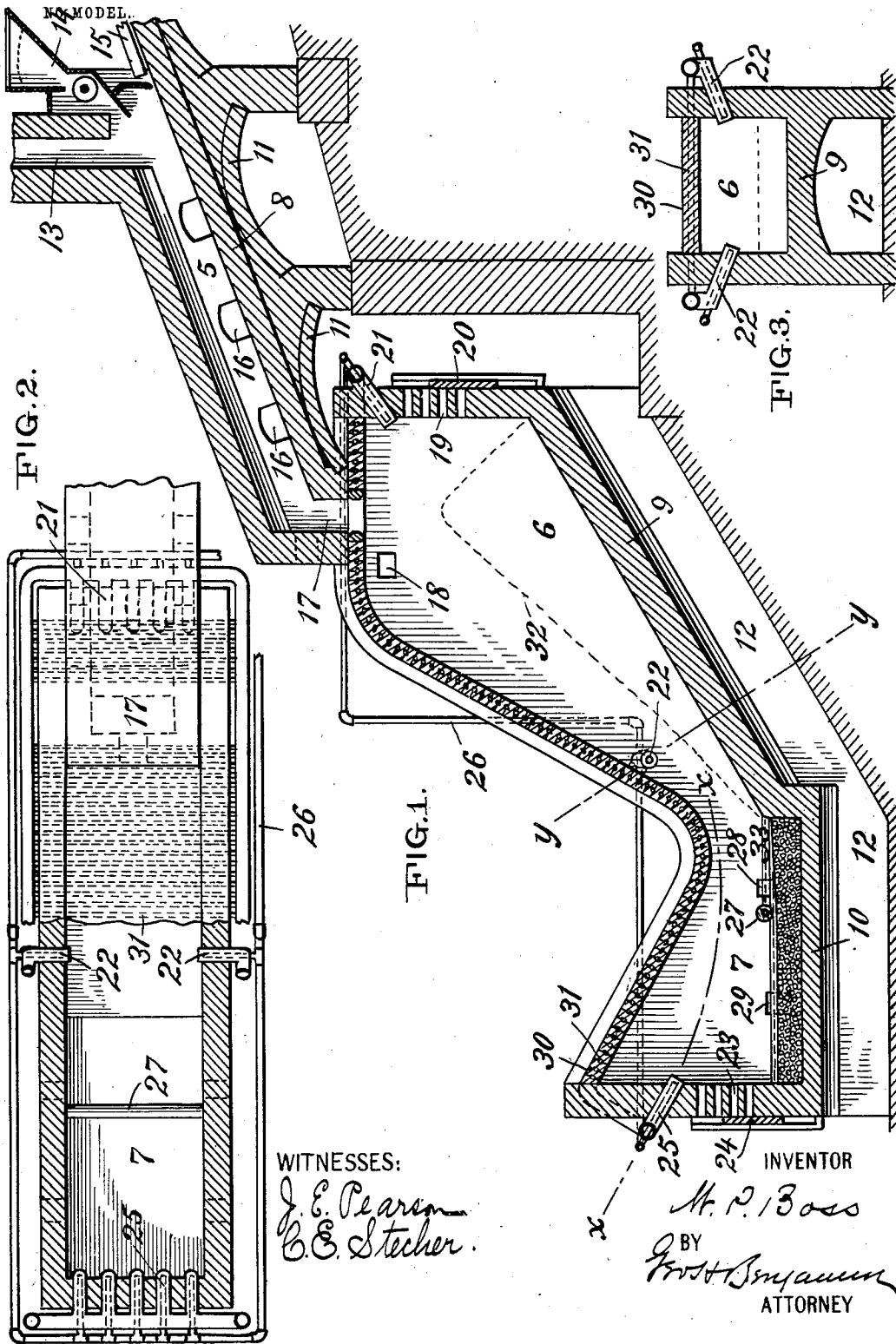


M. P. BOSS.
METALLURGICAL FURNACE.
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UNITED STATES PATENT OFFICE.

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METALLURGICAL FURNACE.

SPECIFICATION forming part of Letters Patent No. 732,265, dated June 30, 1903.

Application filed March 26, 1902. Serial No. 100,016. (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 carry into effect all of the metallurgical operations necessary to extract a metal from its ore and convert it into pig metal.

My invention consists in the construction and arrangement of the chambers in which the metallurgical operations are effected, to the means described for creating the required atmosphere in said chambers, and generally to various details of construction of the furnace.

The object of my invention is to carry on all of the metallurgical operations necessary to reduce a metal from its ore within a single structure, and thereby reduce the cost of handling, as well as the fuel and time necessary to produce the pig metal.

A further object of my invention is to produce the metallurgical results necessary through the influence of radiated heat and properly-directed air-currents, instead of, as has heretofore been the practice, through the direct application of heat.

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

Figure 1 is a vertical section. Fig. 2 is a plan view taken on the line X X of Fig. 1. Fig. 3 is a section taken on the line Y Y of Fig. 1.

In the drawings the furnace is shown as provided with three chambers—i. e., 5, calcining-chamber, where the ore is calcined or roasted; 6, reducing-chamber, where the metal under treatment is partially separated from the materials with which it is combined; 7, oxidizing-chamber, where the metal is finally separated from the materials with which it was combined. The chambers 5 and 6 are provided with inclined hearths 8 9, while the chamber 7 has a horizontal hearth 10. The hearth 8 is suitably supported on

arches 11, and under the hearths 9 and 10 is situated a cave 12, by means of which air may be caused to traverse under these hearths. I do not consider this cave essential and it may be omitted.

Connected to the upper portion of the calcining-chamber 5 is a flue 13, connecting with the chimney-stack. Also connected to the upper part of the calcining-chamber is a feed-hopper 14. Arranged to reciprocate over the hearth of the chamber 5 is a rake 15, which is merely indicated in the drawings. The sides of the calcining-chamber are provided with doors 16, through which hand-rakes may be introduced to push the material upon the hearth forward toward the reducing-chamber 6. The chamber 5 is connected to the chamber 6 through the opening 17. The chamber 6 is made of larger size, and in the top of this chamber is provided a door 18, through which air may be admitted to the interior of the furnace. Another door 19 is located at the back of the chamber and is provided with a sliding cover 20. Located over the cover 20 are a series of hydrocarbon-burners 21.

Located within the lower portion of the furnace and projecting inwardly from the side walls are a pair of burners 22. Located in the front wall of the oxidizing-chamber is an air-door 23, provided with a sliding cover 24, and located over this cover is a series of hydrocarbon-burners 25.

The burners 21, 22, and 25 are connected together through the pipe 26, connected to the source of supply. I do not limit myself in any wise to the class of burners employed, as they may be burners with which a hydrocarbon and air may be used or a hydrocarbon and steam, the steam or air being under pressure.

Located in the oxidizing-chamber is a slag-dam 27 and in front of this slag-dam a slag-door 28.

29 represents a door through which the refined metal may be drawn from the furnace.

The roof of the chambers 6 and 7 is preferably formed of a series of bricks 30, between which are embedded a series of parallel pipes 31, through which a cooling fluid is trans-

mitted. This fluid may be air or water, and the steam generated may be used for various purposes.

The dotted lines 32 33 in chambers 6 and 7 indicate, respectively, the ore under treatment in the reducing-chamber and the fluid metal and slag in the oxidizing-chamber.

The operation of my device is as follows: The ore is introduced through the hopper 14 and falls into the calcining-chamber 5. After remaining in the calcining-chamber the required time, which depends upon the character of the ore, generally three or four hours, the ore is pushed forward by the action of the rake 15 or through hand-rakes introduced through the door 16 and caused to fall into the reducing-chamber 6. This chamber is of considerable size and is purposely so made. In this chamber the ore is subjected to the action, first, of the heat passing from the chamber 7 toward the flue 13; second, to the heat due to the decomposition of the combustible constituents of the ore within the chamber, and, third, heat due to the action of the hydrocarbon-burners 21 22. Combustion within this chamber is promoted by the air introduced through the doors 18 and 19. The amount of air may be determined by controlling these air-passages. The chamber 6 is preferably made so large as to permit of free development of flame from the burners 21 22. In other words, it is my desire and object to cause the flame from these burners to sweep along the roof of the chamber and not come in contact with the body of ore in the chamber. By providing for such movement of the flame the heating effect of the flame is by radiation and not by direct contact. In practice I have found that the results obtained by using such a flame so directed are better than where the flame is caused to impinge upon the material within the chamber. As the ore is decomposed in the chamber 6 it gradually moves toward the chamber 7, the slag moving before the ore. The chamber 7 is also preferably made sufficiently large to permit free development of flame from the burners 25. As the slag moves forward it is stopped by the dam 27 and is drawn off through the slag-door 28. The ore which is deposited in the chamber 7 is gradually deprived of its accompanying material by the action of the oxidizing-flame derived from the burners 25 and air-door 24. In some cases I find it desirable to introduce fluxing materials into this chamber to unite with the impurities.

I wish it understood that I do not limit myself to the precise construction of the furnace shown and described—that is to say, the respective chambers may be given slightly-different shapes without departing from the intent of my invention. I wish it understood, however, that I consider it part of my invention to so construct the reducing and oxidizing chambers that the heating-flames introduced within such chambers shall be freely

developed within the chambers, not brought in contact with the materials in the chambers, and transmit their heat entirely by radiation. 70

Having thus described my invention, I claim—

1. A metallurgical furnace comprising a chamber, means for creating a reducing atmosphere in said chamber, a second chamber connected to the first-named chamber, means for creating an oxidizing atmosphere in said chamber, the said means for creating the required atmospheres having such a location relative to the hearths and tops of said chambers that gaseous flames may be freely developed within such chambers without contact with the material under treatment within the chambers. 75

2. A metallurgical furnace comprising a chamber having an inclined hearth, means for creating a reducing atmosphere in said chamber, a second chamber having a horizontal hearth and connected to the first-named chamber, means for creating an oxidizing atmosphere in said chamber, the said means for creating the required atmospheres having such a location relative to the hearths and tops of said chambers that gaseous flames may be freely developed within such chambers without contact with the material under treatment within the chambers. 80 85 90 95

3. A metallurgical furnace comprising a calcining-chamber, a chamber having an inclined hearth, means for creating a reducing atmosphere in said chamber, a third chamber having a horizontal hearth and connected to the second-named chamber, means for creating an oxidizing atmosphere in said chamber, the said means for creating the required atmospheres having such a location relative to the hearths and tops of said chambers that gaseous flames may be freely developed within such chambers without contact with the material under treatment within the chambers. 100 105 110

4. A metallurgical furnace comprising in its construction, two chambers connected at one end, means located at the ends of the respective chambers opposite the point of connection and intermediate of the hearth and roof of said chambers for introducing fuel and air, whereby gaseous flames may be freely developed without contact with the material within the chambers, and a reducing atmosphere created in one chamber and an oxidizing atmosphere in the other chamber. 115 120

5. A metallurgical furnace comprising a chamber, means for creating a reducing atmosphere in said chamber, a second chamber connected to the first-named chamber, means for creating an oxidizing atmosphere in said chamber, and means for introducing gaseous fuel into the reducing-chamber at about its point of connection with the oxidizing-chamber. 125 130

6. A metallurgical furnace comprising two communicating chambers and four sources of heat within said chambers, two of said sources delivering flames opposed to each other and

longitudinally of the furnace, and two of said sources opposed to each other and transversely of the furnace.

7. A metallurgical furnace provided with a chamber in which calcination of ore may be effected, a second chamber connected at its top to the calcining-chamber and provided with means for creating a reducing atmosphere, and a third chamber connected to the bottom of the reducing-chamber and provided with means for creating an oxidizing atmosphere.

8. A metallurgical furnace having a chamber in which calcination of the ore may be effected, a flue near the upper end of the cal-

cinizing-chamber, a feed-hopper also near the upper end of said chamber, a series of doors in the sides of said chamber, a second chamber, connected to the lower end of the calcining-chamber and provided with means for creating a reducing atmosphere, and a third chamber connected to the lower end of the reducing-chamber and provided with means for creating an oxidizing atmosphere.

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

MARTIN PRIOR BOSS.

Witnesses:

J. E. PEARSON,

C. E. STECHER.