons (Fig. 8).

Tensile testing of nodular-graphite iron should follow the methods used for malleable iron or cast steel where yield point and percentage elongation are determined as well as the tensile strength. Probably, the most consistent type of test-bar for evaluating the true properties of a material is the keel-block coupon as used by steel foundries and described in the Steel Castings Handbook.[7] The keel block mould is so designed that the legs, or coupons, are perfectly fed, and tensile specimens machined therefrom are free from shrinkage. This type of test-bar shows the true properties of a cast material in its best physical condition. Tests on one heat of nodular iron were made with standard 0.505 in. dia. steel-type tensile bars machined (A) from keel-block coupons and (B) from vertically-cast 1.20 in. dia. test-bars (A-48, bar B). (See Table I.)

TABLE I.—*Tensile Properties of a Nodular Iron from a Keel-block Specimen and from a 1.20 in. Dia. Round Bar, Not Annealed.* Tests on 0.505 in. dia. Tensile Specimens.

	T.S., tons per sq. in.	Y.P., tons per sq. in.	El., per cent.	BHN	Remarks.
A. (Specimens from (1)	41.7	26.7	9.4	180	—
keel-block coupon) (2)	41.9	26.7	8.1	186	
B. (Specimens from (1)	26.0	21.4	0.8	187	Centre line
A-48, bar B) (2)	27.3	21.4	1.8	187	shrinkage.

Composition: T.C., 3.70; Si, 2.58; Mn, 0.41; S, 0.028; P, 0.04 Mg, 0.05 per cent.

Centre-line Shrinkage

It is well known that cast steel also shows a decrease in tensile properties, especially ductility, when specimens are machined from sections with even minute centre-line shrinkage. Flinn and Chapin[8] showed comparative tests of a flake graphite grey iron* with a perfectly-fed keel-block

* T.C, 3.66; Si, 1.82; Mn, 0.94; P, 0.10; S, 0.06; Ni, 1.52, and Mo, 1.06 per cent.

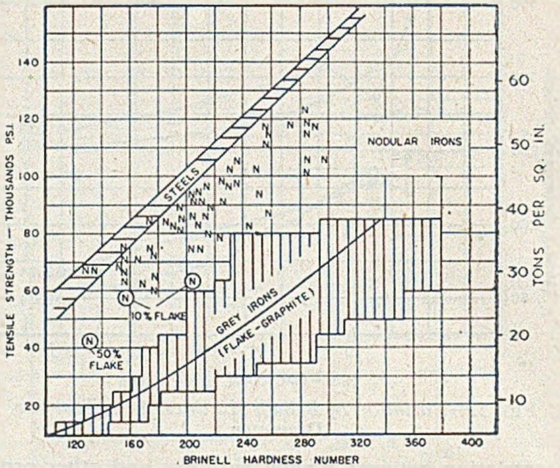

FIG. 9.—*Tensile-strength/Brinell-hardness Relationships for Grey Iron, Nodular Iron, and Steel.*

type specimen *versus* a specimen cut from a 1.20 dia. standard test-bar. Tensile stress/strain curves of 0.505 in. dia. specimens from both bars showed that the centre-line shrinkage in the 1.20 in. test-bar decreased the strength by about 22 per cent. and the elongation by 50 per cent. The effect of centre-line shrinkage shown in Table I, therefore, is not a characteristic of nodular iron alone but applies equally to cast steel and to flake-graphite cast iron. True tensile ductility of any cast material can be evaluated with consistency only by providing a shrinkage-free test-bar.

The type of tensile specimen commonly used for testing malleable iron has been used for nodular iron also. This specimen is cast to size and usually fed from both ends so that when the risers are cut off, the annealed bar may be tested without machining. The feeding characteristics of nodular grey iron are different from those of the white iron for malleable castings and present indications are that the malleable bar may have to be redesigned to give consistent and representative tests with nodular-graphite cast iron.

The tensile/hardness relation for nodular iron more nearly approaches that for steel than grey iron. Fig. 9 shows the approximate range for steels (several sources) and for grey irons (from Fig. 6) with several individual tests on nodular irons plotted in the same chart. It should be noted that, where the irons are incompletely nodular, the tensile/Brinell ratio is lowered toward the range of flake-graphite irons.

As previously intimated, one strength value for flake-graphite irons which correlates well with hardness is the compressive strength. In Fig. 10 values from the 1933 Impact Report[5] are plotted. A.S.T.M. E-256 standard compression tests were performed on a few nodular cast irons. Compressive strengths are rather indeterminate in ductile materials and in these tests the end point was taken as the load where observable bulging of the specimen had occurred. It is obvious that in compressive strength the nodular iron is not superior to flake-graphite iron as it is in tensile strength.

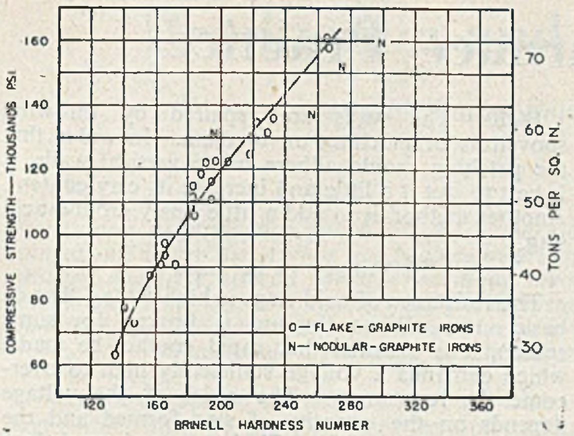

FIG. 10.—*Relation of Compressive Strength to Brinell Hardness.*

In carrying out tests on 10-in. dia. pipe cast in grey iron and in nodular iron, it has been observed that while the nodular pipe has two to three times the bursting strength of the grey-iron pipe, collapse tests show little difference in the two materials. A collapse test on pipe is just the opposite of a bursting test in that hydraulic pressure is applied to the outside of the pipe instead of to the inside. The collapse test is really a compression test and in both materials collapse strength is nearly proportional to the hardness.

It has been observed also that in transverse testing of nodular-graphite iron test-bars, failure sometimes initiates at the top or compression side of the bar. In this case V-shaped chunk is squeezed out from the top of the bar under the load. This type of failure is never seen in normal flake-graphite iron. These examples indicate simply that while in flake-graphite iron the compressive strength may be three times the tensile strength, with nodular graphite iron the compressive strength and the tensile strength are of the same order of magnitude (as with steel).

Conclusions

(1) Increasing section size and increasing carbon equivalent tend to lower the strength values and the hardness of grey cast irons.

(2) Inoculated irons are more consistent and predictable as to the effect of section size.

(3) The position of an iron in the tensile/Brinell chart affords an indication of the graphite form and distribution.

(4) A high ratio of tensile strength to hardness gives the greatest toughness as measured by impact testing.

(5) Properties of nodular-graphite cast irons are best evaluated by transverse tests with complete stress/strain curves or by steel-type tensile tests on specimens from keel-block coupons.

(6) Nodular-graphite cast irons have tensile/Brinell ratios much higher than flake-graphite irons and approaching the range of steels, but the compressive-strength/Brinell ratio is of the same order whether nodular or flake graphite.

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[8] Flinn and Chapin. *Ductility and Elasticity of White and Grey Irons.* Trans. A.F.S. Vol. 54. 1946.

European Steel Prospects

There must be capacity production of iron ore, coke, and scrap if planned increases of about 21 per cent. in European pig-iron production and 14 per cent. in crude steel production in 1951 over this year's output are to be achieved.

This was the conclusion reached by the Steel Committee of the United Nations Economic Commission for Europe after a three-day study at Geneva of iron and steel production plans and 1951 raw-material prospects. Delegates from 16 countries took part in the discussions.

Calling for maximum output of coke, iron ore, and scrap, and economy in their use in order to meet over-all requirements for capacity iron and steel production, delegates were aware that local shortages might arise. These risks are inherent in the situation where very scarce raw materials have to be traded between 24 European iron and steel producing countries, each of which is dependent on imports for covering at least part of its requirements for one of the main steelmaking raw materials.

In this situation, the committee believed that international action was required to ensure adequate supplies during the coming year. It urged the E.C.E. Coal Committee to seek means of achieving a satisfactory level and pattern of trade in coke and coking fines. The Steel Committee decided to reconvene its panel of experts on scrap to promote increases in supplies of scrap. It also urged technical adjustments in blast-furnace charges to conserve scarce materials, and, looking ahead to a more serious shortage of iron ore in 1953, called for an expert study of measures to ensure adequate supplies.

The countries of Europe, not counting the Soviet Union, are expected to produce 52 million metric tons of pig-iron and 69 million tons of crude steel in 1951. This compares with an estimated production this year of 43.3 million tons of pig-iron and 60.4 million tons of crude steel. In 1949 Europe produced 40.4 million metric tons of pig-iron and 55.5 million metric tons of crude steel.

The Steel Committee last spring joined the E.C.E. Transport Committee in urging a more even distribution of orders for railway rolling stock and equipment, especially advising against pre-war practices of placing costly orders during periods of prosperity and high prices and of cutting down purchases during periods of depression. Delegates agreed to continue their interest in this problem of achieving a more rational placing of equipment orders in the interest of the economy as a whole.

Acid Electric-furnace Practice

ANSWERING A QUERY addressed to the Editor of *Fonderie*, Mr. E. Sautereau provides the following information. The query related to the conversion of a 1½ to 2-ton electric furnace from basic to acid practice. Reference is made only to the differences between two processes, where similar conditions exist, they have been ignored.

Construction of the Furnace

Hearth.—In the case of a Héroult furnace, the ramming mixtures used for the converter can be employed—using similar methods for the construction of the hearth. It is best to use them in layers and to ram hard with pneumatic rammers. The complete hearth can be so rammed up, but this involves a protracted drying period. Thus it is best to set a couple of rows of silica bricks against the casing, making a good allowance for expansion at the joints. If the furnace carries a conducting hearth, it is necessary to use a low clay content siliceous mix, having a grain size of about 60 A.F.S. and containing about 30 per cent. of silica grains, ranging between 1.5 to 5 mm. This mixture should be bonded with about 8 per cent. of dehydrated tar.

Walls.—The walls, made either of a monolithic mix or of bricks, can be carried right up to the roof. Stability is best ensured by the use of bricks—a practice to be recommended. These bricks should be covered with the ramming mix to just above the slag line, as in basic practice. The converter lining material is generally somewhat too weak and so far as the walls are concerned, durability is improved by adding from 4 to 6 per cent. clay.

Drying and Burning-in

On completion, it is best to air-dry for at least two days with the doors wide open. Drying should then be continued for a further 48 hrs. by keeping a small wood or better a charcoal fire alight on the hearth. Burning-in must be carried out slowly during the next 40 to 48 hrs., using the electric-arc and protecting the hearth with either coke or electrode ends. After removing these materials, the hearth—still very hot—should be surface-vitrified by adding a few shovelfuls of finely ground acid slag.

Upkeep of the Furnace

Hearth.—Repairs must only be carried out after careful cleaning. With the basic furnace the hearth wears away to form a basin, from which it is easy to remove the steel by using a rabble. With acid hearths, however, much deeper holes are often formed. To clear them it is best to use hooks upon which the metal will gather. The mixture used for making-up the hearth can be used likewise for fettling. Quick work is essential so that existing heat can be utilised to frit it into place. For the same reason it is advisable to wait a few minutes before charging after patching.

Walls.—The walls are repaired by throwing shovelfuls of patching on to them. In order that the patching should adhere on to vertical walls, it is best to wet it a little and increase its clay content. Another method is to add a little finely ground acid slag.

Voltage to be Used

The resistance of acid slags is higher than that of basic ones. When the arc is broken for some reason, it is essential that rapid contact be made, which demands a voltage sufficiently high to overcome the resistance. The order of the voltage depends on the quantity of slag formed and the intensity of the current. Under normal conditions of working, and a current density per electrode of 15 amps per sq. cm., a voltage increase of about 20 volts is needed to simulate basic practice.

Melting Practice

Obviously, there is no question of sulphur and phosphorus reduction. The charges should not contain either ore or mill scale, as these attack the hearth. After melting, the degree of oxidation is estimated by breaking a slag sample. The colour of this may be anything between light yellow, greenish yellow and black. The silica content can be estimated according to the way it runs when a sample is taken at the end of a bar. It may run as droplets or as a continuous string. A dark-coloured slag which gives no string effect—known as "short"—is deficient in silica and is of the type which attacks the lining. The remedy is to add a small quantity of silica sand.

After melting the slag is sometimes voluminous and very viscous. This may mean that the hearth is giving trouble or that too great a quantity of sand has gone in with the scrap. Such a slag is troublesome and a slagging-off is called for. Slagging by tilting as in basic practice is quite difficult. A better procedure is to cover a bar with the slag by revolving it along the surface of the bath.

The composition and quantity of the slag having been established, a "boiling" set up by ore additions is necessary. This boiling has for its object the degasification of the metal, which at the high temperature of the arc tends to absorb nitrogen and hydrogen, which cause blowholes in the casting. A period from a quarter to half an hour is generally sufficient. This brings about decarburisation and an allowance must therefore be made when calculating the carbon content of the charge. When the ore has completely finished its action, the slag is deoxidised. This deoxidation is only partial and consists of displacing the iron oxide combined with the silica by making it react with a stronger base such as lime. This, however, must be carefully used for it tends to attack the lining; the lime content in the slag should not exceed 10 per cent.

Reliance may be placed on the aspect of the

(*Continued on page* 533.)

Production and Methods Control*

Application to Foundry and Patternshop

By T. H. Wood

The subject of production control in the foundry and patternshop is a complex one, and in the preparation of this Paper the Author has become aware of the difficulties involved in presenting as a coherent process, and in a concise form, a technique involving so many dissimilar factors. It is well-nigh impossible to set out a completely-integrated system unless it is limited to one particular foundry; and therefore an endeavour has been made to present the general applications of a production-control system which could be applied to almost any foundry whether large or small.

IT MAY BE USEFUL to marshal some of the advantages which may be expected from the application of a production-control system. A clear idea of what is to be expected may help in overcoming doubts as to the advisability of installing such a system. It may be said that any production system should:—

(1) Improve production and simultaneously reduce the detailed problem of supervisory and management staff.
(2) Enable the management to provide foremen and chargehands with a definite programme of work they should carry out.
(3) Enable it to be known when further orders are required, so that accurate delivery dates may be quoted.
(4) Enable the management to use their equipment to its best advantage.
(5) Finally, to utilise the labour force to its best advantage and to provide accurate information as to potential labour requirements.

The objection is often heard that production control tends to increase clerical staff and to involve an unusual amount of paper work. In general this is a much over-rated statement. It is more than likely that the introduction of a control system will establish the fact that excess paper work is already in existence. Reorganisation under production control usually proves that less clerical staff is required. The success of any system is dependent upon the people who have to operate it, as well as on the adequacy of the procedure itself. Some initial resistance to the installation of production control is almost inevitable. It may come from any quarter, but it will be overcome by patient explanation and, most important of all, by prior and tactful consultation with those who are to be concerned in its operation.

It will be appreciated by all foundrymen that it is a general trend in the foundry to concentrate on large castings, to maintain a high tonnage output, with complete disregard to the smaller castings which in turn become constantly overdue and result in unnecessary correspondence between customer and supplier. With the introduction of production control it is possible to maintain a balanced programme which complies with the delivery quoted to the customer, together with a steady tonnage output per week.

Basic Rules

Any company desirous of introducing production control must, in the first instance, decide on a set policy—for the best systems will not function if the managerial staff are at liberty to deviate from the policy laid down in order to fulfil fictitious delivery promises which only create works overdues. Having laid down a policy for foundry production and furnace tonnage, a survey of foundry equipment is necessary in order to determine the most economical and practical manner in which a set number of moulding boxes can be turned over in one week, to give the tonnage required.

Careful consideration must also be given to the coremaking, drying, closing, heat-treatment and fettling, since success is dependent on the co-ordination of events, as is well known in foundry practice. Bearing this in mind, the Author will now endeavour to outline the main principles involved in carrying out this procedure under strict production control.

In the first instance, a production section must be introduced. This section should be situated in a place where access to patternshop and foundry is readily available. The staff of the section, assuming that the foundry tonnage desired is 200 tons per week, would be as follows:—

Production engineer in charge, two technical men—foundry, two technical men—patternshop, two board controllers (female), two general office clerks (female).

This section would be responsible for job issue and methods control, for patternshop and foundry. Each week a set programme would be issued to both sections and all operational functions would be recorded daily in order to keep a progress check on work on hand. The paper work attached to this procedure would be as follows:—

Official works quotation, standard estimate sheet (Fig. 1), works order master record cards (Fig. 2), operators' job cards, material control cards, loading cards (Fig. 3), record cards, foundry method cards, and master record envelopes.

* Paper delivered to the South African branch of the Institute of British Foundrymen.

Production and Methods Control

The works quotation sheet would be issued to the works by the sales office and would be completed and returned after joint discussions between foundry and patternshop. For office record purposes, a standard estimate sheet is required. This would carry all relevant information as to foundry method, patternshop equipment, delivery, and price required by both sections.

Works Order

On receipt of an official works order, it would be necessary to create the works order master record card. This covers all items on order, together with progress records. With this method, all information is centralised, thus simplifying the detailed problem of filing. The operators' job cards cover all operations, from the patternshop to the final closing of the mould ready for casting. These cards would always be made out complete, in order to have a visual indication of the forward shop load. Movement control cards play an all important part in the job progress control, and their uses will be enlarged upon later. Loading cards (Fig. 3) would act as the key in the co-ordination of operations and would move in strict sequence of each completed operation. The foundry methods card would carry all relevant information, finally decided upon by the foundry personnel, as to method of moulding, size of runners, heads, chills, etc. This card would be issued as a guide to the foundry on the method of production, and would be endorsed on completion of fettling as to the results of method. In this way, it is possible to establish a records file for future reference.

General office records would be composed of cross index cards relating to pattern numbers, drawing numbers, works order numbers and, finally, enquiry numbers. Reference can be made at this stage to the importance of cross references—that is, being able to refer back to one of four key points in order to trace final information. The final document to be described is a master records envelope. This is designed to carry all information appertaining to each item on a works order. With this method it is possible to secure immediate information as to results of methods, pattern, equipment, time taken by operators, original price, customers' correspondence, etc. It may be felt that the above documents would take up an unusual amount of time. But time and motion study has established that a female clerk of average ability, and writing at an average speed, can write the necessary documents required for a works order of 50 items in approximately four hours. Therefore it is well within the realms of possibility for the two general office clerks to deal with 150 items per working day with ease, and the daily input of orders should never exceed this daily output. If desired, operators' job cards and other documents could be preprinted on a machine. The Author, however, having actually seen the work produced in the time outlined, considers pre-printing to be unnecessary.

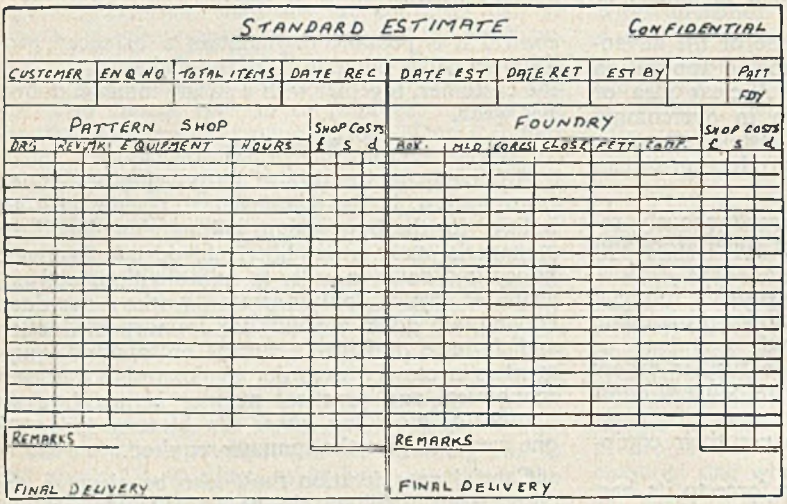


FIG. 1.—*Standard Estimate Sheet.*

Having now created the paper work, it is necessary to proceed to the next phase of operations, which is a description of the "at-a-glance control board." Boards of this type are built in two sections, one to cover the patternshop and the other to cover operations in the foundry. The board for the patternshop is divided into three main sections—namely, "Enquiries," "Works Orders" and "Inspection." Each section is sub-divided into a series of pockets each $1\frac{1}{16}$-in. square. Reading from left to right it gives the months in the year; and from top to bottom the days in the month. The loading cards previously referred to are used to load this board in such a manner that the total shop load in works orders, final inspection and potential orders are shown at a glance. Finally, in the left- and right-hand corners of the board at the top, a box is fitted, each box being 4 by 1 by 1 in. in size. These boxes are used to contain work issued to the shop and final daily inspection.

The patternshop board is based on man-hours available, and it is necessary to have a further control board. This board is a duplicate of the patternshop loading board in all respects except that blocks replace the loading cards. An endorsement is made on these blocks regarding the number of men fully employed per working day, and reference to this board enables the board controller to arrive at pattern delivery dates.

Foundry Control

Foundry control is divided into three sections: moulding, cores and fettling. These sections on the foundry-control board are also divided into a series of square pockets, each $1\frac{1}{16}$ in. square. Dealing first with the moulding section, from left to right are shown the weeks in the year, and from top to bottom the full range of moulding equipment available. It is necessary to endorse against each size of moulding box the anticipated average to be turned over each week, and a margin is left for this endorsement, which should be marked in chalk. Cores follow the same procedure, with the exception that, reading from left to right, months are shown in place of weeks. In the case of fettling, the same set-up applies as for cores. Loading cards are used for loading each section and the method to be applied is as follows:—

Assuming that the average number of boxes to be turned over has been established, loading cards which balance the weight required per week and box turnover would be loaded in each appropriate pocket. In this manner, it is possible to forward load the whole of the foundry's order book. Here again each section would carry a 4 by 1 by 1 in. box for issued work. It will be seen that space has been left on the board which bears the heading "foundry statistics." Reading down in this space the following sub-headings are found:—

(1) Weight of work cast without heads;
(2) weight of metal from furnace;
(3) loss of metal;
(4) weight cast short;
(5) weight re-made;
(6) percentage loss;
(7) percentage yield;
(8) number of jobs cast short;
(9) number of castings rejected;
(10) total jobs in pits;
(11) total jobs on order, and
(12) total weights on order without heads.

Against each of the above sub-headings, it is possible to make a daily endorsement as to progress being made in the foundry; and it will be agreed that the information given would no doubt be beneficial to executives who would be able at a glance to see a picture of the work in hand and its progress. Before finalising this brief discussion of the control boards, one more detail has to be outlined, and reference is now made to the stop-off blocks. These blocks are used to stop-off pockets where a quotation has been given. With this method forward loading is possible, together with the fact that it makes it impossible to overload.

ORIGINAL ENQ				MASTER RECORDS								WORKS ORDER.			
ITEM	DRAWING	REV	MK	DESCRIPTION	QTY	MAT	PATT	DATE PLAN.	DATE DUE	DATE LOADED	DATE ISS.	DATE COMP.	DATE INSP.	T.A.	T.T.

FIG. 2.—*Works Order Master Record Card.*

Flow Chart

Reference is now made to the flow chart (Fig. 4) of the paper work and its co-ordination with methods and final completion. It will be appreciated that a continuous line of information is flowing back to production control, thus making it possible to give information as to progress on any works order, without assistance of works' personnel. This is an important feature, as it is normal practice to have progress personnel in the works to collect information—which often results in wrong information and fictitious promises.

Office Procedure

On receipt of a works' quotation, the technical personnel representing foundry and patternshop should discuss the method and time required for production. Those present at the discussion should each record the method to be applied on the standard estimate sheet. The date of receipt of patterns would be given by the board controllers, and this delivery would be based on man-hours available, present shop load and final date for inspection. Having arrived at this date, a stop-off block should be placed in the pocket or pockets required, which

— MOULDING —						
W.O.	DRG.	REV.	MK.	DESCRIPTION	MAT.	QTY.
MACH:	HAND	DRY	GREEN	Nº OF CORES	EST. WT.	CAST Nº

FRONT

PATT Nº	BOX	MIDS	TOPS	TA	T.T	TS
DATE DUE	PLAN	LOADED	ISS	COMP.	CLOSED	CAST
TYPE OF PATT SUPP:						

BACK

FIG. 3.—*Foundry Loading Card (Moulding Section).*

Production and Methods Control

in turn represent the time required to complete the patterns. At the same time, one loading card is placed in the enquiry section of the board. This card is endorsed with the dates forward planned and the date of confirmation from customer. To complete the cycle for patternshop loading, a final endorsement is made on the hour control board. The foundry would base their delivery of castings from the date of receipt of pattern, box size, man-hours available and finally the position of fettling. These dates having been decided, stop-off blocks are inserted to cover the box equipment and time required for cores and fettling, should the quotation become a works order. The delivery and price would then be endorsed on the works quotation sheet and returned to sales office. To complete the cycle, the standard estimate sheet would be suitably endorsed and filed under its enquiry number.

If the customer places the order on, or before, the confirmation date, all stop-off blocks are left in position until working information is received regarding the order. The standard estimate sheet, Fig. 1, in this case would be endorsed "order received." On expiration of customer's confirmation, the patternshop board controller would withdraw all stop-off blocks and extract the loading card from the enquiry section. Finally, the hours forward planned on hourly control would be adjusted. This information would then be passed to the foundry board controller in order to adjust foundry load. With the procedure outlined it is possible to give accurate delivery dates, together with a visual indication of future commitments.

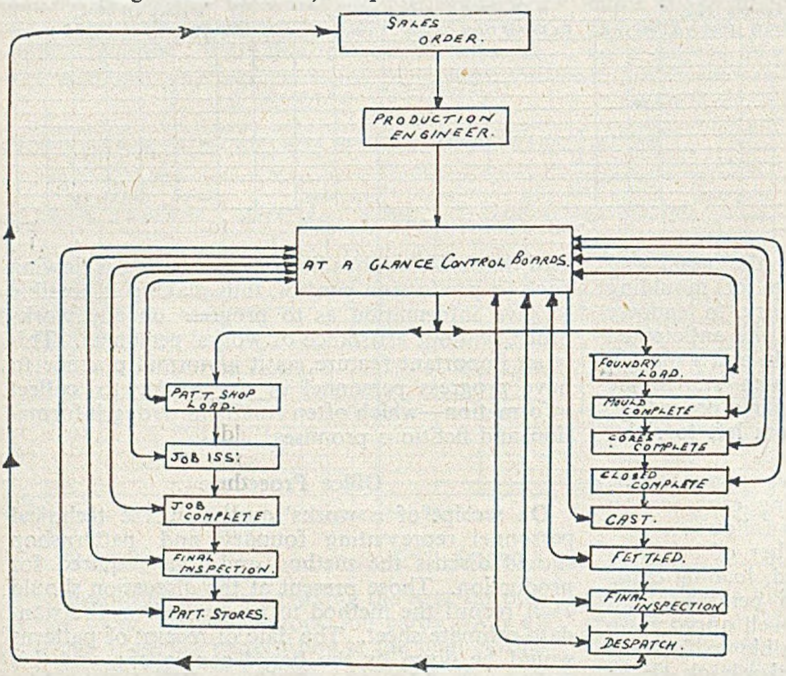


FIG. 4.—*Flow Chart of Foundry Operations.*

The general-office clerks receive official works orders. Upon receipt of such orders, they first withdraw to the original standard estimate sheet and create the necessary paper work required for foundry and patternshop. A final discussion should now take place between foundry and patternshop personnel, at which the final method of production should be decided upon. A delivery date for the pattern is confirmed, and cards endorsed with anticipated hours required are handed to the patternshop-board controller who withdraws stop-off blocks and inserts actual loading cards. At this stage the master records card is endorsed "date planned ready for issue" and the hour control board adjusted as required. The same procedure is adopted by the foundry-board controller, who loads cards for moulding, cores and fettling.

With the cycle completed, it is necessary for the foundry personnel to outline the moulding method on the foundry methods card, and on completion this card would be placed with its job cards and filed ready for issue, in its appropriate weeks programme. The final sequence is to endorse the works master (Fig. 2) to the effect that foundry planning is complete.

Weekly Programmes

The compiling of weekly programmes would be done by the board controller of each section. The method to be adopted would be as follows: the information shown on loading cards, from each pocket of each current week's loading, would be typed in programme form and issued with the relevant job cards to the section concerned. Mention may be made that from foundry loading cards it is possible to arrive at the approximate tonnage required from the furnace; and information to this effect could be passed on to furnace personnel as an indication of the coming week's tonnage. All programmes issued should carry all work not completed during the previous week. The last programme issued therefore carries complete information as to work in progress without reference back to previous programmes—in other words, by adopting this method, works' personnel cannot fail to see the work on which they not honoured the delivery, or which still requires man-hours to complete.

The Author does not intend to delve into the operational functions of the timekeeping apart from saying that a timekeeper is required in each section. Dealing first with the patternshop and its programme, the shop foreman is responsible for the issue of all work; he should endeavour at all times to issue work in its correct sequence. The timekeeper should return twice per day the details of work commenced, completed and passed by inspection. This information would then be endorsed on the works order master records card by the board controller, and loading cards would be placed in the issued boxes on the control board. When a pattern has been finally inspected, all drawings, job cards and movement control cards are returned to production control and a final endorsement is made on the works master that the pattern is complete. All documents should then be filed in the master records envelope, with the exception of material control cards—these should be endorsed as to allocation of pattern in the stores and one card should be handed to the foundry-board controller, to acknowledge the existence of the pattern. The other card would be kept in pattern stores for pattern movement control.

The foundry programme would be compiled in the same manner, from loading cards, but would be issued in three parts; namely, moulding, cores and fettling. These programmes would also be issued complete with job cards and any special information as to methods required. The flow back of final information would be the responsibility of the timekeepers in each section. Here again, endorsements would be made on the master records card by the foundry-board controller, and complete information would return to the master records envelope.

Conclusion

The Author realises in presenting this Paper that the avenue is wide open for criticism. He feels that in many minds the thought must be strong that the system as outlined must be complex in its introduction; but he also feels confident that, once the system is applied, the difficulties to be met can be overcome if the team spirit of the personnel involved is for the scheme and not against it.

Production control in its application to the foundry is not claimed to be 100 per cent. efficient, but it does help considerably in co-ordinating the events we know in foundry practice. The most important feature of any industrial organisation is deliveries—and it is with this in mind that thoughts must automatically turn to some form of production control which can show with reasonable accuracy the position of the work in hand and the potential work that can be honoured for the future.

How often does it happen that an order is taken on with a quick delivery, without a thought being given to equipment being available? This sort of practice must embarrass foundry personnel and must only result in some other customer's delivery being dishonoured to maintain a fictitious delivery promise. Under production control, no fictitious delivery promise would be given. It is only natural that with an efficient control system, a healthy and happy relationship is possible between customer and supplier together with an excellent team spirit within the works itself. Production control has been successfully applied to the engineering industry; and although the hazards met in foundry practice are great, we must look to the future development of our industry and prepare ourselves to take up the challenge and prove that it is possible to introduce a control system where it has never been applied before.

In world markets today, where foundries are all struggling for supremacy, it is naturally the organisation giving an honest delivery which will get the contracts. It is with this thought in mind that the Author has endeavoured to approach a subject which, although complex, must improve foundry production and its allied trades.

Acid Electric Furnace Practice

(*Continued from page* 528)

practice of slag, which should become increasingly clear, until finally it attains a greyish-green tint. The iron oxide freed from the slag can be reduced by either powdered coke or ferro-silicon. This method however is liable to bring about too high a silicon content in the bath, and it is better to allow the iron oxide to be reduced by the carbon in the metal.

The bath then works gently and when the boil has slowed down, the final additions can be made. These consist of a finishing addition of silico-manganese of the order of 0.3 per cent. of the charge, an addition of ferro-silicon and one of ferro-manganese. The ferro-silcon has an actual 100 per cent. yield. On the other hand, the yield of the ferro-manganese will vary according to the length of time it stays in the furnace. It is always wise to ensure a constant rhythm of operation; for example, if the finishing addition is made a quarter of an hour before tapping, there should be an interval of 5 mins. before the other additions. The manganese yield should then be of the order of 80 per cent.

THE BATTERY of 54 W-D Becker coke ovens forming part of the new Vanderbijl Park steelworks in South Africa has been put into operation. This complete coke-making installation, which will carbonise over 1,100 tons of coal per day and cost some £1,500,000, includes coal and coke-handling equipment and comprehensive by-products recovery and treatment plants. It is the fifth coke-oven installation to be built for the South African Iron & Steel Industrial Corporation, Limited, by the Woodall-Duckham Vertical Retort & Oven Construction Company (1920), Limited, Brompton Road, London, S.W.3.

Modernising an Iron Foundry

I.B.F. Birmingham Branch Discussion

AT A MEETING of the Birmingham branch of the Institute of British Foundrymen, held on October 25 in the James Watt Memorial Institute, Dr. Angus presented the Diploma of the Institute to Mr. Keeble and Mr. Caven, and congratulated them both on their achievement. Mr. L. W. Bolton, the evening's lecturer, had also received a Diploma for his Paper "Modernising an Iron Foundry."* This had already been given to the London branch and was being presented to the Birmingham branch on that evening.

MR. BOLTON thanked Dr. Angus for his congratulations, and said that the Paper was being given in two parts, his co-Author, Mr. Ford, dealing with the engineering side.

Following the lecture, DR. ANGUS thanked Mr. Bolton and Mr. Ford for a very interesting evening and said that there were several matters which were of great interest to him, particularly those relating to ventilation and fettling.

The vote of thanks was proposed by MR. KEEBLE, who said that they had been privileged to listen to an extremely instructive and informative lecture on some aspects of foundry production and foundry housekeeping. There had, in fact, been something of interest for everyone.

MR. DUNN seconded the vote of thanks and said that he thought the two lecturers had tackled the problem in their foundry in an extremely practical manner. The problem of ventilation for dust control had been adequately covered, and he had much pleasure in seconding the vote of thanks.

DISCUSSION

DR. ANGUS, referring to the use of electric tools in the fettling shop, said that on a recent visit to the United States he had noticed that they tended to use mainly pneumatic tools, whereas Mr. Ford had stated a preference for electric tools. The main reason given in America was that they were lighter and easier to handle. He would like to have an opinion on this. Referring to heating, he said he had always been rather an advocate of radiant heating in the foundry because this seemed to him to be the most satisfactory answer to the problem of maintaining a satisfactory atmosphere. Mr. Bolton had mentioned the use of radiant-heat panels, and he would like to know what results had been obtained with these if they were now installed.

MR. BOLTON asked Mr. Ford to deal with the question of pneumatic *versus* electric tools, although he did agree that the pneumatic type were lighter, but they did blow dust about. He felt that if the use of compressed air could be avoided, this was an advantage. Mr. Bolton said that the radiant-heat panels had not yet been installed, and therefore could not give an opinion on them as yet.

* Printed in the JOURNAL, May 25, 1950.

MR. FORD said that they actually used a majority of 6-in. dia. wheels on the portable grinders which were electrically driven. These were a little heavier than the pneumatic type, but only slightly so, about 10 to 20 per cent. One consideration which arose on grinding tools was that, with electrically driven machines, the speed of rotation was limited. When small wheels, such as 1½ or 2 in. were being used, obviously the speed of rotation must be stepped up. To sum up, on the heavier grinders they preferred electrically driven machines, but on smaller machines they felt it was necessary to use pneumatic tools, but in their shops they were in the minority.

Space Heating

MR. BLYTH said that he thought a word of praise was due for the very excellent slides shown. Mr. Ford had mentioned that the number of air changes per hour were four in the foundry and 12 in the fettling shop. Mr. Ford had also mentioned that coke combustion stoves were most economical and said they had them placed around each machine.

MR. FORD said what he meant to convey was that the stoves were placed at odd positions about the foundry where there were a group of men round a particular machine, for example, one round the Sandslinger installation, so that all the men working were grouped round the stove within a radius of about 4 yds. Similarly, they had one stove by the two moulding machines. This particular one permitted the men coring up and the men on the machines to work continually during the day within a radius of 2 to 3 yds. of a stove. The total number used in the moulding shop was about eight. Regarding changes of air in the factory, the capacity of the fans theoretically permitted changing the air every 15 min. in the foundry, and in the fettling shop every 5 min., but he would not like to say that they actually did that because they probably made a continual draught round where they were working, but did not change the air in the part of the foundry far distant from the fans.

MR. TWIGGER said it had been mentioned that small and large cores were given the same baking treatment. He would like to know the size of the box used on the rotary Sandslinger unit, and what gates were used on the smaller castings. Had Mr. Bolton any size of box in mind below which he would not go?

The AUTHORS, in reply, said it was approximately 5 ft. 6 in. by 3 ft. 6 in. by 11 in deep. One box was shallower, and the complete box with the 5-cwt. casting weighed about 1½ tons. With reference to the Sandslinger, this was not an actual Sandslinger, but was known as a sand rammer, and they did obtain very satisfactory results from it. They found it necessary to pack facing sand into certain parts, but it was not done on every mould, only on parts of certain moulds.

Facing Sand Provision

MR. HALL said he was very interested to hear that in some cases Mr. Bolton used facing sand, and asked if he had any difficulty in controlling the amount the moulder used. He was also interested in the use of the two types of core, and asked if Mr. Bolton found it necessary to water-spray the larger resin-bonded cores in order to prevent fragile edges. As to changes of air, he agreed that this ought to be done, but in his experience this was a very costly business. He asked whether Mr. Bolton took any special precautions at the inlet of fresh air, and was it taken from any particular place? Another point he would like cleared was the crushing of cores. He would like a little more information about rollers on the belt feed.

MR. BOLTON said they had not experienced any trouble with excessive use of facing sand. It was used only on the bottom part. The facing sand used was about 75 per cent. natural and 25 per cent. silica sand, plus a very small amount of clay. Mr. Bolton said he was pleased Mr. Hall had raised the point about water spraying. They had found it necessary to spray the resin-bonded cores with water before they went into the stoves. This gave a much improved surface hardness. They had tried several ways, but found that the addition of a little blacking to the water gave a clear indication which had been sprayed and which had not. Regarding rollers, not very heavy ones were used, say 30 to 40 lb.; they helped to crush any lumps of moulding sand which had baked hard. Any smaller lumps were either rejected by the screen or broken down still further by the rollers on the knock-out. The large core lumps were not used again.

MR. FORD replied to the question regarding fresh air and said that they did not make any special provision for this. He thought it was the practice in the U.S.A. to pipe fresh air to the fans, but they did not see the point in this. The very fact that their fans were capable of changing the air in the shops proved their efficiency. With regard to the capacity and ability to change the air, this was quite incidental to the fact that they had had to install them in any event to extract dust and fumes, etc. He agreed that to install fans was quite expensive, but the smoke which they were generating and which escaped into the shop atmosphere was so bad they had no alternative but to install equipment adequately to deal with it. Had the plant cost twice as much, it would still have had to be provided. They would, of course, be only too pleased to assist anyone on the subject of ventilation and to show their equipment to anyone interested.

Shake-out

MR. HALL said that his works did use the fan exhaust on the knock-out, and found it very effective. He would like to know how the air velocity was measured.

MR. FORD replied that this was measured by an instrument known as a Volometer, and the one they used was made by Metropolitan-Vickers, but that other models were available.

A question was asked about the mechanical shake-out, and in reply MR. BOLTON said that they did not get 100 per cent. sand return at the shake-out. There was still a certain amount of sand on the castings. They were taking into the core-shop approximately 70 tons of core-sand per week, and quite a large proportion went into the moulding sand at the shake-out. The addition of clay and coal dust was made on the belt feeding the mill. They did not feed mill sand into the hopper, but only on to the screen.

MR. DUNNING asked about adding the bonding of the sand and said he would like to know a little more about this.

MR. BOLTON said that they had a small hopper with a belt feed, the belt being about 8 in. wide running at 10 ft. per min. under the small hopper. There was an adjustable gate in the front of the hopper and they could increase or decrease the amount added. An average addition of 1.5 per cent. bond and 5 per cent. coal dust kept the sand properties at the correct levels. They had carried out experiments originally with timing the belt run for a certain distance carrying a certain amount of coal dust.

MR. DUNNING then asked whether they had tried mixing the coal dust and bond together.

MR. BOLTON replied that they had, but this had not proved satisfactory.

MR. HIRD asked whether resin-bonded cores or oil-bonded cores were found the more satisfactory.

MR. BOLTON said that they had come to the conclusion that the properties were very similar in both cases. The breakdown of the oil-bonded core was excellent and the resin-bonded core might even be very slightly better.

Handling Devices

MR. KEEBLE said that the point made in the lecture about obtaining better castings with less fettling was a point to be remembered. To produce one ton of castings in the despatch department something between 2 and 3 tons of material had to be moved in the course of manufacture; if the amount of handling could be reduced, it would be very advantageous. He would like to know whether Mr. Bolton could say more on this particular point.

MR. BOLTON replied that they had done all they possibly could to cut out heavy manual jobs in the foundry and had used a very large number of air hoists both for lifting castings and moulds. They also had a certain number of electric hoists.

MR. FORD said that the only thing he could add regarding hoists was that they had two types of hoist. They preferred the electric hoist because they thought it was more reliable and preferred to use electricity instead of air because of trouble from leakage. Air was generally at a premium in the foundry, but no doubt, when the cylinder type of air-operated hoist could be used, he would say that it was by far the more reliable. They had had some in use almost continually since 1942, and some of them had had no repair in all that period. The drawback was the length of stroke, whereas with a wire rope you could have almost an unlimited lift.

Hot Sand

A MEMBER, referring to hot sand, said that he had experienced trouble and would like to know if Mr.

Discussion—Modernising an Iron Foundry

Bolton could tell them something about hot sand in his system. They had considered having ploughs on the return sand belt and a possibility of a moisture spray. Another point was trouble with the sand in the return hopper building up round the sides so that the movement tended to be restricted to the centre; they also had the same trouble in the machine hoppers. He would also like to know how maintenance costs compared with the air and electrically operated tools. He thought that the maintenance of the electrical tools would be higher than pneumatic. One final point he would like some information on was the pouring station; was there any ventilation at this point?

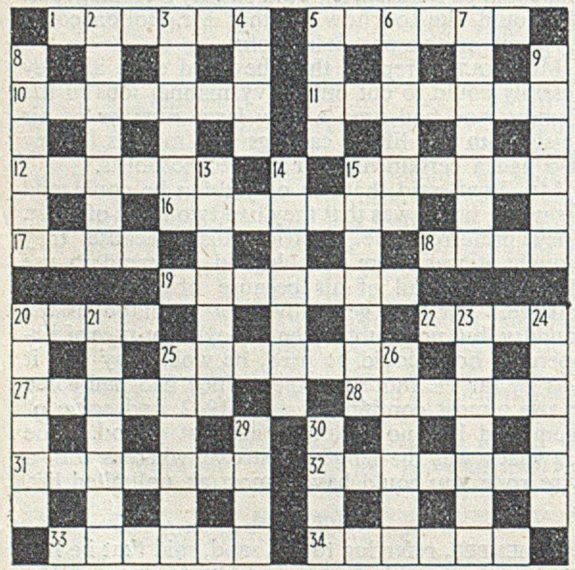
MR. BOLTON, in discussing trouble with hot sand, said it needed qualifying. The sand they used was never cold, but always warm, yet they had not had any trouble from it. They had found it necessary to heat their patterns, particularly the large ones. This they did by passing them over gas burners on their way round the roller track. In the batch-mill sand system, they overcame the difficulty by putting the whole of the knock-out sand through a certain type of plant. The problem of hot sand at the moulding machines rather suggested that the distribution arrangement was at fault; if sand could be thrown through the air, it would cool it better than any other method. Regarding the difficulty experienced with moulding-machine hoppers, they had two members present who were experts on this, namely, Mr. Blyth and Mr. Hird, who would no doubt be able to offer advice. Their own experience had been that, when moulding-machine hoppers were not correctly designed, a pneumatic vibrator on the side of each hopper was necessary.

MR. FORD said that maintenance costs on pneumatic and electric tools compared very favourably one with the other. If the questioner was referring to grinding equipment, then he would think that on the pneumatic type there would be slightly less, but on hoists the two were almost exactly the same with the exception of the cylinder-type air hoist. This latter they considered a very satisfactory piece of equipment which would work for many years with little maintenance.

At this point Dr. Angus had to bring the meeting to a close, and he once more thanked Mr. Bolton and Mr. Ford for a very interesting and capable handling of the discussion.

F.T.J. Prize Crossword Puzzle

A reader, Mr. R. H. Brown, of High Wycombe, has submitted the puzzle appearing below. For the first correct solution reaching us, at the latest by the first post on January 4, we offer a prize of £2 2s. Please mark the envelope "Crossword Puzzle," franking it with a 2½d. stamp. The answers against the clues numbers may be written out and submitted so that the JOURNAL may be kept intact.



CLUES

Across

1. Breakage without one becomes more serious (1, 5).
5. A little bit back (6).
10. B.O.A.C. in the foundry? (7).
12. Legal in the foundry but perhaps not in the street (6).
15. For making bigger and better holes (6).
16. In the ranks from sergeant to private (7).
17. White on walls, black on cores (4).
18. Part of the source or origin of metal (4).
19. Often just as essential as a pattern (7).
20. When moulds are this the metal penetrates (4).
22. Fluid metal is required for these castings (4).
25. Are metal rivers their masters? (7).
27. Scavengers in the foundry (6).
28. Box-parts are often this outside (6).
31. Wearisome (7).
32. A commonsense way of judging sand is by this (3, 4).
33. A riddle produces this sand (6).
34. Merely oppose sister's treatment (6).

Down

2. Both causes and effects when a casting cools (7).
3. A vessel often inserted to take up wear (1, 5).
4. These sections are a steel-founder's aim (4).
5. Rotten in the foundry but sweet enough at Blackpool (4).
6. King Alfred's cores would be (6).
7. An artist with hats and sometimes with castings (7).
8. Produces hematite when added in furnace (6).
9. French yardsticks? (6).
13. Explosive accounts? (7).
14. Blast directors (7).
15. Formers of the Garrett Report perhaps (7).
20. An essential part of foundry welfare rightly often put first (6).
21. Become shipwrecked or just one of us (7).
23. Chromium does this to cast iron (7).
24. Bit of graphite from the Gap of Dunloe? (6).
25. This tap is usually hotter (6).
26. Physical to the metallurgist but mental to the foreman (6).
29. It can't be sued for its dues but it's employed just the same (4).
30. Mix commotion and gaol (4).

Aids to Production

*Mr. K. Docksey's Presidential Address**

IN HIS INAUGURAL ADDRESS to the East Midlands branch of the Institute of British Foundrymen, Mr. Docksey dealt largely with the reports of the various Productivity Teams which have visited America, and in considering their various phases said "all the teams have observed that the American workers seek high productivity and have an eager desire to utilise all aids to increased production. He went on to paraphrase and comment upon selected excerpts from the reports, and what follow are the chief points he brought forward:—

"It is now up to all industries to see what help can be derived from these reports. It is not necessarily wise to copy everything in detail, but there are points which will help us to achieve higher standards. None of these reports suggests that the change can be made easily or quickly, but what is necessary is a change of heart; we must be prepared to put aside our traditional attitude of complacency before we can hope to succeed with production methods which have been so successful in the States.

"The Americans plan every detail in advance; they make machines and tools to do the laborious work and get the maximum use from them, and they allow skilled men to do nothing but skilled work. If, in every foundry in this country these few details received attention the man-hours per ton of castings would be considerably reduced. Before many of these ideas can be practised, every manager, foreman, supervisor, and charge-hand must be conversant with the workshop details of production methods. One important fact that must never be forgotten is that the increased productivity must not be accompanied by higher money costs and prices which would upset the opportunities which devaluation has created, thus making it more difficult to face increasing competition in non-dollar countries."

Training

Referring to training, the branch-president said:—

"Management to-day calls for special training on the human as well as the technical side, and it is here that the greatest benefit will be derived from the recently-held foundry foremen's courses. The trained foundry foreman can do more than anyone else to put this new spirit into our industry; the spirit which will give us the higher productivity we need.

"It is gratifying to see that the training of apprentices in our foundries is now taking a definite form which will be of a greater benefit to the apprentice and his employer. It is hoped that this training will develop their imagination and keenness and help them to assimilate the technical knowledge which is so important. Most of our technical colleges co-operate with our industry, and already many have their own experimental foundries. The National Foundry College has done remarkable work since it opened, and will, no doubt, be one of the training establishments for men who will ultimately occupy managerial positions in industry."

Sales

Finally the president dealt with sales, and remarked that:—

"If we consider the user of castings we see why we need well-trained technical men. Buyers of castings to-day demand from the foundryman many more intricate castings than they did years ago and the present-day competitive market is a challenge to all foundries to improve their product. Users of castings are becoming more critical of the material they receive regarding trueness to pattern, chemical and physical properties, etc. Furthermore, if the quality of the castings deteriorates buyers will quickly look outside the foundry industry for an alternative product. A scrapped casting is a financial loss to the foundry and the customer. In many cases the loss to the customer is greater than that to the foundry, because of the machining which has been carried out on the casting before the defects were found.

These problems face all foundrymen and unless they have men educated on the right lines our foundries stand little chance of progressing. The history of the castings industry has always been one of progress, and because of the basic nature of foundry products, foundries have been necessary for the development of civilisation since early times; therefore, the foundryman must not fail in present-day development.

Role of the Institute

"How can our Institute help under these conditions? Members can take advantage of works visits, enter into discussion on technical Papers and discuss problems with others to their mutual advantage; these are points which are well known and advantage is taken of them. It is necessary to impress on members the importance of the activities of the technical committees. These committees have done valuable work and can be looked upon as forming in aggregate a really sound research organisation. The work of these technical committees can be used to establish the basic scientific data for the industry and help to draw up specifications and standards.

"To conclude," said Mr. Docksey, "in our drive for a better standard of living and increased production, I think we are all agreed that the road is not an easy one, but our success can be achieved by 'coming together, which is a beginning; thinking together, which is progress, and by working together, which is success.'"

* Mr. Docksey is the new president of the East Midlands branch of the Institute of British Foundrymen.

Wire Ropes

By Richard Saxton

IN GENERAL, the chief problems to be considered when installing a wire rope are maximum load to be hoisted and flexibility to meet stress set up by bending over a pulley or round drum. During lifting other stresses are imparted, and a knowledge of these and the load factor may often prove the means of not only prolonging rope life, but also the avoidance of risk of accidents from overloading.

In the case of maximum load it is essential to consider the bending stress set up in bending round the smallest radius in the working system; the nature of the acceleration and deceleration of load and the factor of safety, which, in regulations laid down by the Factory Acts (sub-section 23), recommends a safe working load not to exceed one-sixth of the actual breaking load of the rope.

The reason for such a high factor is because the figure must include an exceptional margin to cover bend and dynamic stresses. The total stress in loading is made up of several factors, most important being load, and length of rope from pulley to load. Additionally, there is stress caused by starting and acceleration, which can be extremely high if the practice is to start hoisting with a slack rope. There is also the bending stress when a rope takes the curve of a pulley, or straightens out on leaving it.

Localised Wear

On every hoisting job, there is nearly always present on part of the rope, a localised spot or spots where the rope is bent over the pulley during application of the greatest load. This usually occurs when the rope is getting under way and gathering speed. During the period of acceleration the tensile stress on the rope is greatest, with the result there exists a tendency for the rope to slip by the pulley which, combined with the greater radial groove pressure, results in heavier wear at localised spots. By cutting off a pre-calculated length of the rope from the loading end, thereby changing the place where maximum wear occurs, deterioration and wear is distributed over a further length of rope, thus prolonging its service life. Before cutting, the rope should be seized (bound) at the point nearest the intended severance, *i.e.*, bound tightly with annealed wire for at least one inch on each side of the proposed cut. Failure to observe this precaution will result in distortion and flattening of the rope, with consequent uneven loading in the future.

Drum Winding

Many a rope has had to be discarded prematurely due to a worn section where the change of layers in bending round the drum has worn it. The odd layers, except the first, have a tendency to seat away from the flange, but are forced against it, and the even layers try to hug the flange, but are forced away. When winding on a smooth-faced drum a "right-lay" rope should be started from the right-hand flange. If started from the left, the rope as it winds will tend to move across the drum face in an uneven way and pile up on one side of the drum. This results in crushing and deterioration, and curtailed service life.

Rope Pressure and Overloading

Under normal conditions, wear on a rope and pulley is dependent on the pressure generated, and where the radial pressure of the rope exceeds the hardness value of the pulley-groove material, the rope will imprint its external shape in the groove. When this occurs, there is a filing action on the rope at every stop and start in the hoisting cycle, due to the tendency of the pulley to slip by the rope. Extraneous conditions, often unknown to the user, may cause overloading, one of the greatest single destructive features operating with wire ropes. When a load is applied to a rope, theoretically each strand within a six-strand rope assumes 1/6th of the total applied load. Hemp cores, which are employed to impart the essential foundation and necessary elasticity to a wire rope, are not always able to withstand the extremely severe radial compressive forces induced by over-loading and a point is reached when loads are increased beyond a maximum, at which the fibres within the hemp core are rapidly cut and pulverised. When this takes place, the six strands bear forcibly against each other, with resultant heavy wear upon, and possible fracture of the crown wires.

Bending Strains

The most severe deterioration due to close bending usually occurs near one end of the rope. The life of a rope thus damaged may be materially increased by exchanging the ends, thus reversing the stresses on the rope. Adapting this method, the worn sections of rope are re-located, resulting in the less-worn sections being exposed to the positions of greatest wear.

Clipped Attachments

In fixing bolts and saddles (clips), to form a loop at the end of a rope, there is a right and wrong way. The saddle is so shaped as to form a seat and prevent the cutting of outer strands when the load is applied. The U-bolts should be fitted over or around the idle end of rope. Fitting these bolts over the holding end of the eye connection causes heavy concentration of pressure at the inside crown of the U-bolt, resulting in severe cutting of rope. Clips have the advantage that little skill is required to make the fastening. The disadvantages are that the clips frequently crush and bruise the rope, and moreover allow it to slip. The strength of a clip fastening is often less than 80 per cent. of the rope tensile strength, particularly when the fastening is incorrectly constructed. A thimble should always be inserted in the loop before tightening the clips, otherwise the rope will flatten out of shape when the load is applied, displacing strands and decreasing attachment efficiency.

The distance between clips should not be less than six times the diameter of the rope, and the saddles should make contact with the longer or load-holding end. No U-bolt should be fitted to make contact with the shorter part of a loop in the rope. All nuts on the clips should be securely tightened before and after the load is applied, and further checked after a few hours service. It is good practice to test the tension of the nuts each day previous to start of loading. Excessive wear can be induced by the incorrect contact of the rope and pulley, and for efficient travel with minimum of wear, one-third of the rope's circumference should be in contact with the pulley groove. The groove should permit free entry and egress of the rope without crushing, because if it is pinched or compressed, additional stress is set up.

Fatigue

Compressive stress during travelling of the pulley results in the strand ropes taking oval or arch form, resulting in fairly heavy frictional wear on the wires in contact with the groove. This applies particularly to ropes with metal cores; with hemp or manilla core, the pressure induces the perimeter of the rope to "give" when compressed. All bending stress, unless checked, leads eventually to fatigue failure of the rope metal. Fatigue, however, is induced most frequently at the point in the rope nearest the load, and is due to vibrations imparted during load hoisting, when travelling in an axial direction: the stress set up is intensified by the arrestment at the point near the load. In all cases of stress induced by vibration, a maximum value for the stress occurs at the point of arrestment, and many authorities assert that constant repetition induces a condition in which the elastic limit is exceeded, with subsequent fracture of the units.

Corrosion

Yet another defect necessitating the withdrawal of many ropes from service is internal corrosion, difficult to detect without opening the rope—a practice universally condemned as injurious. When examining a rope for corrosion during service, the possibility of such a defect should not be overlooked at the point where two metal surfaces are in contact and subjected to vibration. With rope units, an accelerated form of stress corrosion is liable to occur. This is a practical problem, examples of which are found in almost all branches of engineering.

In productions where the rope must work in a moist atmosphere, such as in the acid cleaning of steels, it is advisable to prevent the formation of hydrated rust on the wires by the frequent application of a lubricant. A hydrated rust coating once formed is slimy, and cannot be removed until the rope is thoroughly dried. The application of any type of lubricant on a coating of hydrated rust is of little service.

House Organs

The Half Wheel. Vol. 2, Nos. 1 and 2. The Quarterly Journal of Barnards, Limited, of Norwich.

The best feature of this quarterly house organ is the attention it gives to interesting historical notes of matters relating to the foundry and kindred industries. Completely fascinating is the picture of a pavilion erected at the Philadelphia Centennial Exhibition in 1876. It was made by Barnard, Bishop & Barnard, at the Norfolk Ironworks, Norwich, and weighed 40 tons. Carried out in cast and wrought iron, it was originally intended as a garden pagoda. Actually, until damaged by blast during the war, it was functioning as such in a local park. There is also an article on bells, as Norwich is particularly rich in examples of medieval craftsmanship. For the rest, there is the usual gossip about the activities of the staff, letters from overseas, and the like.

The Iron Worker. Vol. XIV, No. 4. Issued by the Lynchburg Foundry Company, Lynchburg, Virginia, U.S.A.

The cover of the autumn issue of this prince of foundry house organs carries a picture of the Falls Church, in Fairfax County, Virginia. It is a very unusual ecclesiastical building from the British point of view, as it carries neither steeple nor tower, but is a well proportioned colonial-type house. The most fascinating feature of the issue, however, is the double-page historical map. It is garnished with guns, Indian battles, mail coaches, turnpikes, a pillory, whipping post, ducking stool, and so forth. The employees have a full share of this publication, which follows pretty much the same lines as our own.

Contact. Vol. IX, No. 2. Issued by the David Brown Group of Companies, Huddersfield, and elsewhere.

The reviewer was impressed with a short paragraph which details the various organisations which have recently visited the Penistone foundries. The number of the visits was about 15, but their composition ranged from Ambassadors and their staffs to the Townswomen's Guild. There is a better balance of contents in "Contact" than is usually in house organs. Because of the widely dispersed locations of their various factories, there is a commendable compression of the purely local gossip, yet sufficient is disclosed of the more interesting events to create a co-operative spirit. Thus the magazine is alike interesting both internally and externally.

Sif-Tips. Vol. 13. No. 71. Summer 1950. Issued by the Suffolk Iron Foundry (1920), Limited, Stowmarket.

The best feature of this issue is an illustrated interview with Giles, the well-known cartoonist. It is done in the best Jerome K. Jerome style. The balance of the articles follow the usual pattern.

Cast Crankshafts

WHAT FOLLOWS is an extract from the Fifth Annual Report of the Motor Industry Research Association:—

A report has been issued entitled "First Report on the Influence of the Crankshaft Material on Bending Fatigue Strength," giving the results of the bending fatigue test on crankshafts in the various cast materials mentioned in the previous annual report, namely, low-alloy inoculated iron, chrome-molybdenum alloy iron, pearlitic malleable iron, "graphitic cast steel," as-cast and tempered acicular iron. No results are given in this report for nodular irons, since satisfactory casts in these materials have not yet been obtained, or for cast steels since tests on these have only just been completed due to the very slow delivery of specimens. The work discussed in the report leads to the conclusions that (*a*) the bending fatigue strength of cast-iron shafts is given, to an accuracy of ± 10 per cent., by the expression:—Nominally limiting web stress = 0.165 × tensile strength, tensile strength being determined on specimens machined from crankshaft webs (a similar relationship has previously been shown to apply for forged-steel shafts), (*b*) that the relationship between rotating-beam fatigue strength and crankshaft strength was not entirely reliable, and (*c*) that separately-cast test-bars are not, in general, representative of the actual material in a crankshaft.*.

The tests on cast-steel crankshafts give the unexpected result that the shafts are only about half as strong in bending fatigue as one might expect from the tensile strength, the factor in the relationship between limiting web stress and tensile strength (see above) being only about 0.08.

Tests on various surface treatments to improve the fatigue strength of cast crankshafts are being made, initially on bars—as being more readily obtainable specimens than crankshafts—and any treatments showing promise will subsequently be proved on crankshafts. In the usual reversed bending fatigue tests shot-peened bars have shown an increase in strength of 20 to 25 per cent. over untreated bars. However, from considerations of the mechanism by which surface treatments might be expected to improve fatigue strength, it appeared likely that the improvement obtained might be considerably influenced by the type of fatigue load applied and it was expected that non-reversed bending (or one-way bending) would show a greater improvement than reversed bending. Tests with non-reversed bending loads on shot-peened bars have, in fact, shown improvement of about 35 per cent.

Tortional Fatigue Strength

At the time of writing the last annual report, the constant-stress torsional-fatigue machine, being developed for the projected work on torsional fatigue-strength, was running on its initial trials. The machine is a freely suspended two-mass system, a one-throw crank being the flexible element, maintained in torsional oscillation by out-of-balance masses driven by an electric motor through a flexible coupling. At resonance the dynamic magnifier is over 100 and the machine is run at near resonance, actually where the dynamic magnifier is about 50, so that the stress in the system can be controlled by varying the driving-motor speed. This is done electrically, and means that to control the stress to plus or minus 1 per cent. speed must be controlled to 1 part in 5,000. Speed control itself to this order is by no means readily achieved and also the large dynamic magnifier means that the machine is ultra-sensitive to small disturbances, such as voltage fluctuations of the supply mains. Indeed mains fluctuations have been a major source of trouble and it has been necessary to install a motor-generator set controlled to ± ½ per cent. in order to bring the fluctuations within the range of the main control apparatus. Control of motor speed against small sporadic and rapid fluctuations is obtained by passing the field current of the driving motor through a valve, to the grid of which is applied a voltage proportional to the "error-signal," *i.e.*, proportional to the difference between the stress at which the machine is set to run and the actual running stress. Control of larger, slow, and long-term changes is by means of a motor-driven rheostat, also in the field circuit of the main driving motor, which comes into operation when the stress varies by greater than ± 1 per cent. The "error-signal" is obtained by measuring the torque in the system by means of a capacity-type torque meter developed earlier by the Association and matching its voltage-output, which is proportional to torque, against a standard voltage. On failure of the crankshaft under test, or failure of any part of the apparatus, the machine is switched off automatically. Measurements of fatigue strength are proceeding on this machine, but an insufficient amount of work has been carried out to date for useful comment to be made at this stage.

* That separately-cast bars may represent the *material* used for the crankshafts, but test results from test-bars and shafts may differ is thought to be implied here.—EDITOR.

Mersey's New Iron-ore Berth

Commenting on the decision of the Mersey Docks and Harbour Board to provide a new berth on the north side of Bidston Docks for handling iron ore, Mr. Edmund Gardner, chairman, said that the berth would be capable of handling 1,250,000 tons of iron-ore imports a year.

Surveying the year ended July 1, he said that there had been a further increase in the tonnage of vessels using the Mersey docks over the last 12 months to 15,372,000 tons. There was a reduction in inward foreign traffic, but an increase of over £33,000 in outward foreign traffic. Coastwise inward traffic had increased by £24,000. Good progress had been made with the programme of reconstruction.

Notes from the Branches

London Branch—East Anglian Section

The inaugural meeting of the East Anglian section of the Institute of British Foundrymen for the winter session was held in the Lecture Hall, Central Library, Ipswich, on October 10. Mr. W. L. Hardy, occupying the chair for the second year in succession, delivered his presidential address, in the course of which he promised members a very attractive programme during the coming session. He asked everybody to do their utmost to see that speakers were supported by having a good attendance and better discussions. Those who had prepared lectures realised the work involved, and no credit was done the section by having a lecturer travel to Ipswich to talk to a handful of members. Only by discussion and hearing the other fellow's point of view could one further improve one's outlook and progress technically and socially.

Never before had there been so many opportunities for young men in the foundry industry as to-day, and it was obvious there were many men in good positions, all over the world, who owed much in their early days to the Institute. This body of foundrymen was recognised the whole world over, and was something that must not be taken for granted, if members were to benefit further from the work of those who pioneered when times were much more difficult than to-day.

The young man to-day had, if he so desired, every opportunity to learn, not only the practical side of foundry work, but also its academic build up, and almost everywhere the keen lad was encouraged to further his knowledge by attending day and evening classes at technical schools, and then at foundry colleges, where many went on to take degrees. This would undoubtedly lead to a general improvement, but there would always be room for the person who could apply sound common sense, that was, "foundry know-how" learned in the hard school of experience.

Quality

The stage was now reached where "war-time finish" was not good enough, and foundry capacity was kept fully extended to meet the demands for high-quality products. The use of non-destructive testing was becoming a routine matter for pressure-resistant and highly-stressed castings, and although foundrymen would first view this with suspicion and dismay, these methods would help to give the users of castings more and more confidence in the founder and his ability to meet the ever-present competition of substitutes for castings.

Much has been done during the last few years to improve working conditions in the foundries, but the fringe of the problem had only been examined, and that much could be done by all members to ensure cleanliness and tidiness as one of the very first essentials to make foundries better places to work in and also attract a better type of labour than was now employed.

Mechanisation by itself was not a cure for all foundry evils. Unless carefully considered, conditions might be far worse than in the old type of foundry; on the other hand, if given careful thought and extensive exhaust systems were put in at every suitable point, the modern foundry was a vast improvement on the old. The industry had heard much of productivity during the last few months, and it was certain that higher output kept step with better working conditions.

He asked members to study the report of the Ironfoundry Productivity Team. It not only made interesting reading, but there was a wealth of knowledge in it, and it had been gratifying to hear Mr. Russell, the team leader, speaking to the London branch at their opening session. One could not fail to be impressed with his enthusiasm, for Mr. Russell, as was well known, was one of the older active foundrymen, and it was, he thought, more difficult to get enthusiastic over new ideas than when one was younger.

In conclusion, the president asked members to do what they could, however little, to further the work of the section. In so doing, they would get nearer the ultimate goal, better foundries and still better castings.

The address was followed by the showing of two films: "Flawless and British" and "All Star Casting," by kind permission of F. H. Lloyd & Company, Limited. At the conclusion, Mr. C. Kain proposed a vote of thanks for the loan of the films.

London Branch—Slough Section

At a meeting of the Slough section of the Institute of British Foundrymen, held in the lecture theatre of High Duty Alloys, Limited, at the end of November, Mr. D. T. Kershaw, B.Sc., of Modern Foundries, Limited, Halifax, gave a Paper on "The Results of Experimental Work on Oil-sand Practice in the Foundry," which dealt with work carried out to give a clearer understanding of the defects which may be produced in grey-iron castings by faulty practice, and to enable a remedy to be prescribed for such defects. The Paper described the effect of different materials (cereal binders, drying oils, clay, etc.) upon the properties of the resultant cores, and discussed the optimum conditions for making these cores, using a series of detailed graphs to illustrate these points. The castings produced varied in weight from a few pounds up to 25 tons and were for the manufacture of machine tools.

Discussion

A full and free discussion followed for an hour on some very interesting subjects, some of the more salient features being as follow:—

Mr. Templeton asked how long a core might stand without picking up appreciable moisture, and what means could be used to make the coil serviceable. The Lecturer indicated that a core some 20 lb. in weight might stand for a fortnight without serious moisture pick-up and, where longer periods were involved, water could be eliminated by reheating.

Mr. Chambers raised the question of metal penetration, particularly in the case of a long, narrow core, and asked if iron-oxide additions would help to eliminate this defect. Mr. Blandy also raised this question in connection with phosphor bronze.

Mr. Logan suggested that wood flour might be useful

Notes from the Branches

to eliminate flashes caused by metal penetration, allowing relative movement of sand particles which would offset the tendency to expansion cracking. He was intrigued to hear that the addition of cereal and oil as binders provided a dry strength far greater than the additive figure from their separate values, and would like to know whether proprietary oil cereal mixtures gave the same result when added in the emulsified form as in the separately added method described by Mr. Kershaw.

Mr. Tipper said that he had found boric acid effective in the prevention of fins resulting from expansion cracks. He added that harder ramming and the use of a core dressing would also achieve this object.

In reply to Mr. Templeton's query on the reclamation of core sand, Mr. Kershaw said that his company's practice was to scrap all sand after being used only once. A good deal of general discussion arose from this point, from which it emerged that the reclamation of sand would only be economical where transport costs were high and large quantities used, since in order to produce a satisfactory cleaned core sand, an expensive plant would be necessary involving the burning off of residual bond and friction or "scrubbing" treatment to completely separate it. In this connection, sand recovered from the settling tanks in the hydroblast process would be suitably cleaned for re-use as core material.

In conclusion, a vote of thanks was proposed by Mr. Blandy.

Training of Technical Teachers

New arrangements for the training of teachers of technical subjects are announced by the Ministry of Education. Under the Emergency Training Scheme, which is now ending, a beginning was made in providing full-time training for experienced personnel from industry wishing to teach in technical colleges and similar institutions, including secondary technical schools. Three colleges in London, Huddersfield and Bolton, which have been in use for this purpose, are to be continued as part of the permanent training arrangements. These colleges will in future be maintained by the local education authorities concerned.

Courses, normally of one year's duration, will be open to persons not under 25 years of age who already possess appropriate technological or commercial qualifications in their special subjects and who have had practical experience in industry or commerce. The qualifications include a degree or professional equivalent, Higher National Certificate or the full Technological Certificate of the City and Guilds of London Institute. The college authorities will be responsible for the selection of the students.

Tuition will be free and there will also be free board and lodging or a day maintenance allowance for non-residential students, subject to a contribution from the student in accordance with his financial circumstances. Students may also qualify for additional grants, including a personal allowance, vacation allowance, and dependent's allowance where appropriate.

Eye Protection. A leaflet received from Safety Products, Limited, St. George's House, 44, Hatton Garden, London, E.C.1, describes and illustrates a one-piece goggle, the glasses for which can be easily changed. Features such as ventilation, corrosion resistance and replaceability of parts have all been incorporated. The reverse side shows details of a rescue belt, the illustration for which is decidedly macabre. The leaflet is available to our readers on writing to Hatton Garden.

1951 Conference

Association Technique de Fonderie

The 24th Annual Congress of the A.T.F. will be held in Paris from June 2 to June 6. The following programme has been envisaged:—

Saturday, June 2.—From 2 p.m. onwards registration and reception of those participating at the offices of the Association, 2, rue de Bassano, Paris 16. *Sunday, June* 3: Sight-seeing excursions and luncheon in the Paris area. *Monday and Tuesday, June* 4 *and* 5: Presentation of Papers. *Wednesday, June* 6 (morning): Presentation of Papers; afternoon, works visits.

The congress banquet will be held on either the evening of the Tuesday or Wednesday. A programme of a social character for the ladies is being arranged for the Monday, Tuesday, and Wednesday.

Provisional Lecture Programme

Brass and Bronze Alloys.—Melting Losses and Their Effect on Cost Price in Mechanised Bronze Foundries, by Mr. Gerin; A Contribution to the Study of the "Castability" (Life) of Brasses, by Mr. Ciron and Mr. Le Thomas, and High-strength Bronzes and Copper Alloys —Present Position, by Mr. Loiseau.

Foundry Defects.—Laboratory Notes on Dimensional Defects in Sand Castings, by Mr. Chion; From Shrink to Blowhole, by Mr. Léonard (official exchange Paper from Belgium); Estimation of Magnesium in Ferrous Metals by the Wet Method, by Miss Fuchs; Estimation of Magnesium in Ferrous Metals by Spectrography, by Mr. Paton; Grain-size Test for Sands—Interpretation Possibilities, by Mr. Jasson; Sampling and Testing of Gas in Copper and its Alloys, by Mr. Chaudron; Some Recent Analytical Methods for Estimating Traces of Certain Elements in Aluminium and Use of the Polarograph, of Calorimetry and Tracers, by Mr. Chaudron.

Cast Iron.—Study of Some Properties of Spheroidal-graphite Cast Irons, by Mr. Ballay-Chavy and Mr. Grillat; Corrosion by Liquid Zinc of Cast Irons with or without Prior Oxidation, by Mr. Bastien and Mr. Azou; and the Improvement of Properties of Cast Iron by Graphite Modification, by Mr. Guedras.

Light Alloys.—Influence of Impurities on the "Castability" and Viscosity of Aluminium, by Mr. Chaudron; Grain Refining of Aluminium-silicon Alloys, by Mr. Grand; Control Methods, other than Chemical Analysis for Refined Light Alloys, by Mr. Duport, and Study of Shrinkage in Light Alloys, by Mr. Tatur.

Raw Materials, Organisation and General.—The Thermal Behaviour of Crucible Furnaces, by Mr. Blondel; the Use of Grinding Wheels in the Foundry, by Mr. Hubert and Mr. Gross; Improving the Melting Section in an Iron Foundry, by Mr. Begard; Experimental Study of the Best Conditions for Utilising a Foundry Drying Stove, by Mr. Ulmer; Surface Preparation for Metal Moulds, by Mr. Happich; Some Properties of Enamel Coatings, by Mr. Le Thomas and Mr. Tyvaert, and the Mechanisation of Foundries, by Mr. Zimnawoda (American Exchange Paper)..

Apprenticeship—Human Factors.—The Manager and Working Staff, by Mr. Ageron, and British Foundry Training Facilities, by Mr. Faulkner (British Exchange Paper).

It is reported from New York that the U.S. Government has approved plans by 18 companies to spend nearly $470,000,000 (about £167,850,000) to expand steel production. It is estimated that this would increase steel-ingot production by 5,500,000 tons annually, pig-iron capacity by 2,750,000 tons, and coke output by 2,500,000 tons.

Nickel Casting Alloys in 1950

The following paragraphs have been abstracted from a world review of the nickel industry in 1950, published by the International Nickel Company of Canada, Limited:—

Practically all railway passenger coach frames in the United States and Canada were cast of low-carbon nickel steel, as were many other parts of railway equipment. Nickel-containing steel castings continued to be employed extensively by the steel industry for rolls, pinions and heavy machinery parts. Such nickel-steel castings are also used in mining and earth-moving machinery and for many uses in petroleum-producing equipment.

The Nimonic series of nickel-chromium alloys have retained their pre-eminence as the standard blade and flame-tube materials of all production aircraft-engine gas turbines in western Europe. These alloys are also used for the blades of engines made in the United States. The defence programme resulted in expanded uses of precision investment castings, or castings produced by the so-called "lost-wax" method, particularly in the aviation industry. International Nickel's Bayonne (New Jersey) works turned out parts in hundreds of different designs made of nickel, Monel, Inconel, and other alloys. Sand castings were also produced at Bayonne on a scale geared to meet the needs of government agencies as well as private industry.

Nickel-alloy Cast Irons

The combination of properties of Ni-Resist—resistance to heat, corrosion, wear and erosion, and thermal-expansion control—has become increasingly recognised in the past year in sea-water and insecticide pumps and valves, engine-valve guides, steam service, engine liners and glass moulds, and for piston-ring lands in aluminium pistons. Wherever heavy-duty machines demand these properties, Ni-Resist is being adopted as standard. The commercial production of magnesium-containing Ductile Ni-Resist was successfully begun during the year. The improved strength and toughness of this new material, with its resistance to service deterioration, provides an economical alloy which is being favourably regarded by industry. Another new type of Ni-Resist, which can be hardened after machining, is being service tested by many industries where resistance to corrosion and abrasion is required.

Substantial quantities of Ni-Hard, a white iron containing 2.5 to 4.75 per cent. nickel, as well as chromium, were consumed in the form of steel-mill rolls and as abrasion-resisting castings for the iron, copper, and nickel mining industries and in the power and ceramic fields. Grinding balls and slugs, cast in this iron, found an expanding market in the cement and paint industries during the year, with reduction in the consumption rate of grinding media and reduced discoloration of the final products being important considerations.

Engineering grades of alloy cast iron containing from 1 to 3 per cent. nickel are increasingly being specified, notably on the Continent. Belgian foundries are supplying these irons for heavy lathe beds, large-size lock-gate rollers, power-station plant and melting pots. Numerous parts of this material have been furnished by French foundries for hydro-electric plants in North Africa, Madagascar and other French colonies. Swedish interests are actively engaged in developing high-duty nickel cast irons for automobile-engine cylinder blocks and for small power units of all types.

Ductile Iron, a product introduced early in 1949, has made good progress this year, emerging from the pilot-plant stage to become an accepted engineering material. It is estimated that the output from licensed foundries for 1950 will be between 15,000 and 20,000 melt tons compared with 3,500 tons in 1949.

Copper-base Alloys

The greater output of castings, together with the undiminished use of nickel in gear bronzes, pressure castings and bearing bronzes, accounted for a larger consumption of nickel in the non-ferrous casting field during 1950. The alloyed bronzes containing 3 to 5 per cent. nickel found applications for constructional and functional purposes, including valves, pumps, gears and machine frames. Nickel continued to be employed as an addition for equalising the distribution of lead in bearing bronzes and to improve their mechanical properties. More widely recognised has been the function of nickel in imparting high strength and hardness to the aluminium bronzes, as well as contributing to their corrosion resistance. The high resistance to heat and wear of these alloys has established their position in aircraft construction for such parts as valve guides, valve seats, rings and bushings. In Great Britain, ships' propellers up to $3\frac{1}{4}$ tons in weight are now being made regularly of a 5 per cent. nickel-aluminium bronze, which is stronger and gives better service than the manganese-bronze previously used.

Irish Ironfounders' Association

The Irish Ironfounders' Association has 17 members, employing between them 1,162 workers. The four foundries in Eire outside the Association employ between them only about 110 persons. The products manufactured cover a wide range, being chiefly rain-water goods, agricultural machinery and implements, ranges, grates, baths, weights, boilers, cisterns, electric hot-plates, fire-bars, land rollers, cooking utensils, cattle-feeding pans, gates, manhole covers and frames, heaters, hydrants, kiln tiles, bakers' ovens, pumps, pulleys, seats, sewer traps and connections, wheels, etc. An important raw material is cast-iron scrap mostly found locally, but supplemented by shipments from abroad during scarce periods. Coke, pig-iron and ferro-silicon are imported from abroad, chiefly from the United Kingdom when available.

The Association meets once a month, or more often if required, and at the present moment items frequently discussed are:—(1) Scarcity of coke and pig-iron; (2) increasing volume of imports in competition with home-produced items, and (3) the growing use of substitutes (Vitreflex and steel) for rain-water goods and manhole covers. The headquarters of the Association is 3, College Green, Dublin, and the secretary is Mr. Arthur J. R. Cullinan.

More French Steel Mergers

Another merger has been arranged between French steel companies. Les Petits Fils de François de Wendel et Compagnie and de Wendel et Compagnie are to combine, and the capital of de Wendel will be increased from fcs. 400,000,000 to fcs. 2,400,000,000 (£2,450,000).

The other recent integration was between Compagnie des Forges et Aciéries de la Marine et d'Homécourt, Société Anonyme des Aciéries de Micheville, the Auboué works of Hauts Fourneaux et Fonderies de Pont-à-Mousson, and the iron-ore mines of Mairy.

The object of the merger is the constitution of a complete group for the manufacture of steel independent of outside needs.

Steel Industry's New Record

WITH PRODUCTION at an annual rate of 17,472,000 tons, the United Kingdom steel industry established a new record in November, the previous record rate being 17,147,000 tons last March. Last month's output compares with an annual rate of 16,358,000 tons in November, 1949. It is now expected that 1950 steel output will reach about 16,400,000 tons, which compares with the "Economic Survey" estimate of 15,750,000-16,000,000 tons.

Maintenance of steel production at a high level can be greatly assisted, says the British Iron and Steel Federation, by all steel-using firms returning their scrap, whether arising from current operations or from the scrapping of obsolete plant and buildings, as rapidly as possible. The federation also reports that orders for steel for the home market, after falling earlier in the year, have increased sharply in recent months, though there is so far little evidence that expanded defence programmes have made any large demands on steel supplies, except in the case of a few products.

Steps to Limit Exports

Steps are being taken to limit steel exports. This move, the federation says, together with the high level of steel production, should enable supplies for the home market to be appreciably increased. "Expansion in sheet supplies will follow the coming into operation of the new plant at Margam in the middle of 1951."

Pig-iron output in November was at an annual rate of 10,042,000 tons, compared with 9,745,000 tons a year ago.

Latest output figures (in tons) compare as follow with earlier returns:—

	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
1950—1st nine months	183,000	9,517,000	310,700	16,156,000
October ..	193,900	10,084,000	327,700	17,040,000
November ..	193,100	10,042,000	330,000	17,472,000
1949—1st nine months	181,600	9,444,000	297,100	15,449,000
October ..	183,900	9,565,000	306,900	15,959,000
November ..	187,400	9,745,000	314,600	16,358,000

Board Changes

SIEMENS BROS. & COMPANY, LIMITED—Mr. Edgar Humphries has been appointed a director.

A. V. ROE & COMPANY, LIMITED—Mr. J. A. R. Kay and Mr. J. Green have been appointed directors.

MACKAY INDUSTRIAL EQUIPMENT, LIMITED—Mr. R. G. Ledger and Mr. K. F. Dormer have been appointed directors.

SKINNINGROVE IRON COMPANY, LIMITED—Mr. C. R. Reed, works manager, who has been with the firm for 16 years, and Mr. W. H. Tubbs, chief engineer, with 11 years' service, have been appointed directors.

CLEVELAND BRIDGE & ENGINEERING COMPANY, LIMITED—Mr. Claud E. Pease, a director since 1930, has resigned from the board. The Pease family have been represented on the board of the company for 50 years.

BIG EXTENSIONS are planned to the foundry of Sterling Metals, Limited, Gypsy Lane, Nuneaton. Discussions are in progress between the borough surveyor and the firm for improving access to the works from the Nuneaton side.

News in Brief

THE NATIONAL FARMERS' UNION has joined the Federation of British Industries.

MECHANISED HANDLING PLANT & MACHINERY, LIMITED, have changed their address from 133-135, Euston Road, London, N.W.1, to Maxwell House, Arundel Street, London, W.C.2.

CORRESPONDENCE FOR THE Coleman Foundry Equipment Company, Limited, now being operated by Stone-Wallwork, Limited, should be addressed to 157, Victoria Street, London, S.W.1.

ORDERS EXCEEDING £10,000,000 were taken by exhibitors of agricultural machinery at the Smithfield show which closed on December 8. It is estimated that 40 per cent. are export orders.

IAN N. MERRILL & COMPANY, LIMITED, Cavendish Road, Sheffield, 11, have been appointed north-eastern area representatives for Wynn Products, Limited, makers of diaphragm valves, of Rhostyllen, near Wrexham.

LEYLAND MOTORS, LIMITED, and Auto Diesels, Limited, of Uxbridge, announce an agreement whereby the latter company will build exclusively a modern range of high-speed generating sets incorporating Leyland engines under the name of Leyland-Auto Diesel.

BROWN BROS., LIMITED, metal stockholders, etc., of Great Eastern Street, London, E.C.2, have obtained Treasury consent to the issue of 217,920 ordinary £1 shares at 30s. a share. These are to be offered to members at the rate of one new share to every five ordinary shares held.

ANDERSON & BECKETT, of Rutherglen, a subsidiary of the Coltness Iron Company, Limited, Wishaw, have just completed a haulage plant weighing 80 tons for Newtown Colliery, near Manchester. The plant will step up output by handling 150 tons per hr., hauling the load from the coalface to the pit bottom.

AN ORDER WORTH £2,250,000 has been placed by the Pakistan Government with Braithwaite & Company, Engineers, Limited, for the construction of a series of new jetties, comprising seven berths for ships up to 10,000 tons each, at the port of Chittagong. A condition of the contract is that the work is to be completed within three years. The contract will involve 22,000 tons of steel.

Heavy Damages for Foundry Worker

A former labourer in a Wolverhampton foundry whose knee was said to have been crushed by a segment of a moulding box was awarded £1,872 14s. damages at the Birmingham Assizes last week.

He was Mr. William McShera, of Walsall, who sued his former employers, Bayliss Rolls, Limited, of Victoria Works, Wolverhampton, alleging negligence.

For McShera it was said that an overhead crane with a segment of the moulding box attached to its tackle moved forward. McShera at the time was bearing down on the segment to raise its furthest edge above the top of the casting. He was struck by the swinging segment and received an injury to his left knee, which had been followed by some permanent disability. The defendant firm's answer was a denial of negligence. They alleged that McShera had told the crane driver to traverse the crane at the moment when the accident happened.

It was submitted that the method used by McShera to raise the segment had been common practice in the foundry for 50 years and that this was the first accident associated with it.

Giving judgment for McShera, Mr. Justice Barry said he thought that the crane driver by a very natural mistake had started the crane too soon.

Personal

MR. JACK RYDER, head of the engineering department at Coatbridge Technical College, has been appointed to the new post of vice-principal for evening duties.

MR. W. PORTON, who had been with General Refractories, Limited, since 1927, has recently left to take up the position of secretary with Herbert Alexander & Company, Limited, engineers, of Leeds.

MR. V. PENDRED, until recently a director of Skinningrove Iron Company, Limited, has joined Head Wrightson & Company, Limited, Thornaby-on-Tees. He will be in charge of the sales organisation of the group.

SIR ARCHIBALD FORBES is the new deputy-president of the Federation of British Industries. He was chairman of the former Iron and Steel Board. Sir Archibald will retain his position as chairman of the F.B.I. defence programme committee.

MR. W. KENNETH G. ALLEN, joint managing director of W. H. Allen, Sons & Company, Limited, founders and mechanical engineers, of Bedford, is going to Australia for business talks with the firm's agents and customers. He expects to be away from England for two or three months.

U.S.A. Accepts British Rusting Standards

In December, 1949, it will be recalled, the British Iron and Steel Research Association's corrosion laboratory issued a series of photographs at natural size depicting different grades of breakdown by rusting of painted steel surfaces. Reprints of these photographs were made freely available in the hope that comparisons in this important field would become more uniform.

It is now announced that the standards have been accepted for use by the American Waterworks' Association in its exposure tests. This will very greatly facilitate comparison of results of tests carried out here and in the United States.

Shipbuilders' Wage Increases

At a meeting in London last Wednesday, the Confederation of Shipbuilding and Engineering Unions accepted proposals for wage increases from the Shipbuilding Employers' Federation. There will be increases for all time workers of 11s. a week for skilled men and 8s. a week for semi-skilled and unskilled men. The increases will be retrospective to the first full pay week after November 13.

The agreement is in "full settlement" of all outstanding national claims, chief of which was a claim for £1 a week submitted about a year ago.

Nickel Price Raised

The International Nickel Company of Canada, Limited, and their associated companies, the International Nickel Company, Inc., of the United States, and the Mond Nickel Company, Limited, in the United Kingdom, announced last Wednesday that their prices for refined nickel are being increased immediately. The Mond Nickel Company are raising their price in the U.K. to £406 per ton delivered works, with appropriate increases for other countries. The previous price was £386 per ton.

Publications Received

Aluminium-alloy Castings Containing Nickel. Issued by The Mond Nickel Company, Limited, Sunderland House, Curzon Street, London, W.1.

Based on the Paper presented by Mr. Frank Hudson. F.I.M., on behalf of the Institute of British Foundrymen, to the congress of the American Foundrymen's Society in May of this year, this booklet deals with all aspects of castings in these alloys, including early developments, recent metallurgical practice and modern production methods. A tabulated summary of the many alloys available, combined with a wealth of illustrations showing foundry technique, etc., makes this publication valuable to engineers and designers in all industries.

The Journal of the Engineers' Guild. September, 1950. Published by the Guild from 28, Victoria Street, London, S.W.1.

This organisation has a very imposing general council. Put shortly, it exists to raise the status of engineers to put them on the same level as doctors and lawyers. Thus this issue contains an address from Dr. Charles Hill on "The Organisation of the Medical Profession." The rest of the contents is largely that of self criticism. Surely there should be a recognition of the fact that status comes from without. Apothecaries and mechanics at one time were the equivalent of the doctor and chartered engineer, whilst *ingenieur* in France carries all the kudos the Guild seeks. Internal preaching will not help. However, the reviewer wishes the Guild well in its objectives and suggests that for a period members assume they have arrived—then the world will be convinced.

The Economic Background to Purchasing. By J. F. Blitz. Published by the Purchasing Officers' Association, Wardrobe Chambers, 146a, Queen Victoria Street, London, E.C.4.

This is a plain unvarnished tale of the impact of world events upon British economy in pre- and post-war days. The author has somehow or other managed to keep off politics, yet it is an extremely controversial subject. A significant omission in this background information, in the reviewer's opinion, is that no reference is made to the enormous increase in Government internal expenditure which must have a very baleful influence on our export prices which in turn are directly connected with our ability to import.

Accidents—How they Happen and How to Prevent Them. Vol. 5, new series, October, 1950. Published for the Factory Department by H.M. Stationery Office, York House, Kingsway, London, W.C.2. Price 9d. net.

This issue illustrates a number of accidents which should never have occurred. The example taken from the foundry industry is a case of a man sweeping out an empty sand mill and tumbling inside it with fatal results. It is thought that he was trying to recover a tool he had dropped and overbalanced. Now an extra guard has been installed.

The Iron and Steel Trades in 1950. Published by William Jacks & Company, Limited, Winchester House, Old Broad Street, London, E.C.2.

This review follows the now well-established pattern, confining its attention strictly to the subject matter of the title. The foundry industry is completely neglected, a factor which needs remedying in a pamphlet of this character. It is extremely useful as a work of reference as to outputs and prices of pig-iron and steel.

Pig-iron and Steel Production

STATISTICAL SUMMARY

The following particulars of pig-iron and steel produced in Great Britain have been extracted from the Statistical Bulletin for August, issued by the British Iron and Steel Federation. Table I gives the production of pig-iron and ferro-alloys in July, with the number of furnaces in blast; Table II, production of steel ingots and castings in July, and Table III, deliveries of finished steel. Table IV summarises activities during the previous six months.

TABLE I.—*Weekly Average Production of Pig-iron and Ferro-alloys during July. (Thousands of Tons.)*

District.	Furnaces in blast. 29.7.50	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants, Essex ..	25	—	17.7	23.3	0.7	—	41.8
Lancs. (excl. N.W. Coast) Denbigh, Flints. and Cheshire .. Yorkshire (incl. Sheffield, excl. N.E. Coast) ..	5	—	5.2	—	—	1.4	6.6
Lincolnshire ..	13	—	22.0	0.4	—	—	22.4
North-East Coast	22	7.1	35.0	0.3	—	1.3	43.7
Scotland	8	0.8	7.6	2.0	—	—	10.4
Staffs., Shrops., Worcs., and Warwick ..	9	—	8.3	1.5	—	—	9.8
S. Wales and Monmouthshire	8	4.5	19.1	—	—	—	23.6
North-West Coast	6	16.6	—	—	—	0.1	16.7
Total ..	96	29.0	114.9	27.5	0.7	2.8	175.0†
June, 1950 ..	98	27.8	124.1	26.3	1.1	2.8	182.2†
July, 1949 ..	101	26.4	115.2	30.5	1.3	4.0	177.4

† Incl. 100 tons of direct castings.

TABLE III.—*Weekly Average Deliveries of Non-alloy and Alloy Finished Steel. (Thousands of Tons.)*

Product.	1948.	1949.	1949. July.	1950. June.	1950. July.
Non-alloy Steel :—					
Heavy rails and sleepers	8.9	9.8	8.5	12.5	10.4
Heavy and medium plates	36.1	39.2	26.3	40.1	32.9
Other heavy prod.	34.7	36.1	30.8	38.5	35.2
Light rolled prod.§	59.7	40.4	40.9	45.8	43.0
Hot-rolled strip ..	(bracketed with above)	17.1	16.4	19.2	16.6
Cold-rolled strip ..	4.8	4.9	4.1	5.6	5.8
Bright steel bars ..	6.1	5.8	4.9	6.7	6.9
Sheets, coated and uncoated ..	26.3	27.6	23.6	33.6	30.1
Tin-, terne- and blackplate ..	13.5	13.7	12.0	14.9	14.6
Tubes, pipes and fittings	15.1	18.5	15.7	20.6	19.8
Wire	12.8	15.0	12.3	16.2	14.5
Tyres, wheels, axles	3.9	4.1	3.7	3.8	3.3
Forgings	6.0	6.3	5.3	6.6	5.9††
Castings	3.5	3.6	2.9	3.7	3.2††
Total	231.4	248.1	207.4	267.8	242.2
Alloy Steel† :—					
Tubes and pipes ..	0.4	0.6	0.3	1.0	0.6
Bars, plates, sheets, strip and wire ..	4.7	4.7	3.7	4.9	5.5
Forgings	2.5	2.7	2.2	3.0	3.0††
Castings	0.7	0.7	0.6	0.8	0.8††
Total	8.3	8.7	6.8	9.7	9.9
Total deliveries from U.K. prod.‡ ..	239.7	256.8	214.2	277.5	252.1
Add from other U.K. sources	5.7	5.8	7.6	4.2	6.2††
Imported finished steel	3.4	7.7	11.5	5.3	4.2
	248.8	270.3	233.3	287.0	262.5
Less intra-industry conversion ..	35.0	39.1	35.3	41.3	36.3
Total deliveries of finished steel ..	213.8	231.2	198.0	245.7	226.2

[†] Excludes high-speed steel. ‡ Includes finished steel produced in the U.K. from imported ingots and semi-finished steel. †† Estimated. [§] Excl. wire rods and alloy-steel bars, but incl. ferro-concrete bars.

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in July. (Thousands of Tons.)*

District.	Open-hearth. Acid.	Open-hearth. Basic.	Bessemer.	Electric.	All other.	Total. Ingots.	Total. Castings.	Total ingots and castings.
Derby., Leics., Notts., Northants and Essex ..	—	2.9	10.9(basic)	1.2	0.2	14.6	0.6	16.2
Lancs. (excl. N.W. Coast), Denbigh, Flints., and Cheshire .. Yorkshire (excl. N.E. Coast and Sheffield) ..	0.8	19.0	—	1.2	0.4	20.7	0.7	21.4
Lincolnshire ..	—	22.5	—	—	0.1	22.4	0.2	22.6
North-East Coast ..	0.9	51.1	—	0.8	0.5	51.8	1.5	53.3
Scotland ..	2.2	26.3	—	1.3	0.5	29.0	1.3	30.3
Staffs., Shrops., Worcs. and Warwick ..	—	14.7	—	0.7	0.7	14.8	1.2	16.1
S. Wales and Monmouthshire ..	11.7	50.8	4.8 (basic)	0.8	0.1	67.8	0.4	68.2
Sheffield (incl. small quantity in Manchester) ..	7.4	25.8	—	7.3	0.6	39.4	1.7	41.1
North-West Coast ..	0.6	2.2	5.2 (acid)	—	0.1	8.0	0.1	8.1
Total ..	23.6	215.3	20.9	13.3	3.2	268.5	7.8	270.3
June, 1950 ..	27.0	246.6	21.0	14.4	3.5	303.9	8.6	312.5
July, 1949 ..	22.5	187.8	19.6	11.5	2.8	237.7	6.5	244.2

TABLE IV.—*General Summary of Pig-iron and Steel Production. (Weekly Average in Thousands of Tons.)*

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy). Imports.†	Steel (incl. alloy). Output of ingots and castings.	Steel (incl. alloy). Deliveries of finished steel.	Steel (incl. alloy). Stocks.‡
1938	228	89	—	130	118	16	200	—	—
1948	252	172	200	178	174	8	286	214	1,028
1949	258	169	199	183	188	17	299	231	1,275
1950—February ..	250	170	194	184	206	8	325	244	1,257
March*	255	174	197	186	212	12	330	252	1,279
April	242	171	196	183	207	11	324	236	1,320
May*	248	172	199	186	204	10	319	240	1,326
June	243	170	194	182	199	12	313	246	1,352
July	243	166	191	175	176	13	276	226	1,152

* Five weeks. † Weekly average of calendar month. ‡ Stocks at end of years and months shown. [§] Excl. reinforcement wire, material for drop forgings, bolts, nuts and washers.

Raw Material Markets

Iron and Steel

The improved output of pig-iron is fully absorbed. Current requirements are heavy, and if deliveries keep abreast of consumption, there is no surplus available for the replenishment of stocks. The heaviest demand emanates from the engineering foundries. Activity in the light-castings trade is subdued and no great difficulty is experienced in providing the usual high-phosphorus grades of pig-iron. But the heavy engineering trades have a superabundance of work in hand, and to sustain the foundries in full operation, more refined iron and hematite is being used, owing to the shortage of low- and medium-phosphorus grades.

Re-rollers are working to capacity limits to clear orders due for execution before the end of the year, and the outlook for 1951 seems to be "set fair." Their one anxiety concerns the provision of re-rolling material. The shrinkage of imports throws an added burden of responsibility on the shoulders of home producers of semi-finished steel, and although big deliveries are coming forward, supplies are falling rather short of current consumption. Sheet mills are assured of their normal supplies of bars and slabs, but the smaller sizes of billets are scarce, and there is a strong market for defectives, crops, etc.

Steel exports for December are expected to reach an unusually high level. Big cargoes are due for despatch to Australia, South Africa, and the Middle and Far East before the end of the month. But thereafter the voluntary limitation of exports is to be imposed on the steel industry with the sole purpose of ensuring adequate supplies for power consumers, who are themselves so busily engaged on foreign orders. Shipbuilders, power-plant producers, and wagon and locomotive builders all have an exceptionally big volume of work in hand for oversea, and the provision of the steel they require is a first charge on the resources of the rolling mills. It is understood that reimposition of control is not at present contemplated, but the sheet trade is a notable exception. For sheets the demand so far exceeds the supply, that distribution is strictly controlled, and very few export permits are being issued.

Non-ferrous Metals

Last week brought more enlightenment on the short supply situation in the base metals. Before the House of Commons rose for the Christmas recess a statement was made by the Parliamentary Secretary to the Ministry of Supply (Mr. Freeman) on aluminium and zinc. In regard to the former, he said that contracts with the Aluminium Company of Canada had been concluded, which secured sufficient metal to meet defence and essential civilian needs for 1951. Whether this means that we shall have more than the 15,000 tons per month already reported is not quite clear. Probably not. As to zinc, there is to be an allocation system coming into force on January 1. This, however, is likely to be on an interim basis to be worked out in more detail later. Apparently the shortage in zinc has arisen on account of the non-arrival of a large shipment from Belgium. Mr. Freeman said that the Government was seeking out all the zinc possible and would not allow considerations of price to stand in the way.

Fabricators, faced with running on short times, or perhaps even closing down altogether, will reflect rather bitterly that it is a pity this decision was not reached months ago. The Ministry of Supply appears to have been very much out of touch with developments on the supply side of this metal, for it has been obvious to most people connected with the trade for months past that a scarcity was developing.

An announcement regarding allocation of copper was made last week. From January 1 consumers will receive a tonnage monthly, no greater than their average takings of imported copper during the first half of this year. Compared with the industry's recent rate of activity this means a substantial cut. In the special shapes, however, those consumers interested will be allowed to acquire no more than two-thirds of what they had on a monthly average during the first half of this year. They may, however, have the other third in standard shapes if these are available. It is understood that consumers have already been advised of their quotas for the first quarter.

Scrap prices are still very firm, and in view of the desperate scarcity of zinc and copper it is unlikely that we shall see any improvement in the New Year. On the other hand, the state of emergency declared in the United States and price ceilings there may influence events on this side.

Official tin quotations on the London Metal Exchange were as follow:—

Cash—Thursday, £1,160 to £1,170; Friday, £1,195 to £1,200; Monday, £1,200 to £1,240; Tuesday, £1,280 to £1,290.

Three Months—Thursday, £1,000 to £1,005; Friday, £1,032 to £1,035; Monday, £1,040 to £1,045; Tuesday, £1,080 to £1,085.

Foundry Equipment Handbook

Some time ago, the Foundry Equipment and Supplies Association, in conjunction with the Board of Trade, prepared a booklet for overseas distribution only, which contains a very useful buyers' guide and an account of British foundry development during the war. There is a small surplus stock of these books, and permission has been received from the Board of Trade to distribute these to our readers. Those desiring to receive a copy should write to the secretaries, Peat, Marwick, Mitchell & Company, 94-98, Petty France, London, S.W.1, mentioning the JOURNAL.

Souvenir Album for American President

In what was hoped to be in good time for Christmas, a souvenir album has been posted to Mr. H. P. Good, the president of the Gray Iron Founders' Association of America. This illuminated album, by means of a map, many photographs, and press cuttings, tells the story of Mr. Good's public appearances and lightning tour of foundry concerns in this country, which were compressed between September 20 and 28.

Institute of Vitreous Enamellers

Mr. W. Thomas has resigned his position as honorary secretary of the Institute of Vitreous Enamellers, with effect from January 1, 1951. In his stead, the firm of John Gardom & Company, of Ripley (Derbyshire), have been appointed as secretaries.

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

(Delivered, unless otherwise stated)

December 20, 1950

PIG-IRON

Foundry Iron.—No. 3 Iron, Class 2:—Middlesbrough, £10 10s. 3d.; Birmingham, £10 5s. 6d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent P, £12 1s. 6d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si)—North Zone, £12 10s.; South Zone, £12 12s. 6d.

Scotch Iron.—No. 3 foundry, £12 0s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £13 2s. 6d.; South Zone, £13 5s.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £13 12s. 6d.; South Zone, £13 15s.

Cold Blast.—South Staffs, £16 3s. 3d.

Hematite.—Si up to 2½ per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. Coast and N.-W. Coast of England, £12 0s. 6d.; Scotland, £12 7s.; Sheffield, £12 15s. 6d.; Birmingham, £13 2s.; Wales (Welsh iron), £12 0s. 6d.

Spiegeleisen.—20 per cent. Mn, £17 16s.

Basic Pig-iron.—£10 11s. 6d., all districts.

FERRO-ALLOYS

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

Ferro-silicon (6-ton lots).—45 per cent., £33 15s.; 75 per cent., £49.

Ferro-vanadium.—35/60 per cent., 15s. per lb. of V.

Ferro-molybdenum.—70/75 per cent., carbon-free, 8s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £100 per ton.

Ferro-tungsten.—80/85 per cent., 19s. 6d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 21s. 6d. per lb of W.

Ferro-chrome.—4/8 per cent. C, £60; max. 2 per cent. C, 1s. 5½d. lb.; max. 1 per cent. C, 1s. 6d. lb.; max. 0.15 per cent. C, 1s. 6¾d. lb.; max. 0.10 per cent. C, 1s. 7d. lb.

Cobalt.—98/99 per cent., 15s. 6d. per lb.

Metallic Chromium.—98/99 per cent., 5s. to 5s. 3d. per lb.

Ferro-manganese (blast-furnace). — 78 per cent., £30 5s. 11d.

Metallic Manganese.—96/98 per cent., carbon-free, 1s. 7d. to 1s. 9d. per lb.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—Basic: Soft, u.t., £16 16s. 6d.; tested, up to 0.25 per cent. C (100-ton lots), £17 1s. 6d.; hard (0.42 to 0.60 per cent. C), £18 16s. 6d.; silico-manganese, £23 19s.; free-cutting, £20 1s. 6d. Siemens Martin Acid: Up to 0.25 per cent. C, £22 4s.; case-hardening, £23 1s. 6d.; silico-manganese, £26 6s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £19 16s. 6d.; basic, hard, over 0.41 up to 0.60 per cent. C, £21 1s. 6d.; acid, up to 0.25 per cent. C, £23 1s. 6d.

Sheet and Tinplate Bars.—£16 16s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £20 14s. 6d.; boiler plates (N.-E. Coast), £22 2s.; chequer plates (N.-E. Coast), £22 19s. 6d.; heavy joists, sections, and bars (angle basis), N.-E. Coast, £19 13s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £22 6s.; flats, 5 in. wide and under, £22 6s.; rails, heavy, f.o.t., £19 2s. 6d.; hoop and strip, £23 1s.; black sheets, 17/20 g., £28 16s.

Alloy Steel Bars.—1-in. dia. and up: Nickel, £37 7s. 3d.; nickel-chrome, £55; nickel-chrome-molybdenum, £61 13s.

Tinplates.—I.C. cokes, 20 × 14, per box, 41s. 9d., f.o.t. makers' works.

NON-FERROUS METALS

Copper.—Electrolytic, £202; high-grade fire-refined, £201 10s.; fire-refined of not less than 99.7 per cent., £201; ditto, 99.2 per cent., £200 10s.; black hot-rolled wire rods, £211 12s. 6d.

Tin.—Cash, £1,280 to £1,290; three months, £1,080 to £1,085; settlement, £1,290.

Zinc.—G.O.B. (foreign) (duty paid), £151; ditto (domestic), £151; "Primo Western," £151; electrolytic, £155; not less than 99.99 per cent., £157.

Lead.—Good soft pig-lead (foreign) (duty paid), £136; ditto (Empire and domestic), £136; "English," £137 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, all English destinations, £170 7s. 6d.; rolled zinc (boiler plates), all English destinations, £168 7s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £139 10s.

Other Metals.—Aluminium, ingots, £120; antimony, English, 99 per cent., £250; quicksilver, ex warehouse, £37 10s. to £38; nickel, £406.

Brass.—Solid-drawn tubes, 21⅝d. per lb.; rods, drawn, 28⅛d.; sheets to 10 w.g., 26d.; wire, 26⅝d.; rolled metal, 24⅞d.

Copper Tubes, etc.—Solid-drawn tubes, 23½d. per lb. wire, 226s. 6d. per cwt. basis; 20 s.w.g., 254s. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £225 to £260; BS. 1400—LG3—1 (86/7/5/2), £235 to £270; BS. 1400—G1—1 (88/10/2), £300 to £345; Admiralty GM (88/10/2), virgin quality, £310 to £345, per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £330 to £350; L.P.Bl, £240 to £260 per ton.

Phosphor Bronze.—Strip, 34d. per lb.; sheets to 10 w.g., 35⅞d.; wire, 36d.; rods, 33½d.; tubes, 38¾d.; chill cast bars: solids, 34½d., cored, 35½d. (C. Clifford & Son, Limited.)

Nickel Silver, etc.—Ingots for raising, 2s. 2¾d. per lb. (7%) to 3s. 1½d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 2s. 8¾d. (7%) to 3s. 7½d. (30%); to 12 in. wide × .056, 2s. 9d. to 3s. 7¾d.; to 25 in. wide × .056, 2s. 11d. to 3s. 9¾d. Spoon and fork metal, unsheared, 2s. 5¾d. to 3s. 4½d. Wire, 10g., in coils, 3s. 2½d. (10%) to 4s. 1d. (30%). Special quality turning rod, 10%, 3s. 1½d.; 15%, 3s. 5¾d.; 18%, 3s. 10d. All prices are net.

Obituary

MR. P. GOOD

It is with the deepest regret that we learn of the death, on December 2, of Mr. P. Good, C.B.E., director of the British Standards Institution, who had been connected with the Institution for 37 years. A memorial service was to be held at the Church of St. Martin-in-the-Fields, Trafalgar Square, on Monday, December 18. Mr. Good was a past-president of the Institution of Electrical Engineers, and an honorary fellow of the Imperial College of Science and Technology.

MR. J. D. D. DAVIS

We regret to record the death at the age of 71 of Mr. J. D. D. Davis, a well-known personality in South Wales business circles. He was secretary of the Welsh Engineers' and Founders' Association, the Swansea Metal Exchange and of the South Wales and Monmouth Association of Tinplate, Iron, Steel, Metals and Scrap Merchants. A bachelor, Mr. Davis was well known in sporting circles and at one time played for Glamorgan County Cricket Club, and also a member of the Welsh Golfing Union. Mr. W. D. M. Davis, has succeeded the late Mr. J. D. D. Davis as secretary of the Welsh Engineers' and Founders' Association of which previously he was assistant secretary.

MR. HERBERT BRIGHT, a director of Bury Ring Mill, Limited, died on December 5 at the age of 80.

MR. JOHN GALLIE, late of R. & J. Dick, Limited, belting manufacturers, of Glasgow, has died at the age of 80.

MR. JAMES DUNSMUIR, late of John Brown & Company, Limited, Clydebank, died last Monday at the age of 90.

MR. FREDERIC HARRY FOSTER, of the Butterley Company, Limited, Ripley (Derbyshire), died suddenly last Saturday.

MR. ROBERT DICKSON, chairman of the Lion Foundry Company, Limited, Kirkintilloch, died on December 8. He entered the service of the company as a boy.

MR. ALBERT VICTOR LOWE, a traveller and foreign correspondent for Arthur Balfour & Company, Limited, steel and tool manufacturers, of Sheffield, has died at the age of 61.

MR. JOHN CECIL FROST, who died at Sheffield recently, was employed in the heat-treatment department of Thos. Firth & John Brown, Limited, for 52 years. He retired 10 years ago.

Wills

ROSE, H. F., iron and steel merchant, of Darlaston (Staffs)	£16,877
CAUKWELL, HERBERT, a former director of Rawlinsons, Limited, lift and hoist makers, of Leeds ...	£1,481
PHILPOTTS, SIR R. B., late chairman of the British Tabulating Machine Company, Limited, London, W.C.1	£17,482
TANGYE, A., a late director of Tangyes, Limited, engineers and pump manufacturers, of Smethwick	£73,508
WILLIAMS, A. E., late of J. T. Williams & Sons, engineers, metal and machinery merchants, etc., of London, S.E.16	£55,922
FELLOWS, A. E., late mines manager for E. J. & J. Pearson, Limited, manufacturers of refractories and firebricks, of Stourbridge (Worcs)	£3,526
CRISPIN, GEORGE, of James Crispin & Sons, heating and ventilation engineers, of Bristol, and a pioneer of the Bristol Manufacturers' Association	£50,788

CLASSIFIED ADVERTISEMENTS

PREPAID RATES : Twenty words for 5s. (minimum charge) and 2d. per word thereafter. Box Numbers. 2s. extra (including postage of replies).

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, 49, Wellington Street, London, W.C.2. If received by first post Tuesday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

FOUNDRY SUPERINTENDENT/METALLURGIST (36), M.I.B.F., seeks position. Metal, sand control. Experienced in light repetition and heavy jobbing ironfounding. Some non-ferrous experience.—Box 156, FOUNDRY TRADE JOURNAL.

TECHNICAL SALES REPRESENTATIVE (Metallurgical), fully experienced uses, applications, foundry practice, heat treatment, aluminium alloys, desires progressive sales executive post.—Box 420, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

YOUNG FOUNDRYMAN wanted for routine technique control by Birmingham gravity die-casting and sand foundry. A basic training in pyrometry and some metallurgical knowledge advantageous. Good future possibilities for a suitable man.—Box 380, FOUNDRY TRADE JOURNAL.

WORKING FOREMAN required for Non-ferrous Foundry, S.W. London. Engineering and Art Castings. Preference experience and knowledge of High-tensile bronzes and Aluminium Alloys.—Full particulars to Box 426, FOUNDRY TRADE JOURNAL.

DRAUGHTSMAN WITH EXPERIENCE of Foundry Machinery and Electrical Equipment required by old-established firm in Glasgow area. Permanent position, 5-day week, and pension scheme. Please give full details of experience and salary expected.—Address 13K1, WM. PORTEOUS & Co., Glasgow.

FOUNDRYMAN required in Birmingham, to take charge of small Sand Production Foundry in Aluminium and Copper-base Alloys. An ability to develop productivity methods and a well grounded experience in moulding and alloy techniques is essential.—Box 382, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER required for expanding medium size Newcastle Iron Foundry. Age about 35. Should be fully conversant in modern methods of quantity production for high grade engineering and motor cylinder castings. Must have knowledge of Cupola, Sand Control and Metallurgy, and capable of utilising and training "green" labour. Excellent prospects for energetic man. Write, giving full particulars, salary required.—Box 386, FOUNDRY TRADE JOURNAL.

PATTERN SHOP FOREMAN required for Grey and Malleable Iron Foundry in Midlands. Must be experienced in plate pattern making and able to take full control of organisation of shop.—Apply Box 424, FOUNDRY TRADE JOURNAL.

VACANCY exists for young FOUNDRY METALLURGIST in modern special steel Foundry, N. Notts area. Experience of H.F. and preferably arc-furnace melting, sand control, etc. Reply, stating age, experience and salary required, to Personnel Manager.—Box 430, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

CHIEF ASSISTANT METALLURGIST, age 21-25 years, required for Steel Founders in the Manchester area. Applicants will be required to undertake investigational work on foundry problems and some knowledge of open-hearth furnace is required. Good prospects for suitable type of applicant and Staff Pension Scheme operating.—Full particulars, stating salary required, to Box 434, FOUNDRY TRADE JOURNAL.

CHEMIST, 21-23 years, required for Foundry in the Manchester area. Applicants must have experience in general iron and steel works analysis, and preferably some knowledge of open-hearth furnace operation. Progressive position. Good prospects for suitable type of applicant, and Staff Pension Scheme operating.—Full particulars, stating salary required, to Box 432, FOUNDRY TRADE JOURNAL.

STANDARDS ENGINEER

VACANCY for young man, age 25/30, to be trained for above situation in large modern foundries in Yorkshire, producing high-class steel, iron and non-ferrous castings. Knowledge of foundry practice essential. Good prospects for person with ability.—Apply, giving details of age, education, salary, etc., to Box 346, FOUNDRY TRADE JOURNAL.

DRESSING SHOP FOREMAN for small Steel Foundry. Must be young, willing and experienced man. Good house provided after 3 months' trial period.—Apply Box 428, FOUNDRY TRADE JOURNAL.

COMPANY of International repute invite applications from FOUNDRY TECHNICIANS/METALLURGISTS who think they have a flair for selling. Some general knowledge of foundry operations essential as service work links up with an extensive range of chemical-metallurgical products. Preferred age group 25/40. Although not essential it is desirable applicant should possess a car or have ability to drive. We are only interested in keen, enterprising hard workers who are willing to submerge other interests for a tough but fascinating job. The provisional areas are Scotland, Yorkshire and South Wales. Reply should be as explicit as possible and interviews probably given in the particular area.—Box 358, FOUNDRY TRADE JOURNAL.

EXCEPTIONAL opportunity occurs for Gentleman (preferably with practical or executive experience) to take over whole or part of Managing Director's holding in Foundry (Grey Iron, general and repetition, non-ferrous) in West Bromwich district; commodious premises, long lease, going concern, full order book; capacity 20/30 tons weekly; present output 8 tons, ample scope; capital required £3,000-£6,000; room for development and extensions. A rare opportunity, as working capital is required for expansion.—Apply, first instance, "ACCOUNTANT," Box 398, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*Contd.*

REPRESENTATIVE required for Scotland for sale of well-established and advertised range of Core Binders. Payment by salary, expenses and bonus.—Apply, giving fullest particulars of age, experience, salary required, etc., to Box 368, FOUNDRY TRADE JOURNAL.

SMALL Iron Foundry in North-East, approx. 5 miles Darlington, producing Grey Iron Castings for the Machine Tool and Valve Trade, also general jobbing work, require experienced FOUNDRY FOREMAN. Conversant with this class of business. It is possible that a house could be provided in a very short time for suitable applicant. Only top class man who feels he can improve existing conditions need apply. Please state experience, age, and salary required.—Box 378, FOUNDRY TRADE JOURNAL.

MOULDER required for Non-ferrous Foundry, Middlesex area. Accustomed to jobbing work up to a £100. Good prospects for right man.—Box 364, FOUNDRY TRADE JOURNAL.

BUSINESS WANTED

A FIRM of Engineers wish to purchase a small Iron Foundry as a going concern.—Box 938, FOUNDRY TRADE JOURNAL.

BUSINESS FOR SALE

SMALL Grey Iron Foundry, South Midlands, as going concern. Full order book, several months' work guaranteed. £1,000.—Box 336, FOUNDRY TRADE JOURNAL.

AGENCIES

CUPOLA Limestone 2 in. down and Silica Clay ex our Ketton Quarry. Any quantities. AGENTS wanted, or supply direct. Limestone, calcium carbonate 97.04 per cent.; Clay, silica 83.68 per cent.—Full particulars, KETTON FOUNDRY Co., LTD., Ketton, near Stamford. Tel.: Ketton 206.

SELLING ORGANISATION, with offices in London, Liverpool, Glasgow, Cardiff and Newcastle-upon-Tyne, and at present marketing machined and unmachined non-ferrous work over the whole of the British Isles, can accept further Agencies for other types of work, *e.g.*, Brass Stampings and Pressings, Iron Castings or Patented Fittings.—Please write to JAMES BROWN & SONS (SALES), LTD., Royal Liver Building, Liverpool, 3, for details.

MACHINERY FOR SALE

1 6-FT. dia. Revolving Pan Mill (Smedley Bros., Belper), No. SB/B.9066, complete with 400 volts, 50 amp., 3-phase Motor, 7.5 h.p., 715 r.p.m., star-delta starter, "V" rope drive.—Box 340, FOUNDRY TRADE JOURNAL.