G. MITCHELL.

APPARATUS FOR THE TREATMENT OF ORES.

APPLICATION FILED NOV. 8, 1912.

1,074,282.

Patented Sept. 30, 1913.

2 SHEETS—SHEET 1.

Fig. 1.

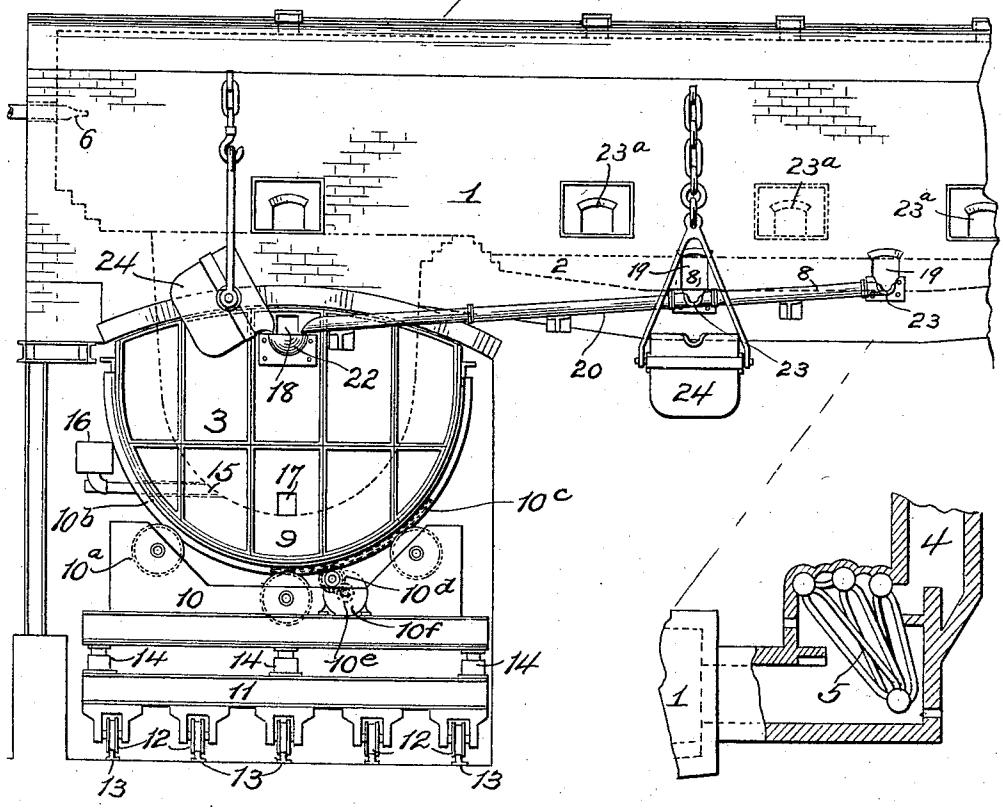
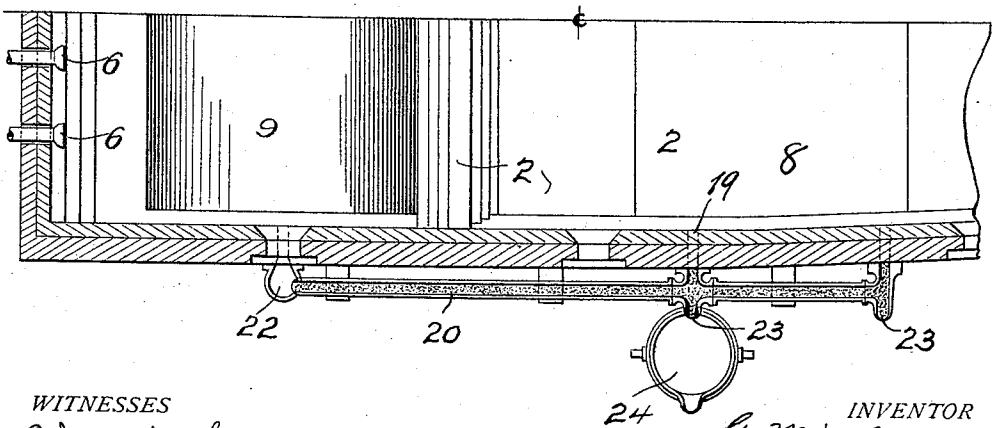


Fig. 2.



WITNESSES

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2 SHEETS—SHEET 2.

Fig. 3.

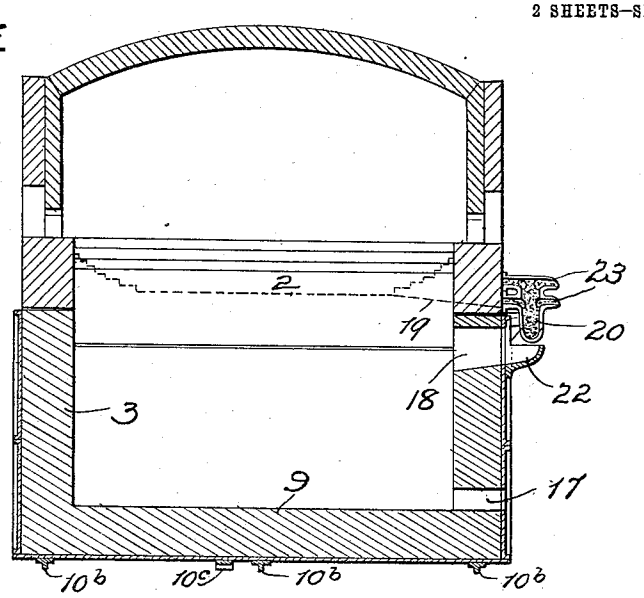
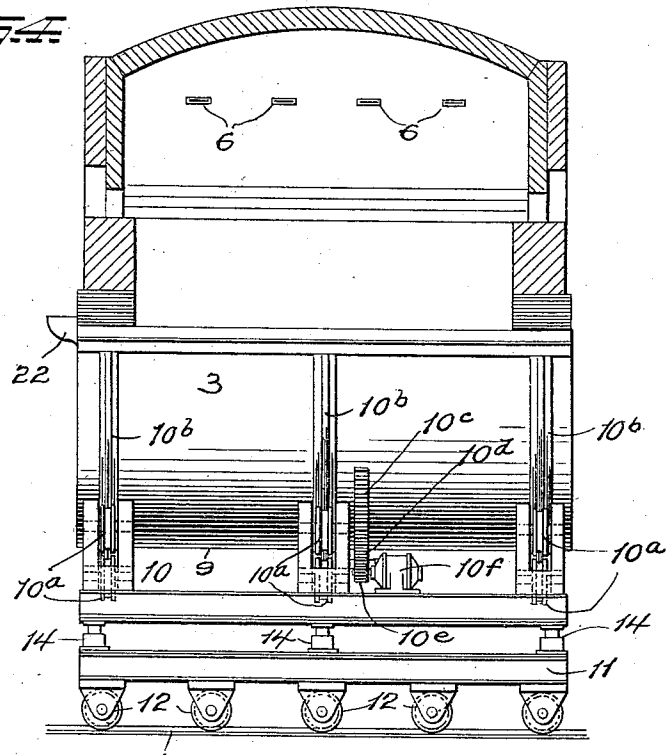


Fig. 4.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR THE TREATMENT OF ORES.

1,074,282. Specification of Letters Patent. Patented Sept. 30, 1913.

Application filed November 8, 1912. Serial No. 730,296.

To all whom it may concern:

Be it known that I, GEORGE MITCHELL, of Los Angeles, in the county of Los Angeles and State of California, have invented certain new and useful Improvements in Apparatus for the Treatment of Ores; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in apparatus for the treatment of ores and particularly copper, iron, lead, zinc, cobalt, gold and silver ores.

The object of the invention is to provide a furnace wherein the ore, say for instance copper, may be smelted and the matte reduced or bessemerized in one heat, the heat from the converter assisting in smelting the ore; and it consists in a furnace with a converter at one end and adjacent the fuel burners, the lower section of the converter being removable, a smelting hearth intermediate the converter and the stack, a dam intermediate the hearth and converter, and a trough leading from the hearth to the outside of the furnace, whereby the matte may be drawn from the pool on the hearth into a ladle, and charged into the converter.

In the accompanying drawings, Figure 1 is a view in side elevation of a portion of the furnace; Fig. 2 is a view in horizontal section through one side wall of the furnace and end wall of the crucible showing the spout and ladle; Fig. 3 is a view in vertical section through the furnace and converter only one half being shown and Fig. 4 is a view in elevation partly in section showing the means for tilting the converter.

1 represents a furnace of substantially the shape shown, and of a length sufficient to provide an ample smelting hearth 2, and a converter 3, which as shown is located at one end of the furnace and the stack 4 at the other end, a steam generator or boiler 5, being adjacent the stack, if desired, which generates the steam employed for the blowers for the converter.

The furnace may be arranged for burning coal, oil, or gas, either natural or artificial, and in the present instance I have shown burners 6 for gas or oil, the burners being located at the end of the furnace over the converter.

The converter as shown, is sunken below the hearth thereby providing a space the full depth of the furnace above the converter which greatly minimizes the wear and tear on the roof caused by mechanical action and chemical reaction of the matte during the converter operation. The upper part of the converter is formed as in integral part of the furnace structure, with the hearth 2 at the rear, the latter having a slight pitch from its rear toward the front and is scoop shaped adjacent the dam 8, so as to form a pool, as shown in dotted lines in Fig. 1, into which the matte gravitates and where it is stored until drawn off into the ladle as will be hereinafter described. The lower section 9 of the converter is rectangular in shape, and curved transversely in the arc of a circle as in Fig. 1. I would have it understood however that I do not confine the invention to any particular shape of converter, but have shown it as above simply as the preferred form. The lower section 9 is mounted on a cradle 10, carried on a truck 11, the wheels 12 of which run on trackways 13, the cradle being supported on hydraulic jacks 14 carried by the truck, by which the removable section 9 may be raised into position and lowered, for its removal to a point where it can be conveniently relined. I have shown the track 13 located at right angles to the furnace, but it will be clearly evident that it may be in the direction of the length of the furnace, so that the bottom section of the converter may be moved out endwise of the furnace.

The cradle 10 carrying the converter, is provided with a series of grooved rolls 10^a located respectively at the ends and at intermediate point or points. These rolls are mounted to rotate and form supports for the rails 10^b secured to the underside of the converter, the heads of the rails resting within the grooves of the wheels so as to be guided by the latter. The converter 10 is also provided on its bottom with a rack 10^c which is engaged by the gear wheel 10^d mounted in bearings on the cradle 10, and meshing with the pinion 10^e on the armature shaft of the motor 10^f, the latter being firmly secured to the cradle 10.

From the foregoing it will be seen that by energizing the motor, the lower section of the converter may be tilted to discharge its contents, or to receive a spout by which the matte may be supplied to the converter.

While I have shown an electric motor and

gearing for tilting the converter, it will be apparent that any other type of motor may be used.

By making the converter in two sections and mounting the lower section on a truck, when one has been removed for relining or repair, another can be run into place thus saving the time required to repair or reline the removed section. This lower section of the converter is provided with twyers 15 and twyer boxes 16 for the transmission of the blast from a blowing engine, and a pit or chamber is formed preferably all around the converter for the convenience of the operators in examining the converter and twyers, and to provide ample space for the manipulation of tools through the twyers for removing deposits from the latter.

The converter is provided with a tap hole 17 for tapping the charge, and also with a skimming and slag tap hole 18 through which the slag may be removed.

Leading from tap holes 19 in the side of the furnace, in rear of the dam 8, is a trough 20 lined with fire brick. This trough leads from the pool on the hearth in rear of the dam, and extends downwardly and forwardly at the side of the furnace toward the front thereof, so that the matte when drawn off, will flow by gravity from the hearth into a spout 22 secured to one end of the lower section of the converter in the plane of the skimming door 18, so that the matte discharged therein from the trough 20 will flow directly into the converter.

The trough 20 preferably communicates with the hearth through two tap holes 19, and is provided opposite each tap hole with a spout 23 by which the matte may be discharged into a ladle 24 carried by a traveling crane. By opening either tap 19, and damming the trough just below the spout to be used, the matte will be discharged from the spout into the ladle 24, and conveyed by the latter to the spout 22 in the end of the converter and discharged into the latter. When the matte is conducted to the spout 22 through the trough 20, the spouts 23 are closed by clay plugs or other suitable devices.

After the smelting has progressed up to the point where there is sufficient matte to blow, the heat generated in the converter will in many instances be ample for smelting purposes but if necessary it may be augmented by the burners 6 which are always used to start the furnace.

The dam 8 prevents the matte from flowing directly into the converter, hence in the operation, a charge in the converter will be wholly refined and discharged before more matte is added.

The sides of the furnace in rear of the dam are provided with doors 23ª through which skimming tools may be operated for removing the slag formed during the smelting process.

With this furnace I smelt the ores and refine the matte by a continuous operation, thus doing with one apparatus the work generally performed by separate processes, which results in saving in many ways the cost of producing refined metal.

The converter may be initially heated by gas or oil, or by coal introduced through suitable openings into the converter chamber.

It is evident that changes in the construction and relative arrangement of the several parts might be made without avoiding my invention and hence I would have it understood that I do not restrict myself to the particular construction and arrangement of parts shown and described, but:—

Having fully described my invention what I claim as new and desire to secure by Letters Patent, is:—

1. In a combined smelting and converting furnace, the combination of an elongated furnace chamber having a smelting hearth therein and an opening in its bottom adjacent the hearth, a removable converter section the top of which conforms in size and shape to the opening in the bottom of the furnace chamber so as to make a close fit with the latter, a truck carrying said converter section and means carried by the truck for lifting and lowering and tilting said converter section.

2. In a combined smelting and converting furnace the combination of an elongated furnace chamber having a smelting hearth therein, an opening in its bottom adjacent the hearth and a dam intermediate the smelting hearth and the opening, a removable converter section the top of which conforms in size and shape to the opening in the bottom of the furnace chamber, and a trough located at one side of the furnace and in communication with the hearth, and adapted to discharge into the removable section of the converter, the said trough having a discharge spout intermediate the smelting hearth and converter whereby the matte can be tapped from the trough into a ladle, from which it may be subsequently discharged into the converter.

3. In a combined smelting and converting furnace, the combination of an elongated furnace chamber having a substantially horizontal smelting hearth, and an opening through its bottom adjacent the hearth, a removable converter section the open top of which registers with the opening in the bottom of the furnace chamber, fuel burners at the end of the furnace chamber adjacent the converter, a dam intermediate the hearth and converter, and a trough located at one side of the furnace and in communication with the hearth, and adapted to discharge

into the removable section of the converter, the said trough having a discharge spout intermediate the smelting hearth and converter whereby the matte may be tapped from the trough into a ladle from which it may be subsequently discharged into the converter.

4. In a combined smelting and converting furnace, the combination of a horizontal elongated furnace chamber having a hearth and an opening through its bottom adjacent the hearth, a dam intermediate the hearth and opening in the bottom of the furnace, a removable converter section the upper end of which conforms in size and shape to said opening, a tap hole in the removable section of the converter, slag tap holes in the furnace adjacent the hearth, and a trough extending lengthwise the furnace and in communication with the hearth, and adapted to discharge into the removable section of the converter, the said trough having a discharge spout intermediate the hearth and the converter whereby the matt may be tapped from the trough into a ladle from which it may be subsequently discharged into the converter.

5. In a combined smelting and converting furnace, the combination of an elongated furnace chamber having a hearth and an opening in the floor adjacent the hearth, a converter section the upper open end of which conforms in size and shape to the opening in the floor of the furnace, a cradle carrying the converter section, means on the cradle for turning said section, a truck carrying the cradle, and means on the truck for elevating and lowering the cradle and the converter section thereon.

6. In a combined smelting and converting furnace, the combination of an elongated furnace chamber having a smelting hearth therein and an opening in its bottom adjacent the hearth, the side walls of the opening being arched, a removable converter section provided with a curved upper edge conforming in curvature to the curve of the arch so as to make a close fit with same, a truck carrying said removable converter section and means carried by the truck for lifting and lowering and tilting said section.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses.

GEORGE MITCHELL.

Witnesses:
W. J. THOMAS,
INA EVERSHED.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents Washington, D. C."