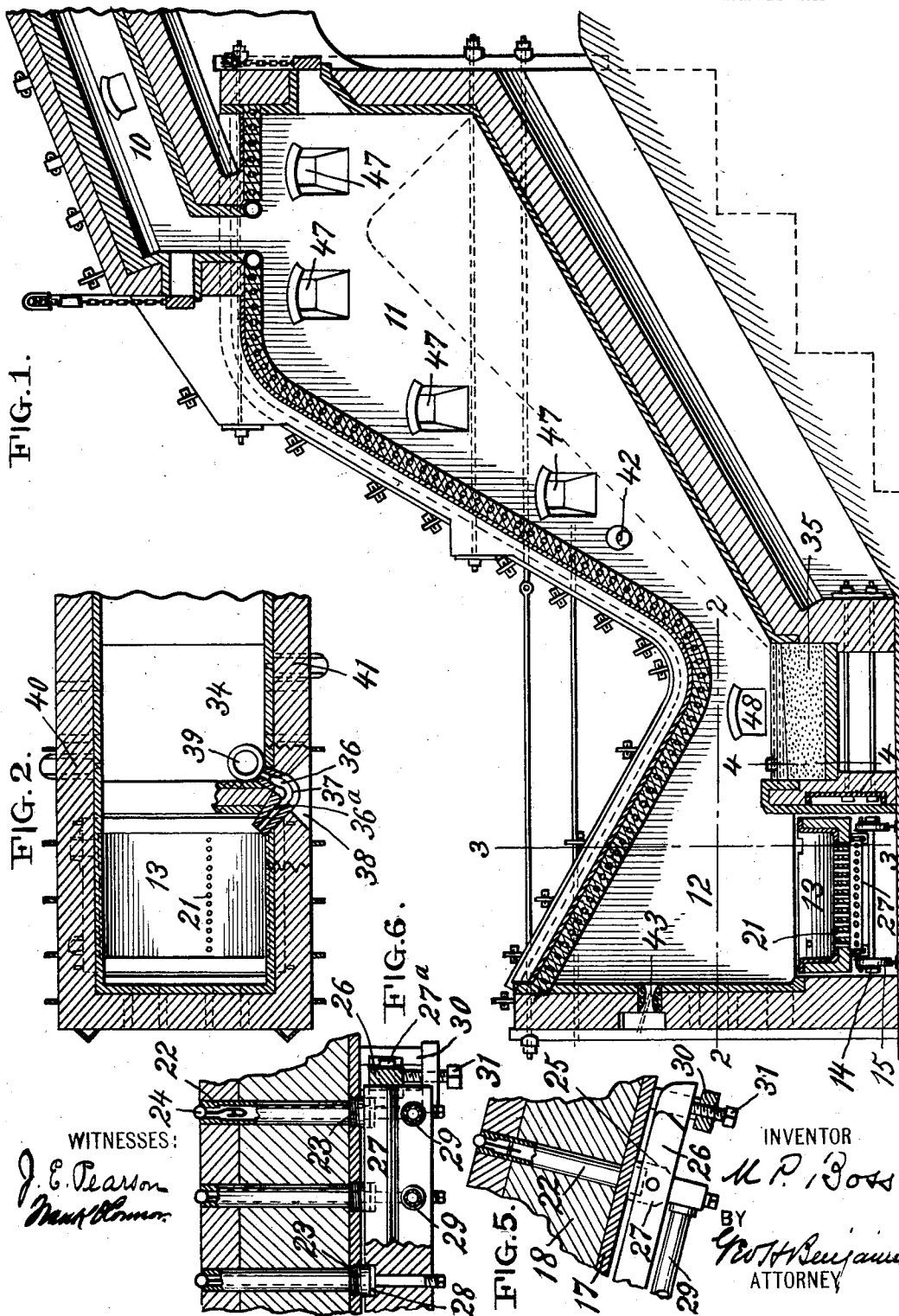


M. P. BOSS.
METALLURGICAL FURNACE.
APPLICATION FILED JUNE 11, 1902.

NO MODEL.

2 SHEETS—SHEET 1.



WITNESSES:

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2 SHEETS—SHEET 2.

FIG. 3.

FIG. 7.

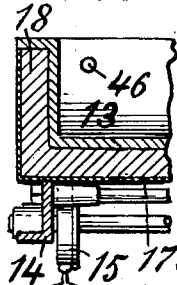


FIG. 8.

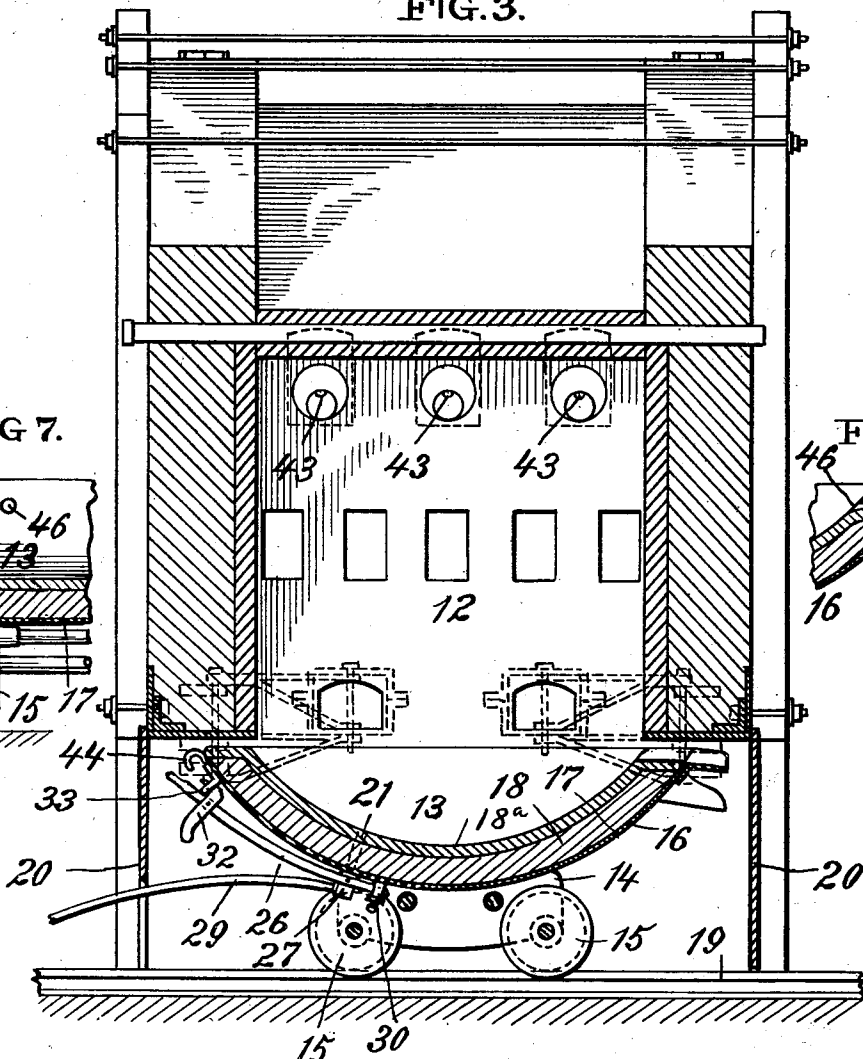
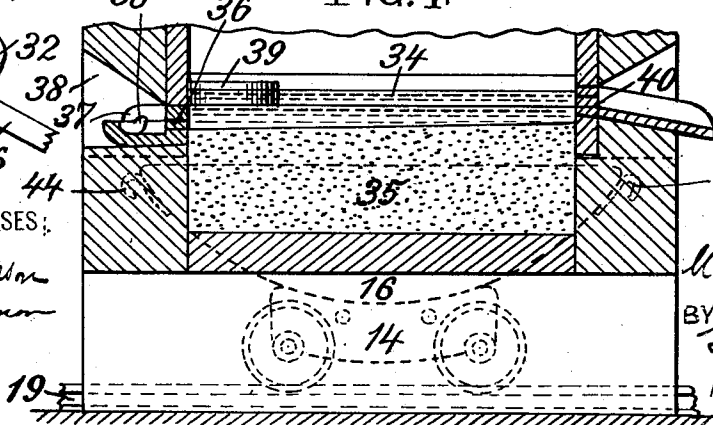


FIG. 9.



FIG. 4.



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UNITED STATES PATENT OFFICE.

MARTIN PRIOR BOSS, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO THE HYDRO-CARBON SMELTING COMPANY, A CORPORATION OF WEST VIRGINIA.

METALLURGICAL FURNACE.

SPECIFICATION forming part of Letters Patent No. 732,268, dated June 30, 1903.

Application filed June 11, 1902. Serial No. 111,169. (No model.)

To all whom it may concern:

Be it known that I, MARTIN PRIOR BOSS, a citizen of the United States, residing at San Francisco, county of San Francisco, State of California, have invented certain new and useful Improvements in Metallurgical Furnaces, of which the following is a specification.

My invention relates to a furnace adapted to permit within a single structure the carrying into effect of all the metallurgical operations necessary to extract the metal from its ore and convert it into pig metal.

In a previous application I have generally described the main features of construction of a metallurgical furnace such as I prefer to use.

My present invention relates to a modification of such furnace; and it consists, broadly speaking, in substituting for the fixed hearth or bed of the oxidizing-chamber a removable hearth or bed.

It further consists in the various constructional changes necessary to permit the employment of such removable hearth or bed.

The object of my invention is twofold: first, to facilitate the handling of the metal produced upon the hearth or bed of the oxidizing-chamber; second, to permit the ready repair or renewal of the lining of the removable hearth or bed. Various other advantages are obtained incidental to the construction.

The accompanying drawings will serve to illustrate my invention, and in which similar numerals indicate like parts.

Figure 1 is a vertical section. Fig. 2 is a horizontal section on the line 2 2 of Fig. 1. Fig. 3 is a vertical section on the line 3 3 of Fig. 1. Fig. 4 is a vertical section on the line 4 4 of Fig. 1. Fig. 5 is a longitudinal section through a portion of the removable hearth, showing one of the air-twyers, partially in elevation and partially in section, and a side elevation of the device for connecting the air-supply to the twyers. Fig. 6 is a transverse section through a portion of the removable hearth, also showing, in elevation, the air-twyers, and a front view and partial section of the device for feeding air to the twyers. Fig. 7 is a detail of one corner of a removable hearth, showing its shape and the position of

the pouring-hole for the metal. Fig. 8 is a detail of the pouring-lip of the removable hearth. Fig. 9 is a detail of the forward end of the side frames of the air-supply device.

In the drawings the furnace is shown as provided with three chambers—*i. e.*, 10, the calcining-chamber, where the ore is roasted or calcined; 11, the reducing-chamber, where the metal under treatment is partially separated from the materials with which it is combined; 12, the oxidizing-chamber, where the metal is finally separated from the material with which it is combined. The chambers 10 and 11 are provided with inclined hearths, while the chamber 12 is provided with a removable hearth 13.

The removable hearth 13 consists of the supporting portion 14, mounted on wheels 15, and the independent hearth portion 16. The hearth portion is formed of a metal casing 17, lined with a bed 18, of brick, sand, or other suitable material. I may form the bed entirely of refractory material and provide it with a glazed surface, such as is common in reverberatory furnaces, or line it with refractory material, such as is commonly employed with air-converters of the Bessemer type, or I may form the bed of a layer of refractory material 18, such as sand, and superpose upon this layer a layer 18^a of a mixture of refractory material and a material such as lime or lime and iron, or other materials which will combine with the copper slags. In shape the cavity of the hearth forms an arc of a circle in its long diameter and is rectangular in its transverse central diameter. This shape I find to be convenient in practice, as it facilitates the flow of metal from the hearth when it is tilted. I do not in any wise limit myself to the shape of the removable hearth, its construction, or lining, as very many changes may be made without departing from the intent of my invention. The removable hearth as a whole is mounted upon the tracks 19, arranged transversely of the furnace, and the sides of the furnace have formed in it the openings or doors 20, through which the removable hearth may be introduced into the oxidizing-chamber and removed from the oxidizing-chamber. Manifestly instead of having the rails 19 arranged transversely of the

furnace they may be arranged longitudinally of the furnace and a door or opening 20 provided in the front of the furnace.

Arranged transversely of the bed of the removable hearth are the air-twyers 21, which may be of any suitable construction. As shown in the drawings, they consist of tubular bodies 22, secured to the metal casing through suitable threaded couplings 23, the heads of which project below the bottom of the casing. In the upper end of the air-twyers I have shown ball-valves 24. These valves, however, are not essential and may be omitted. Instead of arranging the air-twyers transversely of the bed of the removable hearth I may arrange them longitudinally of the bed or give them any location relative to the bed which may be desired. I prefer, however, to arrange them transversely, as by so doing the metal which flows onto the bed from the reducing-chamber will necessarily pass across the row of air-twyers and thereby brought into the best position to be subjected to the action of the air-blasts passing through the twyers. In order to supply the twyers with air, I provide the removable coupling 25, Figs. 3, 5, and 6. This coupling consists of a pair of side frames 26, (only one shown,) carrying a transverse hollow casting 27, pivoted to the side frames at 27^a. The upper end of this casting is provided with a series of recesses 28, having such position and size as to receive the heads of the couplings 23 of the twyers 21. Connected to the lower part of the casting is an air-tube 29, connected to any suitable source of air-supply. Depending from the bottom of the casing 17 of the removable hearth are the open brackets 30, (but one shown,) in the bottom of which are the adjustable screws 31. These brackets are adapted to receive the forward end of the frames 26. Pivoted in the outer ends of the side frames 26 are the hooks 32, the forward ends of which are adapted to engage with the eye 33, projecting below the casing 17. To adjust the removable air-supply device in position, the ends of the frames 26 are forced into the brackets 30 over the screws 31. This will permit the heads of the couplings 23 of the twyers 21 to enter into the recesses 28 of the casting 27. If now the outer ends of the side frames 26 are raised and the hooks 32 engaged with the eyes 33, the removable air device will be held in position. By adjusting the screws 31 close contact may be insured between the casting 27 and the couplings 23. Any suitable packing device may of course be inserted in the cavities 28 of the casting 27.

I do not limit myself in any wise to the employment of a removable air-feeding device of the character indicated, as other means may be employed for feeding the removable hearth at the twyers with the required air-currents.

Located between the removable hearth 13 and the reducing-chamber 11 is a tank 34, into which the partially-oxidized metal from the

reducing-chamber 11 flows. This tank is provided with a bed 35, which may be formed of refractory material—such as sand, sand and clay, fire-brick, or any of the materials commonly employed for lining Bessemer converters, or of a mixture of a refractory material and a material which will combine with the metal or its accompanying impurities under treatment—such, for instance, as sand, clay, pig metal, including copper and iron, copper-matte, and dolomite, or other corresponding substance commonly employed in basic linings. I wish it understood that I do not limit myself in any wise to the materials which may be employed to form the bed or lining of the removable hearth or receiving-tank. Communicating between this tank and the cavity of the removable hearth is a passage-way 36, provided with a spout 36^a, adapted to discharge on the bed of the removable hearth. This passage-way is bent at an angle and has formed in it an opening 37, which opening is located in a cavity 38 in the side wall of the furnace. The object of this arrangement is to permit inspection of the channel through the opening 37, the introduction of the cleaning-rod, and a clay stop to close the passage-way when the removable hearth is withdrawn from the furnace. The outer side of this opening is adapted under ordinary conditions to be closed by a block of clay or other similar material.

Situated in front of the opening of the passage-way 36, where it communicates with the tank 34, is a floating ring 39. This ring serves as a slag-dam to prevent the slag which accumulates in the tank 34 from flowing onto the removable hearth 13. Situated in the sides of the tank 34 are the openings 40 41, which may be used to draw off either the slag on the top of the molten metal or the metal itself.

42 43 represent burners for gas or gas and air, located, respectively, in the reduction and oxidizing chambers. In the drawings two of such burners are shown in the reducing-chamber and three in the oxidizing-chamber. Any number or arrangement of burners may be used.

Connected to opposite ends of the removable hearth 13 are the hooks 44, by which the hearth may, when removed from the furnace, be lifted off the support 14.

Projecting from one end of the removable hearth 13 is a spout 45, communicating with the cavity of the hearth through a passage-way 46. This may be used to pour the molten metal from the hearth by tilting the hearth toward the spout.

47 indicates doors in the reduction-chamber and 48 a door over the tank 34, through which the metal in this tank may be poled if desired.

The operation of my improved device is as follows: The ore is calcined in the chamber 10, from which it is gradually fed into the reducing-chamber 11. Here the ore is reduced

by means of the heat due to the decomposition of the sulfur in the ore, as well as that derived from the burners 42 43, and air admitted through the doors 47 in the reduction-chamber. When the metal reaches the oxidizing-chamber and is discharged upon the removable hearth 13, it is subjected to the action of the air passing through the twyers 21, as also to the fluxing action of the bed of the hearth, if a fluxing-bed is employed. After the metal under treatment has been thoroughly oxidized and fluxed to remove impurities, the hearth as a whole is drawn out of the oxidizing-chamber, the bed 13 lifted off of the support 14, and carried by a crane to the casting-pits. A fresh bed is then put on the support 14 and pushed into the furnace. The air-supply device is preferably adjusted before the hearth is returned to the furnace.

It will be observed from the construction described that by reason of the employment of the removable hearth and air-supply thereto I am able to do away with the employment of a separate and independent air-converting apparatus, and, further, owing to the general shape of the hearth and its support, a fresh hearth may be substituted at any time for a worn or scorched hearth; further, that the hearths may be readily and cheaply relined as often as is required. A further advantage is found in the fact that a number of hearths may be kept on hand provided with different linings—for instance, a certain number of hearths with an ordinary non-fusible lining and other hearths with a lining containing a substance adapted to coact with the metal under treatment, &c.

Having thus described my invention, I claim—

1. In a metallurgical furnace, the combination in a furnace structure, of chambers provided with means for calcining, reducing and oxidizing the metal under treatment, a removable hearth in the oxidizing-chamber, and means for supplying said hearth with air-currents.

2. In a metallurgical furnace, the combination of a calcining-chamber and a reducing-chamber having inclined hearths and provided with heating means, a tank into which the metal from the reducing-chamber is conveyed, an oxidizing-chamber provided with means for heating, a removable hearth in said oxidizing-chamber, and means for conveying the metal from said tank onto said hearth.

3. In a metallurgical furnace, the combination of a calcining-chamber, a reducing-chamber, and an oxidizing-chamber, said chambers provided with heating means; a tank interposed between the oxidizing and the reducing chambers, a removable hearth in the oxidizing-chamber, the bed of said hearth occupying a lower horizontal plane than the beds of said calcining or reducing chambers and tank.

4. In a metallurgical furnace, the combination of a receiving-tank, a removable hearth, a passage-way for the metal between said tank and hearth, said passage-way provided with an opening connected to the exterior of the furnace, whereby access may be obtained to the interior of the passage-way.

5. In a metallurgical furnace the combination of a receiving-tank, a removable hearth, a passage-way between the tank and the hearth, and a floating slag-ring in the tank.

6. In a metallurgical furnace, a removable hearth provided with air-twyers, and a removable device for feeding air to said twyers; said device consisting of a pair of side frames, a transverse pivoted casting having recesses adapted to receive the end of the twyers, and means for connecting said side frames to said hearth.

7. In a metallurgical furnace, the combination of a removable hearth, a series of air-twyers provided with couplings which project below the bottom of the hearth, a device for conveying air to the twyers, said device consisting of a pair of side frames, a transverse casting having recesses in its top adapted to receive the heads of the couplings on the bottom of the twyers; means for supporting and securing said side frames to the bottom of the hearth, and means for supplying air to said twyers.

8. In a metallurgical furnace, an oxidizing-chamber having its hearth formed in two portions, one portion fixed and the other movable, a body of material located upon the fixed portion of the hearth which will coact with the material under treatment, means for introducing an air-blast into the metal on the movable portion of the hearth, and means for creating an oxidizing atmosphere in said chamber over said hearths.

In testimony whereof I affix my signature in the presence of two witnesses.

MARTIN PRIOR BOSS.

Witnesses:

J. E. PEARSON,
FRANK O'CONNOR.