Modifications of Open Hearth Practice.—Many attempts have been made with more or less success to increase the rapidity of working in the Siemens processes, both acid and basic. Fluid blast furnace or cupola metal has been repeatedly tried, and although the results obtained by different people were promising, this method of working until comparatively recently has not been generally adopted. It is somewhat difficult to arrive at the causes which militated against the use of molten metal, especially in the basic furnace, as although no doubt the destruction of bottoms is a serious matter, and the increase in output is not very great, the increase in yield is undoubted. Mr. James Riley,* as the results of some experiments in acid furnaces, stated that this destruction of the furnace bottom had been greatly exaggerated, and that with respect to economy of working, increased output, yield, &c., he had obtained good results. As regards the speed of working charges in the acid furnaces, there is little, if any, gain, as during the melting period, in ordinary working, a large amount of purification is effected; but there is a considerable gain both as regards labour and time in charging. In basic Siemens, where oxidising reagents can be put on the bottom first, and more or less melted before the metal is poured into the furnace, the speed of working the charges is undoubtedly increased, but the wear and tear on the bottom is great. In the Southern States of America experiments were made by Talbot in 1893 on pouring molten metal into a bath of molten Oxide in a basic Siemens furnace, but owing to the very violent reaction, which rapidly destroyed the furnace bottom, they were not a practical success.

One reason why liquid metal was not years ago generally used in basic open hearth practice was that the early experiments were usually made with direct blast furnace metal, which was liable to vary considerably in temperature and in the content of Silicon. Under the best conditions the percentage of Silicon was always high, and this, with the varying temperature, was very destructive to the furnace hearth. Even when cupola metal was employed, the Silicon was always *comparatively* high, and the cost of melting had to be added to the cost of furnace repairs. The modern practice in basic open hearth works having a large output, is to pass the metal first through a large basic-lined *gas fired* mixer, so that small additions of lime and oxide can be made, and the metal very largely desiliconised and to some extent desulphurised. By this means metal, uniform both as regards temperature and composition, is obtained, the Silicon is reduced to ·5 per cent. or less, and the wear of the furnace hearths is greatly decreased. When working with low Sulphur and low Silicon mixer metal, the output of the open hearth furnace is increased by about 20 to 30 per cent., and with fairly high Sulphur metal by 15 to 20 per cent., compared with furnaces melting cold pig-iron, or one and a-half to two extra charges per furnace per week; the yield is also increased by at least 5 per cent., and in good practice every 100 tons of molten metal charged should yield from 97 to 100 tons of ingots.

The use of these gas-fired mixers gives much greater elasticity to the working of the basic open hearth process, as by modifying the details of working—*i.e.*, by varying the composition of the slag and the temperature—almost any degree of decarburisation and dephosphorisation can be obtained. With a suitable blast furnace metal fairly low in Phosphorus not only can the Silicon be completely removed, and an appreciable percentage of the Sulphur, but also a very large percentage of the Phosphorus and Carbon; thus the open hearth furnace can be supplied with a refined metal which

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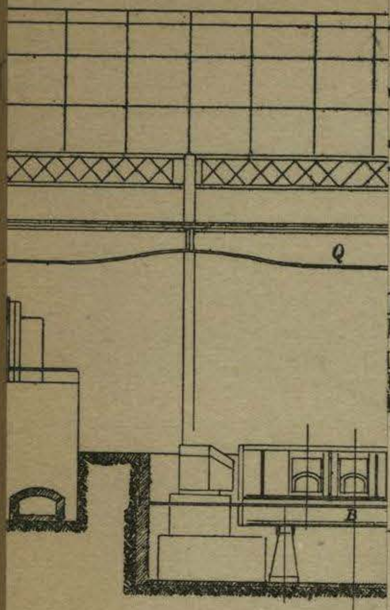
* *Iron and Steel Inst. Journ.*, 1900, vol. i., p. 22.

[*To face p.* 198.

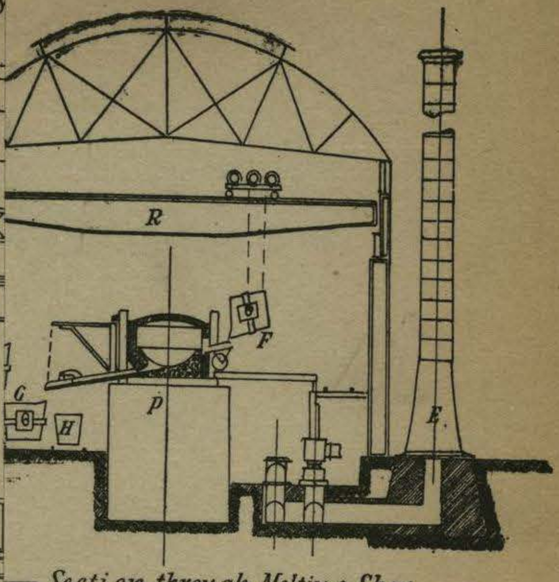
neral Arrangement for

Designed by Mr. John Darby



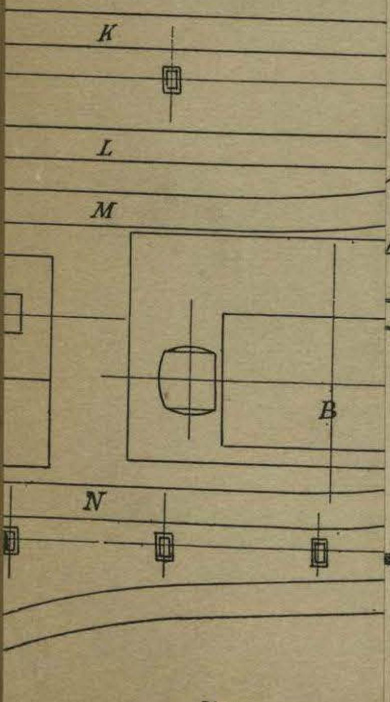
Elevation.

Fig. 165.



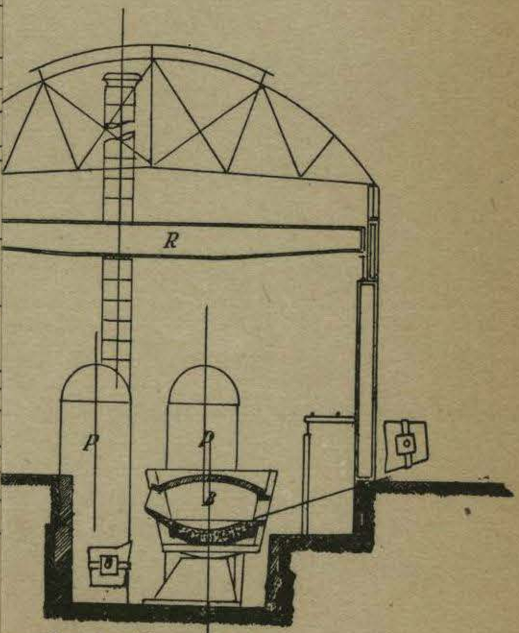
Section through Melting Shop

Fig. 166.



Plan.

Fig. 168.



Section through Mixer

Fig. 167.

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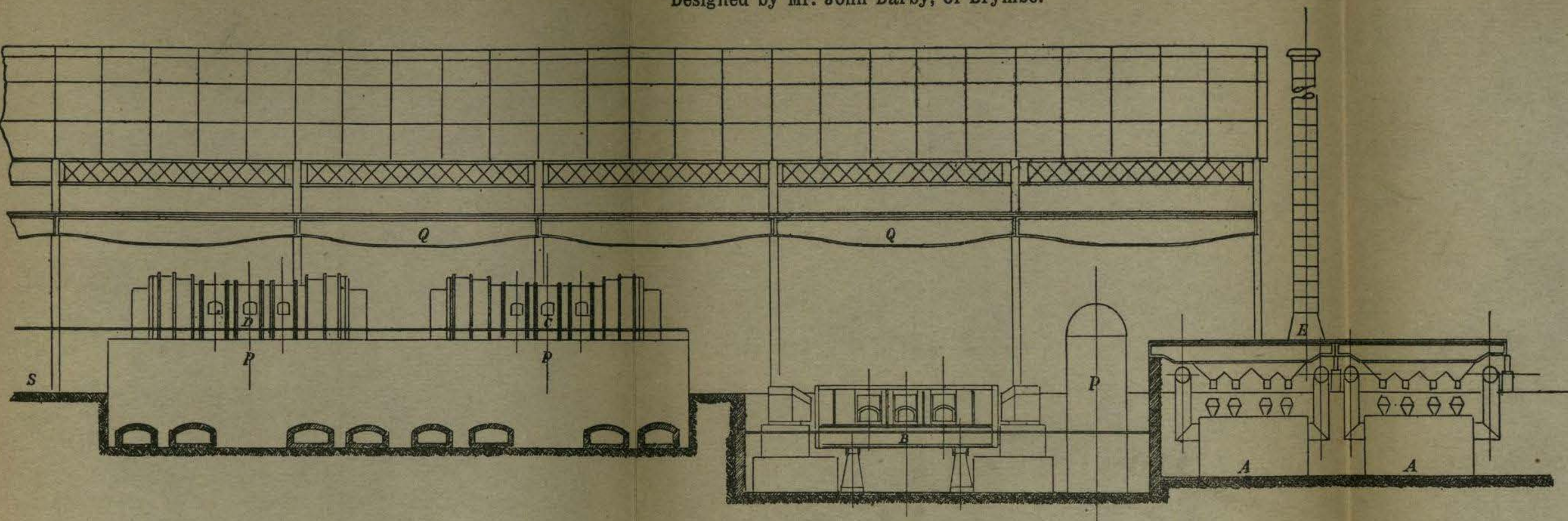
Blast-furnace metal is poured into the metal mixer, B, by means of a ladle. The mixer is gas fired, and has air regenerators, so that "week end" pig-iron and scrap can be melted if desired, but no attempt is made to dephosphorise, and neither ore nor lime or limestone is added. The molten metal is transferred from this mixer to the primary furnace, C, by the overhead travelling crane, R, and the ladle, F, and when the furnace is sufficiently full, iron ore and limestone are added as rapidly as possible. Within a period of three hours the whole of the Silicon should be removed, and in case of the pig-iron containing about 1·5 per cent. to 2 per cent. Phosphorus, the Phosphorus reduced to 0·15 per cent., while the Carbon, if the temperature has been carefully controlled, should not be less than about 2·00 per cent. The whole charge is now poured into a ladle, preferably with a large stopper and nozzle, and transferred by the overhead travelling crane, R, to the secondary furnace, D, which may contain highly-heated scrap, ore and lime. Iron ore and limestone are added from time to time, and the metal "boiled down" to remove the last traces of Phosphorus, and to reduce the Carbon to the required extent. When finished, the whole charge is poured into the casting ladle, G, and teemed into ingot moulds. It is estimated by Mr. Darby that the time required for each charge in the finishing furnace will be under three hours, and, allowing for repairs between heats, that a pair of furnaces will produce eight charges in the twenty-four hours.

A, Gas producers.
B, Metal mixer.
C, Primary furnace.
D, Secondary or finishing furnace.
E, Chimney.
F, Transfer hot metal ladle from mixer to primary furnace.
G, Casting ladle.
H, Slag pot.
J, Ingot mould on car.
K, Through road.
L, Casting road.
M, Slag road.
N, Road to producers.
O, Hot metal road.
P, Regenerators.
Q, Crane runway.
R, Overhead crane.
S, Other furnaces as required.

PLATE XII.—General Arrangement for the Bertrand-Thiel Process.

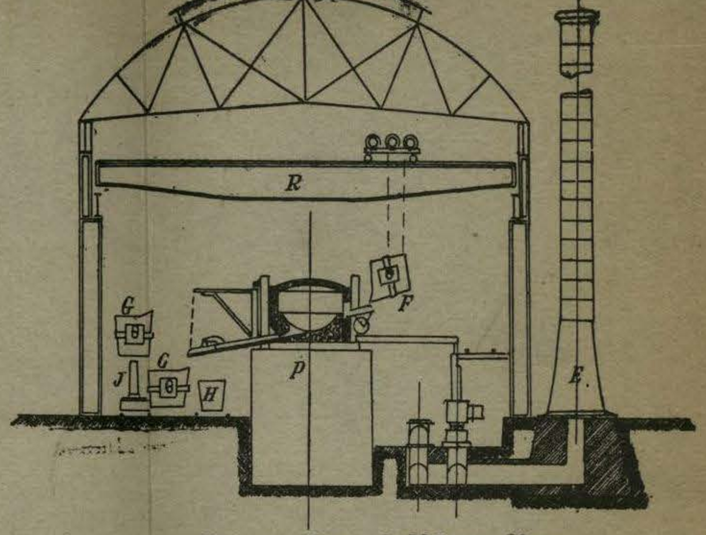
[To face p. 198.

Designed by Mr. John Darby, of Brymbo.



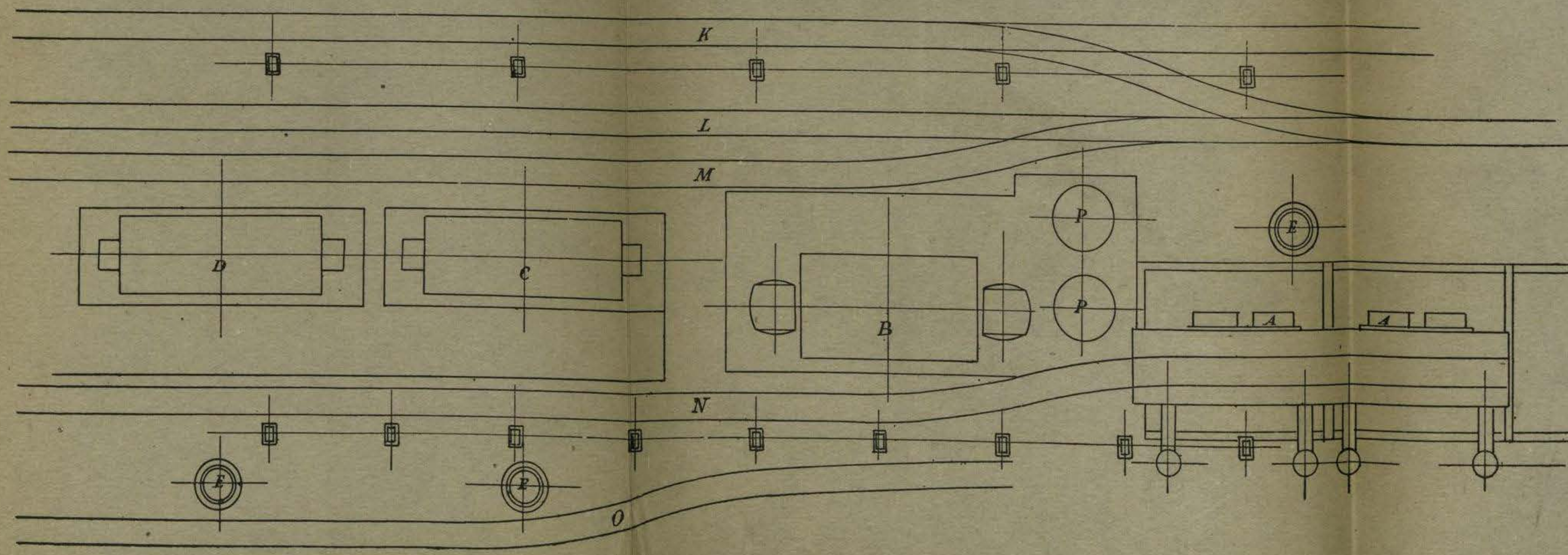
Elevation.

Fig. 165.



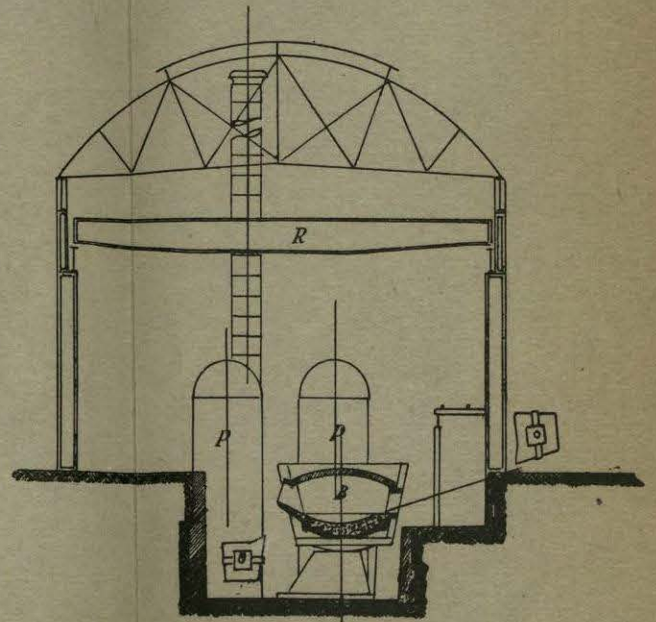
Section through Melting Shop.

Fig. 166.



Plan.

Fig. 168.



Section through Mixer

Fig. 167.

can be converted into finished steel with great rapidity, half the work having been done in the mixer. The mixer really does similar work to the primary furnaces in the Bertrand-Thiel process described below, but the purification, owing to the large quantity of metal present, and rapidity with which it is generally necessary to pass the blast furnace metal through the mixer, cannot be controlled to the same extent.

The most economical method of working the mixer, whether simply to store or partially desiliconise the metal, or whether to completely desiliconise and partially dephosphorise and decarburise, will depend upon the quantity of blast furnace metal which has to be passed through the mixer daily, as well as the composition of the metal, and the method of working will have to be varied to suit the conditions. Given, however, a good basic blast furnace iron low in Silicon and Sulphur, and with not more than 0·7 per cent. of Phosphorus, a very large quantity of metal can be passed through the mixer, and a refined metal obtained which can be finished in the open hearth furnace in about four hours, thus giving a very large output from each furnace. The modern gas-fired mixer is very similar to the large tilting furnaces used for the Talbot process, has gas and air regenerators, and the principal difference is that the hearth is much deeper to allow it to hold a larger quantity of metal.

Bertrand-Thiel Process.—This process consists essentially of the use of two Siemens furnaces in combination, one known as the primary and the other as the secondary furnace. Pig-iron, Oxides, and limestone are charged into the primary furnace, and scrap and limestone in the secondary furnace. The charge in the first furnace is desiliconised, partially dephosphorised, and to some extent decarburised during melting, and after about 4½ hours is transferred to the secondary or finishing furnace, either by means of a runner or a ladle, special care being taken to keep the silicious Phosphoric slag from passing into this furnace with the metal. In this secondary furnace are scrap, limestone, and Oxides heated to a very high temperature, and when the metal is run upon these materials in a heated state, a very vigorous reaction takes place, and the entire charge is converted in about 2¼ hours. In the earlier results published the dephosphorisation and decarburisation took place more or less simultaneously, with the result that Carbon and Phosphorus in the metal when tapped from the primary furnace were present in about equal percentages. From a large number of analyses given by Mr. Bertrand* as representing later results when working pig-iron containing 3·8 per cent. Carbon, 1·6 per cent. Phosphorus, 1·0 per cent. Silicon, and 1·00 per cent. Manganese, it appears that Phosphorus can be largely removed before the Carbon, and the following may be taken as representing the composition of the metal when run from the primary furnace :—

	Carbon.	Phosphorus.	Manganese.	Silicon.
1, . .	2·35	0·300	0·053	0·107
2, . .	2·35	0·432	0·002	0·163
3, . .	1·54	0·430	0·061	0·046
4, . .	2·12	0·589	0·052	0·102
5, . .	2·12	0·204	0·056	0·032

It will be seen that with 2·0 per cent. of Carbon the Phosphorus varies from ·20 to ·60 per cent., and is on an average about ·40 per cent. Metal

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* *Iron and Steel Inst. Journ.*, 1897, vol. i., pp. 122 and 123.

of this composition can be dealt with readily in the finishing furnace. This removal of the Phosphorus before the Carbon is due to working the primary furnace at as low a temperature as possible, and with a highly basic slag. The results obtained with two experimental heats of metal containing 2·5 per cent. Phosphorus and 3·8 per cent. Carbon showed that the metal contained 1·20 per cent. Carbon and 0·55 per cent. Phosphorus when tapped from the primary furnace. It is considered that this percentage of Carbon and Phosphorus is suitable for taking direct to the finishing furnace, although it has been suggested that Carbon may be increased by recarburising on the way. This possibly could be done, but it introduces another operation which is objectionable, and it would probably pay better to work a lower Phosphorus pig-iron rather than attempt to recarburise should this be necessary. The present practice in the Bertrand process is to take fluid metal from the mixer, blast furnace, or cupola to the primary furnace and pour it on to Oxide of Iron and limestone on the hearth of the furnace. When working fluid iron there appears to be no difficulty in dephosphorising before decarburising, and the author is informed by Mr. George Hatton, of the Earl of Dudley's Steel Works, that, working with 2·0 per cent. Phosphorus pig, a metal with 0·10 per cent. Phosphorus and 2 per cent. Carbon can readily be obtained in the primary furnace for transference to the finishing furnace. If this can be done regularly it is a most important point, as nothing is of greater importance in basic Siemens work than the removal of Phosphorus before the Carbon. When a metal with 2·0 per cent. Carbon and 0·10 per cent. Phosphorus is transferred to the finishing furnace, the final steel must of necessity be very low in Phosphorus, as it is equivalent to working a hematite pig-iron, and the author is informed that at Kladno they are regularly producing steel with ·02 per cent. or less of Phosphorus in this way. To ensure this dephosphorisation, combined with rapid work, a very shallow bath of metal, about 6 to 8 inches deep, is necessary, and consequently very large furnaces must be used, far larger than the ordinary basic furnaces for the same weight of metal. The wear and tear on the furnace bottoms will in all probability be very considerable when using metal of the composition obtainable in England, as the fusion of Oxides on the furnace hearth cannot fail to soften it very much, and, when the molten metal is teemed into it, it is practically certain to cut it up. At Kladno they have an exceptionally good pig-iron, low in Silicon, and the bottoms are stated to stand remarkably well. Pig-iron of almost any description can be used in the Bertrand process, but it should be low in Sulphur and Silicon to obtain the best results as regards quality, and to keep repairs to the furnace within reasonable limits. The advantages claimed by the patentees for this process are—(1) High yield, 101 to 103 tons of ingots from 100 tons of metal charged; (2) a rich Phosphoric slag from the primary furnace, containing as much as 25 per cent. of Phosphoric acid; (3) increased speed of working; (4) low cost of plant, taking output into consideration; (5) low labour costs where fluid metal is used as in plant shown in sketch; and (6) superior quality of product.

There is no doubt that the yield is considerably higher than the ordinary Siemens, 101 tons having been obtained in actual working at Kladno. From Phosphoric iron a very rich Phosphoric slag can be obtained, as the great bulk of the Phosphorus present is concentrated in the slag from the primary furnace. So far no plant has been erected with large furnaces capable of holding 50 tons of metal, so that it is difficult to form an estimate as to what will be the speed of working in a large furnace of 50 tons' capacity or more. From the surface area of the Kladno furnace it appears that an ordinary Siemens furnace of 50 tons' capacity will not hold more than 25 tons of metal when working the Bertrand process, so that, although the speed of working is undoubtedly greatly increased, the quantity of metal turned out for the *same number of charges* will be only half that obtained from an ordinary Siemens furnace of same surface area, and hence the 50 per cent. greater output claimed by the patentees would necessitate very rapid working indeed. A great deal of confusion has been caused on this question of output, by speaking of a 50-ton furnace as a furnace which will hold 50 tons of metal, as what may be a 50-ton furnace, working the Bertrand, would be large enough to hold 80 to 100 tons under ordinary conditions of Siemens work, and consequently one may be comparing the output of furnaces of totally different capacity. This question of size of furnace within reasonable working limits is, however, only a matter of first cost. It is impossible to form a fair estimate as to the cost of plant and labour per ton of steel until the process is actually in operation upon a large scale, with a modern plant especially designed to insure large output; the plant at Earl Dudley's Steel Works has been partially altered to work this process, and several furnaces have been working for some years apparently with satisfactory results.

As regards the quality, there can be no question that both in respect to freedom from Phosphorus and other impurities, and as regards mechanical properties, steel of the best description can be produced by this process.

Figs. 165 to 168 represent a plant designed by Mr. John Henry Darby, of Brymbo, for working the process on a large scale, which he has kindly allowed the author to reproduce.

What is to all intents and purposes metallurgically the Bertrand-Thiel process is at work in the Hoesch Works in Germany. There are six 30-ton furnaces supplied with molten metal from a mixer; considerable quantities of Oxides and lime are charged on the furnace bottom, and then the molten metal is charged, the temperature being kept as low as possible to insure dephosphorisation before decarburisation. When largely dephosphorised the refined metal is tapped into a ladle, the Phosphoric slag separated, and the refined metal returned to the same furnace to be decarburised and converted into finished steel. The process is thus worked in two stages identical with those of Bertrand-Thiel, and the only modification is that both stages are carried on in one furnace instead of two.

Another modification of this process, which does away with the necessity of emptying the furnace to separate the metal from the slag, has lately been introduced at the Union Works near Dusseldorf. The dephosphorisation and partial decarburisation is carried out in a tilting furnace exactly the same as in the Hoesch process, and then, instead of tapping the metal into a ladle to separate the slag, the furnace is tilted and as much slag as possible poured off on the charging side. An iron blast pipe is then pushed through the tap hole, and a blast of air at a moderate pressure impinged upon the surface of the bath, which causes it to boil, and the greater portion of the remaining slag is blown off. A new slag is then made, and in about two hours' time this slag is removed in the same way, when a final or finishing slag is made. This final slag contains very little Phosphorus, and when tapping the finished steel as much of it as possible is retained in the furnace to form the first slag for a new charge. The author recently saw this process in operation, and four heats were being made in twenty-four hours from mixer iron containing about 1·0 per cent. of Silicon, 1·8 per cent. of Phosphorus, and 1·0 per cent. of Manganese.

If this simple device for removing the slag proves satisfactory, it will probably be largely adopted in basic open hearth works where they have tilting furnaces, as the possibilities of largely increasing the output are very considerable.

The Talbot Continuous Process.—Practically all the modifications that have been introduced to increase the output and improve the yield of the basic open hearth process have depended upon the use of fluid metal, with large additions of Oxides, and the difficulty has always been to prevent the destruction of the hearth by the combined chemical action of the Oxides and the mechanical abrasion of the fluid metal when poured into the furnace.

This problem of the treatment of fluid pig-iron of more or less irregular composition, as regards Silicon or Phosphorus, has been most effectively attacked by Mr. Benjamin Talbot, formerly of Pencoyd, in what is known as the continuous open hearth process. In this process a basic-lined tilting furnace is used, especially designed so that any quantity of slag and metal can be poured off at any time during the working of the charge, and also that large or small additions of oxidising agents, limestone, or metal can be added. The process of working is as follows:—

On Saturday, after completely or partially emptying the furnace, gas is taken off for a short time, whilst the gas tubes are cleaned. This now only takes an hour or two, when gas is again put on, and the furnace slowly filled up during Saturday night and Sunday with molten pig-iron from the blast furnace, or partly from blast furnace and mixer. On Sunday evening when the ordinary shift comes out the furnace is usually practically ready for tapping. Assuming the furnace to be just tapped, it is turned back and a pan of slag taken off, and any necessary repairs made round the slag line on the far bank. Lime, scale, or iron ore is then added in the requisite quantity, the front banks and jambs round the doors are then fettled, and the molten pig-iron from the blast furnace, or preferably the mixer, poured in. This is usually brought up in two ladles of, say, 25 tons each, assuming the amount tapped to be 50 tons, which is the usual amount cast. As a rule, very little reaction occurs, as it is found best to avoid anything approaching a violent reaction, so that all the pig-iron can be added at once, and less time appears to be lost in charging the metal and preparing the slag. The charge soon picks up heat, and comes on the boil, reacting with the oxide, and lime is rapidly absorbed by the slag. The slag gradually thickens, but rarely foams up unless the Silicon is high in the pig-iron charged. It is "opened out" with a small quantity of scale or iron ore, and soon boils clear, within about an hour or an hour and a-half of charging the molten metal. The boil continues without further additions for two or three hours, until the Carbon is boiled down to about 0·25 per cent. A pan of slag is then drawn off, and a further amount of scale and lime added, in order to make the finishing slag and to work the charge down to the requisite Carbon. A little pig-iron is often added to pig back and get an ingot free from any tendency to pipe. When the pig-iron contains sufficient Phosphorus, the basic slag is sold as a manure. The old trouble in working basic charges, of having Phosphorus left in the bath when the Carbon has all gone is practically unknown, provided the Phosphorus does not exceed 1·75 per cent., as under the above conditions Phosphorus is largely eliminated before the Carbon.

By the device of keeping the furnace hearth always two-thirds full of molten metal, the fluxing action of the slag on the basic lining is confined to a few inches above the bath of metal on which it floats, as it never comes near the bottom of the furnace, except when the furnace is being emptied at the end of the week. Thus, a slag which, in the ordinary method of working the Siemens process, would almost destroy the bottom of a basic furnace, has no appreciably destructive effect on the lining when the furnace hearth is protected by a bath of molten metal. When working the furnace very hot, as with low Phosphorous irons, the reaction between the Carbon and Oxides is so vigorous that the combustion of the **CO** given off is sufficient to maintain the heat of the furnace during the reaction when all the gas is shut off from the producer, although in practice it is not usual to work the furnaces so hot as this. When working at a lower temperature to dephosphorise before decarburising, this reaction is slower, and the sudden generation of **CO** filling the entire furnace with flame does not take place to the same extent. The rapidity of working depends upon the temperature, the composition of the pig-metal introduced, and the percentages of metal removed and charged each time; the purer and hotter the molten-pig metal and the smaller the charges, the more rapid the purification. Thus, when charges equal to one-third of the total capacity of the furnace, with 1·0 per cent. of Phosphorus and ·5 per Silicon are worked, each heat is finished in from four and a half to five hours, and about four heats are made in the twenty-four hours, whereas when working charges equal to one-tenth the total charge the purification is effected in about one hour, The usual practice, however, is to work with a charge equal to about one-third of the total capacity of the furnace.

To obtain the very best results, experience has shown that, as in the case of the basic open hearth furnace using molten metal, the blast furnace metal should be first passed through an active gas-fired mixer, where it is largely desiliconised and desulphurised, and a hot metal, regular in composition and low in Silicon, produced.

The time required for working charges will vary with the composition of the pig-iron, the size of the furnace, etc. With Cleveland iron in a 175-ton furnace the time from tap to tap will be from 5½ to 6 hours, and the output per week will be from 1,100 to 1,300 tons, with a yield of 103 to 104 tons for each 100 tons of pig-iron charged; the same size of furnace working with hematite pig-iron direct from the blast furnace will produce 1,200 to 1,400 tons of ingots per week, with a yield of 105 to 106 tons of ingots per 100 tons of pig-iron charged. With desiliconised mixer metal the output with hematite iron would probably be considerably increased, although the yield might be reduced. The rapid elimination of impurities is due to two causes—(1) Rapid oxidation by the molten metal being poured through a layer of molten fluid basic slag rich in oxides of iron, by which means slag and metal are brought into very intimate contact, thus insuring the essential and best conditions for rapid chemical action. (2) Dilution by mixture of the partially purified mixer metal with three or four times its weight of finished steel.

The rapidity of working will largely depend upon the percentage of Silicon and Phosphorus in the metal, and, other things being equal, the lower the Silicon the more rapid the work. The condition of the Carbon in the molten metal also seems to have a most important influence on rapidity of working, as metal, in which graphitic Carbon readily separates in the ladle, works much more slowly than metal in which it remains combined with the iron.

An important point in the Talbot process, from a practical point of view, is the readiness with which a regular supply of ingots can be supplied to the mills at frequent intervals, and in any required quantity, the ingots being taken direct from the casting pit to mill furnaces. It frequently happens in ordinary Siemens practice in large works, where a number of furnaces are working, that three or four will be ready to tap at or about the same time, with the result that far more ingots are produced than the mill furnaces can deal with at once, and consequently a number have to be allowed to cool down, and be re-heated at extra cost, or, on the other hand, mills may have to wait for the Siemens furnace. This can be, to a great extent, obviated in working on the Talbot system, as the time of tapping of the metal can be better controlled to suit the requirements of the mills.

Furnaces up to 250 tons are now working in America and England, but it remans to be seen if this is a more economical unit than the 175 or 200-ton furnace when against increased output is set the extra capital expenditure, cost of repairs, etc. The 250-ton furnace working in England has been in operation for a few months only, and the time is too short to form an opinion as to its advantages or disadvantages compared with the somewhat smaller furnaces.

This process has made considerable progress during the last few years, some 11 or 12 furnaces now being in regular work in England at five or six different works, while in America Messrs. Jones & Laughlins have had nine 200 to 250-ton furnaces in operation for the last three or four years, and are putting down at their new works at Aliquippa furnaces of 275 to 300 tons capacity. At Witkowitz, in Austria, four large furnaces are now in course of erection. The total output in Europe and America for the last year was approximately 1,000,000 tons, and when the furnaces now under construction in America are in operation, this will be largely increased.

In the design of the furnaces themselves considerable improvements have been made since the original furnace was started at Frodingham. In the United States central rotation of the furnace, as distinct from the rolling-forward movement, has been commonly in use. This method of rotation has now been successfully employed at the Skinningrove Works, where the latest furnace has been put up. The advantage of this is that the gas can be kept on the furnace during the whole time of tapping, whereas in those furnaces which roll forward on the Wellman system, gas has to be taken off the furnace during tapping.

Another improvement which has added very largely to the length of time these furnaces can run without being put off for repairs, is the complete separation of the block from the tilting portion of the furnace, which was always a source of weakness, owing to excessive wear. The gas and air are now brought up in flues in the movable port end, and given the necessary direction in this part of the furnace. The air enters over the gas in one opening. The arch between the gas and air is protected by three or four iron water-cooled pipes, through which water constantly circulates. These tubes are practically exposed to the direct flame, and, so long as the water flows rapidly through them, there is little tendency for them to burn. On the movable port end a water-cooled chill encircles the air and gas ports, a similar chill is on the tilting section, but this has one central opening only, and thus the old form of block in the furnace is completely done away with. This furnace is shown in fig. 169, Plate xiia, and should be compared with the ordinary Wellman furnace described on page 149 (fig. 133), and also figs. 170, 171, and 175 (Plates xiii. and xiv.). Figs. 174 and 175 (Plate xiv.)

ATE X

[To face p. 202.

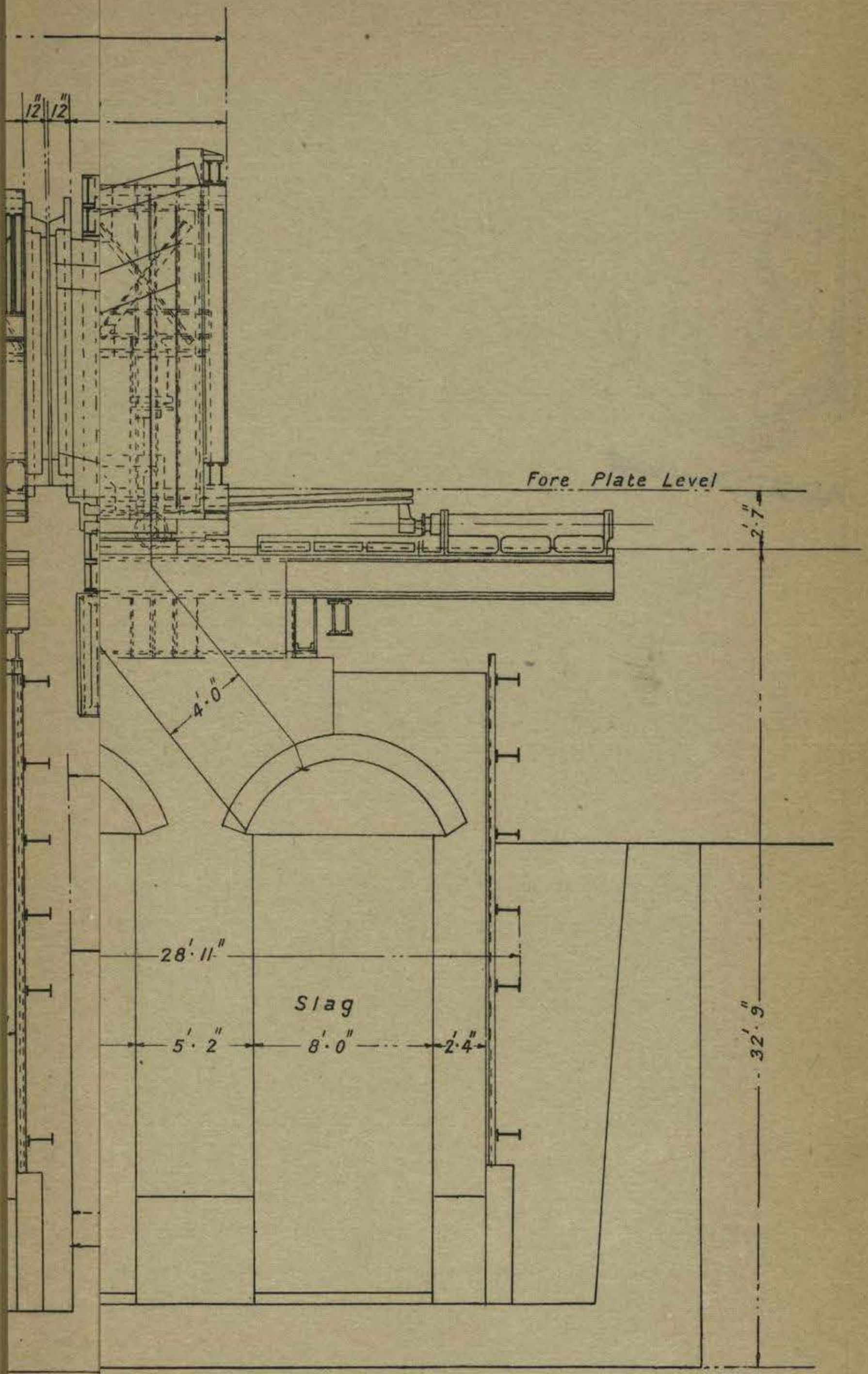


PLATE XIIA.—250-Ton Talbot Furnace.

This furnace is very similar to the ordinary Wellman type,
principal difference being in a greater depth in the body and
details of the construction of the "block," which is quite
arate from the tilting section and can be run back from furnace
d rapidly cooled for repairs. In the tilting section there is only
e opening at each end, the separate gas and air passages being
tirely in the movable port ends. Before tilting the "block" is
ved a few inches from the furnace by the hydraulic cylinder
own; there is no water seal over the passages from the regenera-
s to the ports, and the joint between the port and the furnace is
de by water-cooled chills.

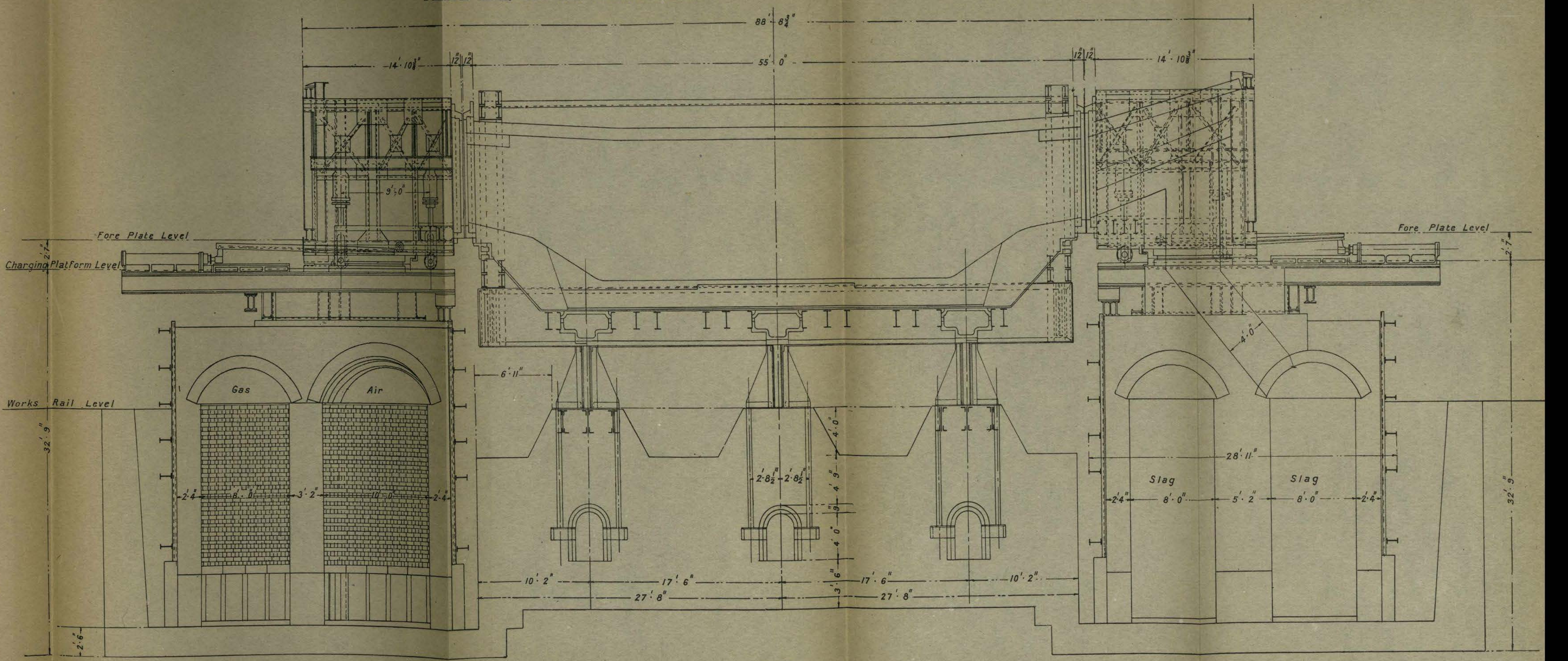


Fig. 169.

or Talbot Process.

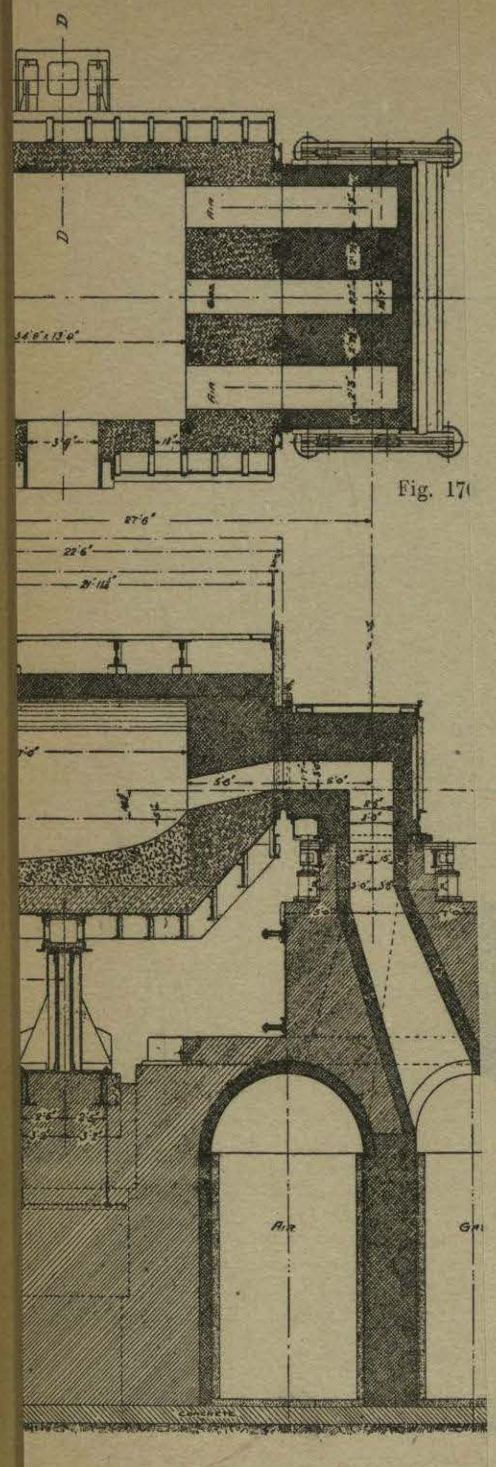


Fig. 17

This furnace is very similar to the ordinary Wellman type, the principal difference being in a greater depth in the body of the furnace, and in details of the construction of the port, which is designed so it can be run back from the furnace to enable a man to get between it and the furnace for repairs. The port is moved a few inches from the furnace, before pouring, by a hydraulic cylinder to allow the furnace to tilt freely, but there is no water seal over the passages from the regenerators to the ports, the joint being made by hollow steel water-cooled chills. A slag hole is provided at the charging side, so that slag can be poured off from either side of the furnace. The joint between the port and the furnace is made by water-cooled chills.

PLATE XIII.—Tilting Furnace, adapted for Talbot Process.

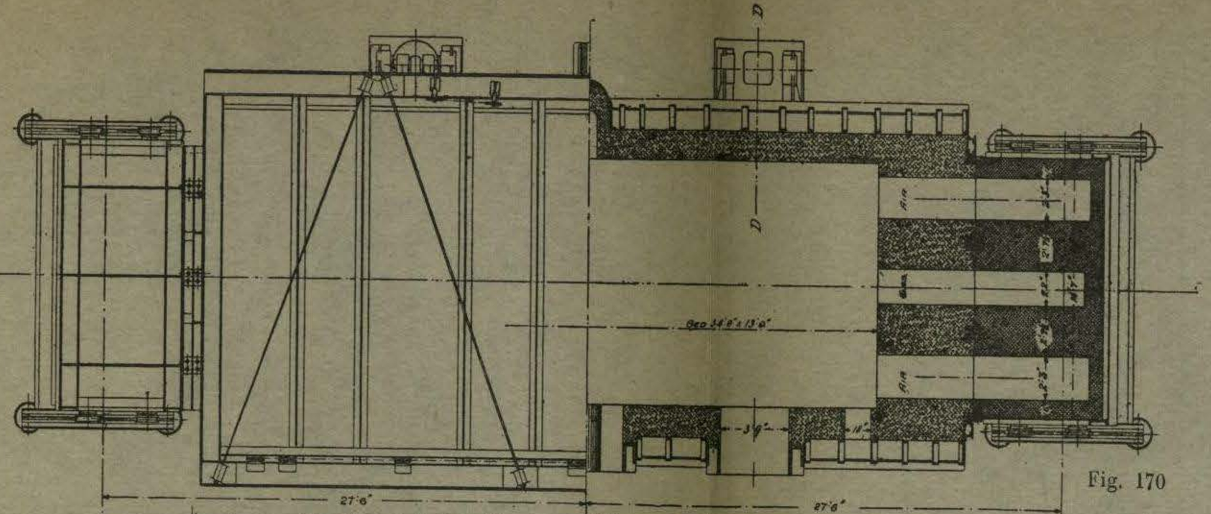


Fig. 170

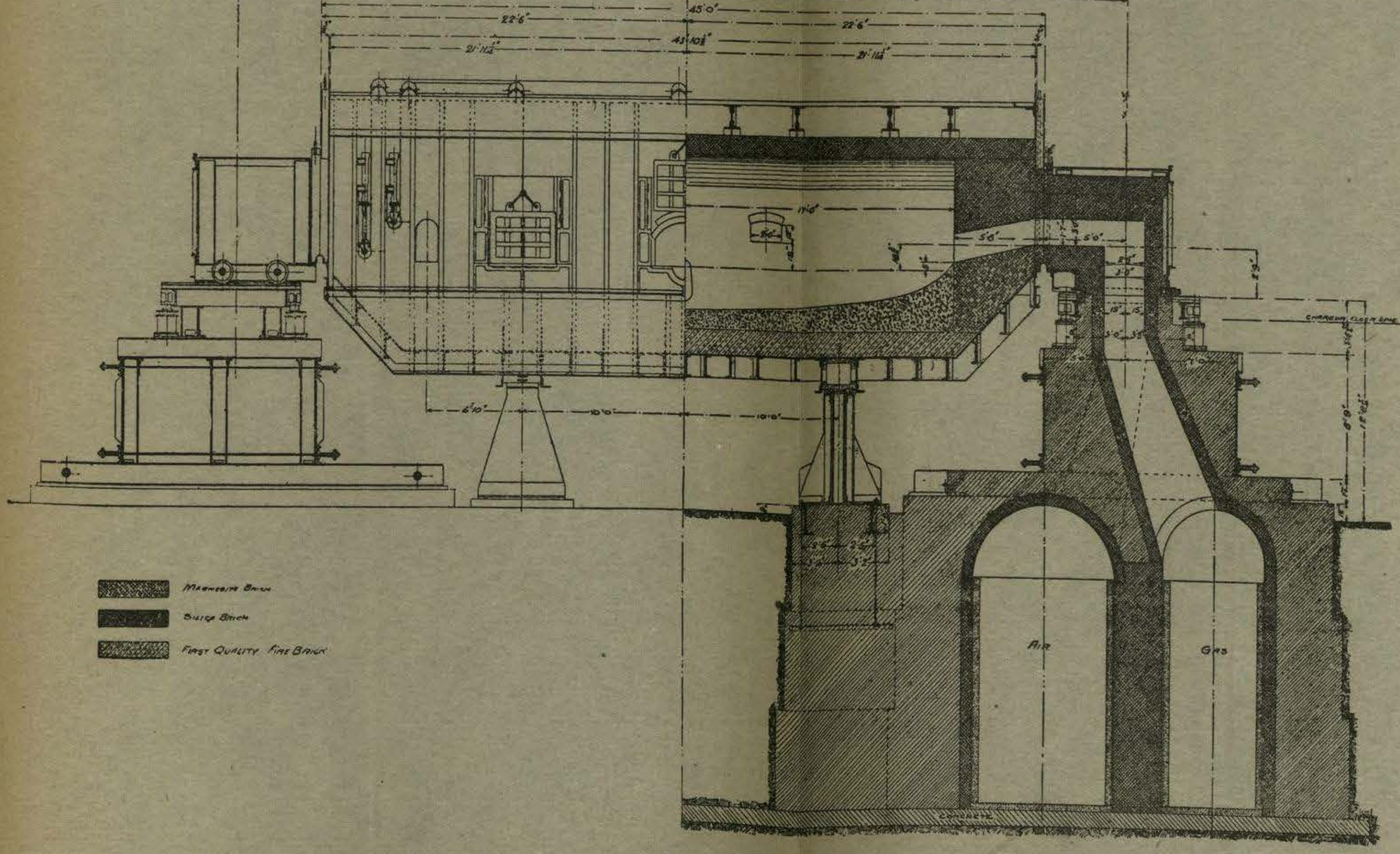
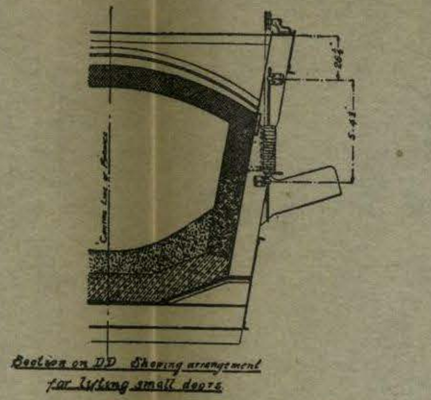


Fig. 171.



Section on DD Showing arrangement for lifting small doors

Fig. 172.

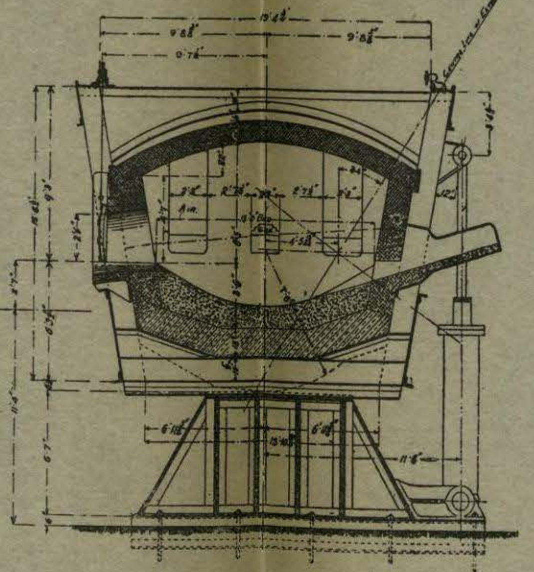


Fig. 173.

PLATE XIV.—Talbot 200-Ton Plant.

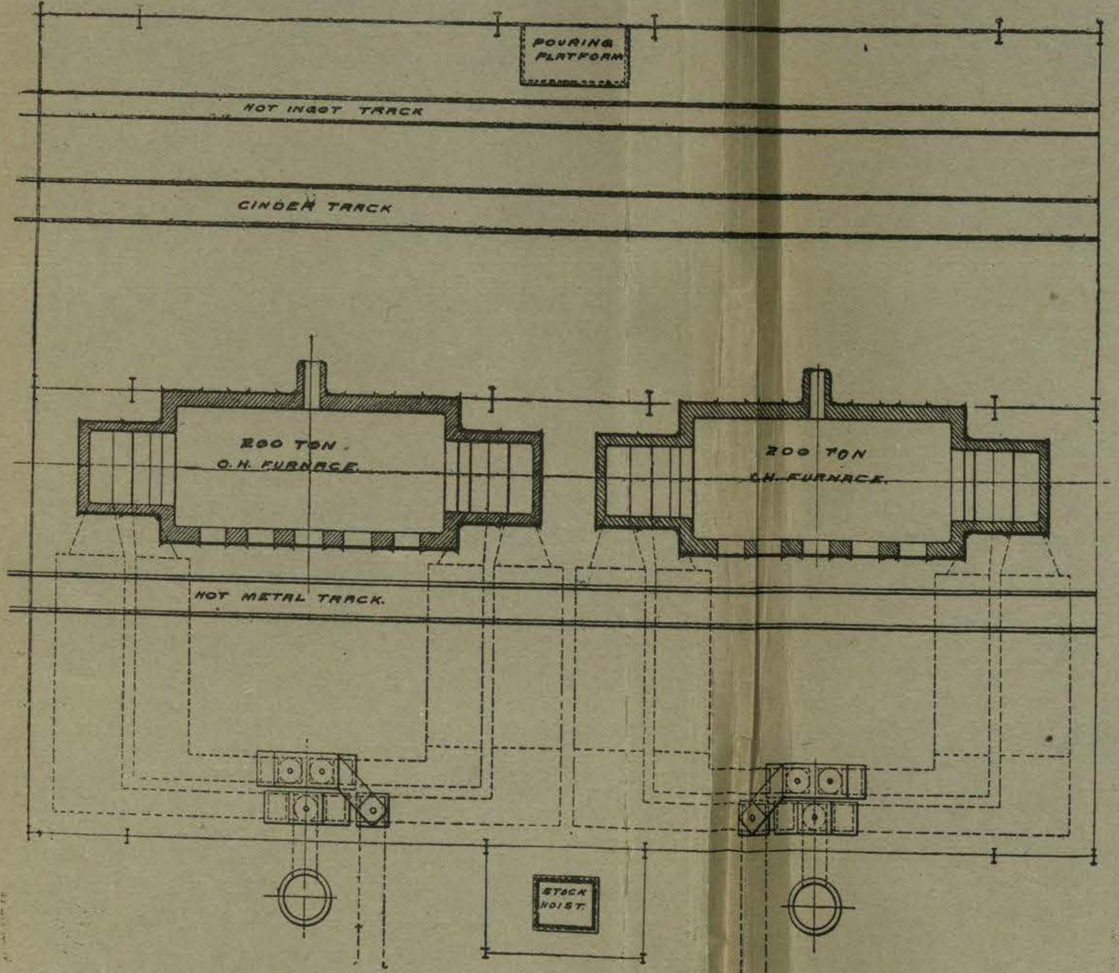
Showing method of filling the furnace and pouring and teeming the finished steel into ingot moulds on cars.

A, Ladle ready to receive finished steel.

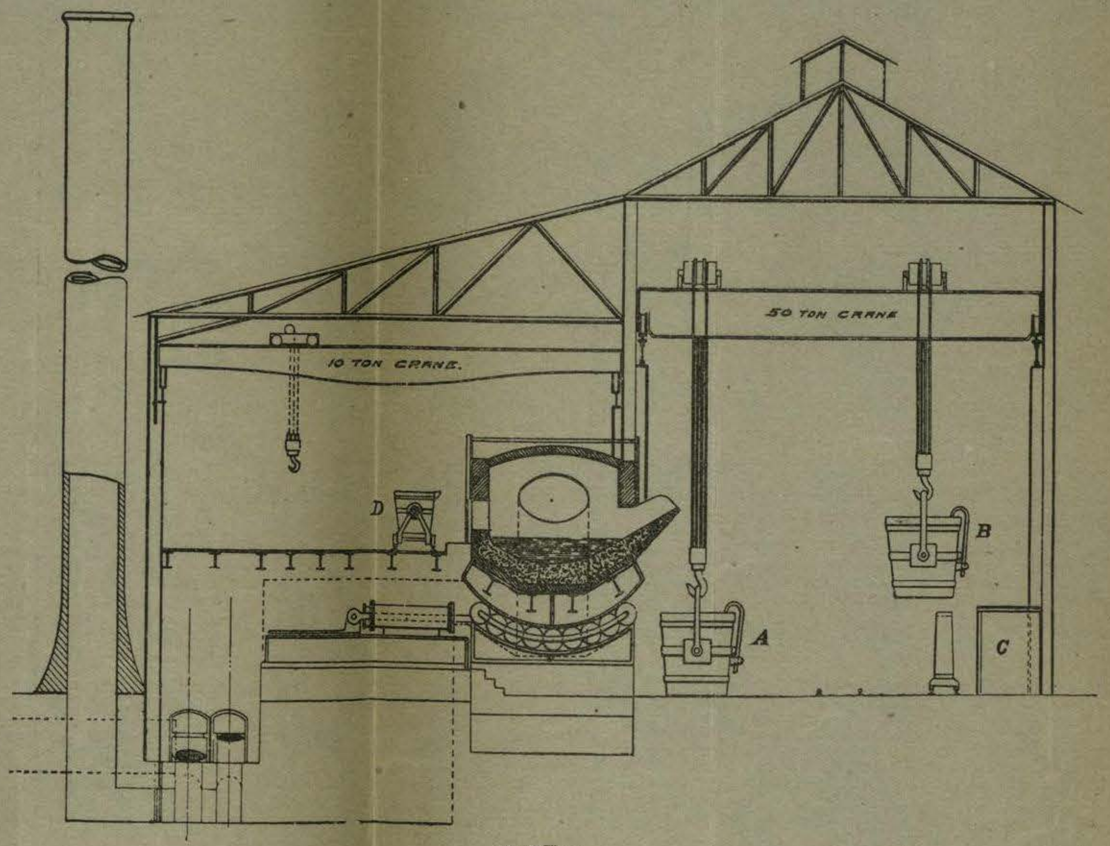
B, Ladle ready for teeming the ingots.

C, Tapping or pouring platform.

D, Hot metal ladle ready to pour metal into furnace.



Plan.
Fig. 174.



End View.
Fig. 175.