

Oct. 6, 1931.

E. J. FOWLER ET AL

1,825,947

ROASTING APPARATUS

Filed May 16, 1928

3 Sheets-Sheet 1

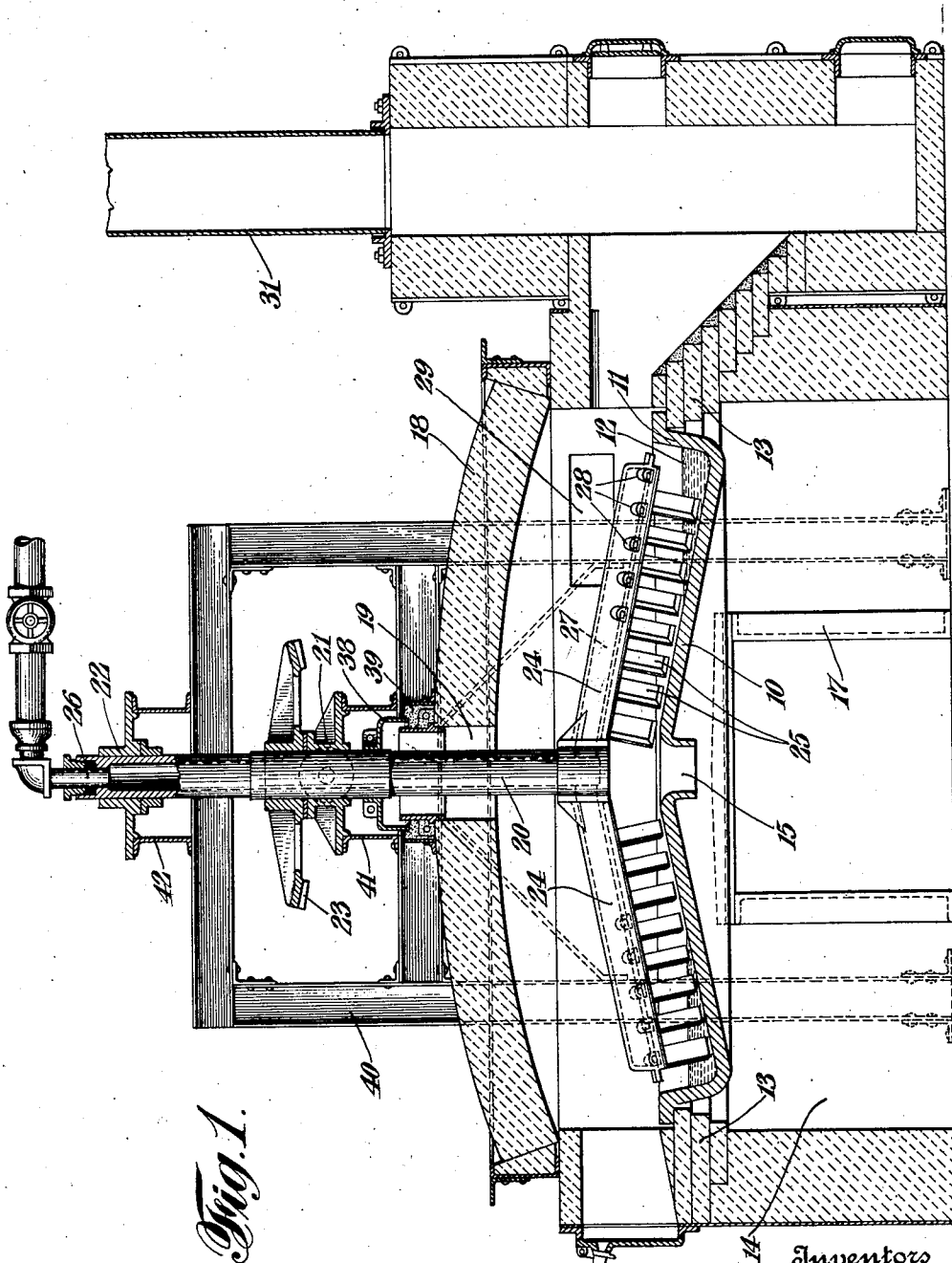


Fig. 1.

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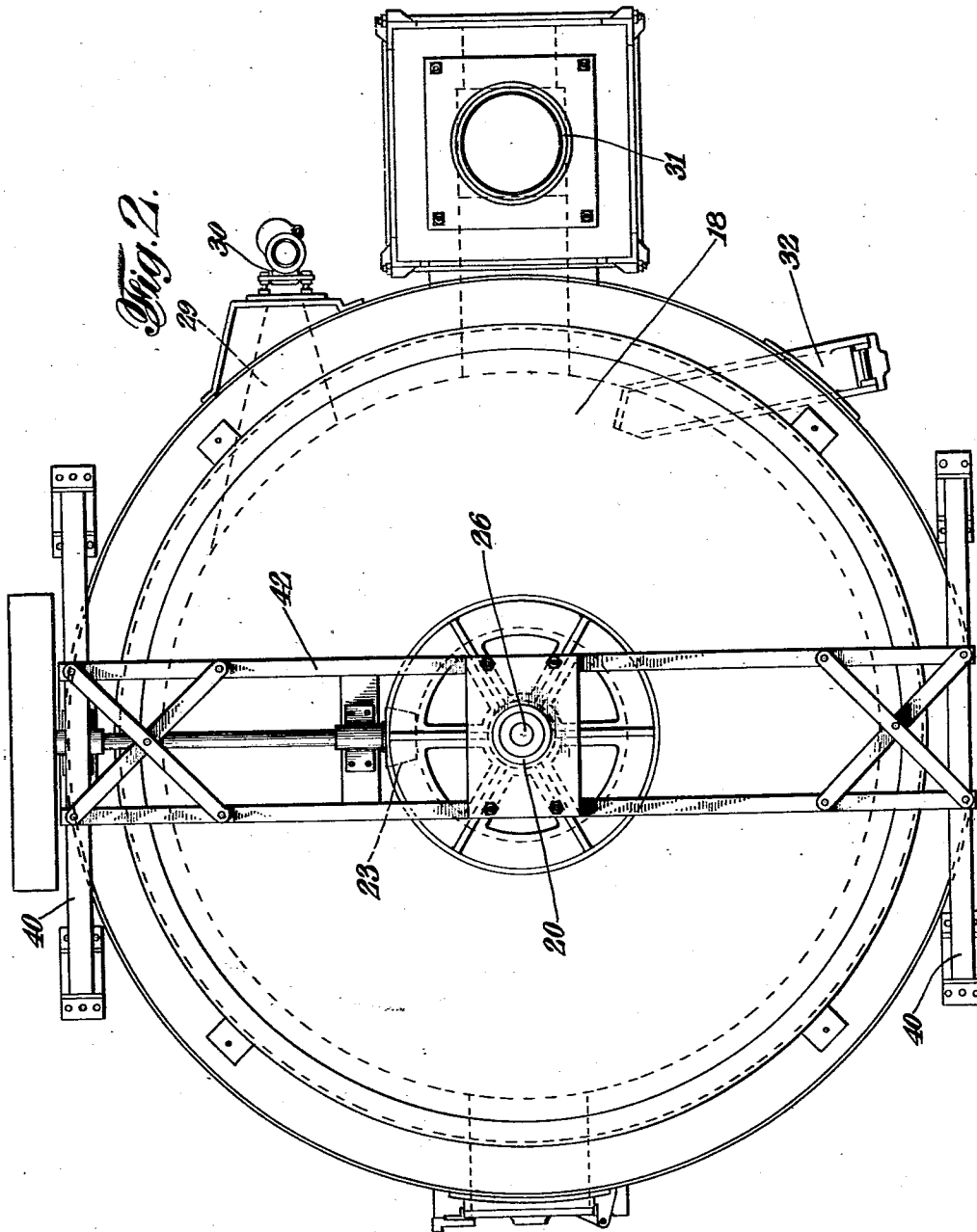
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3 Sheets-Sheet 3

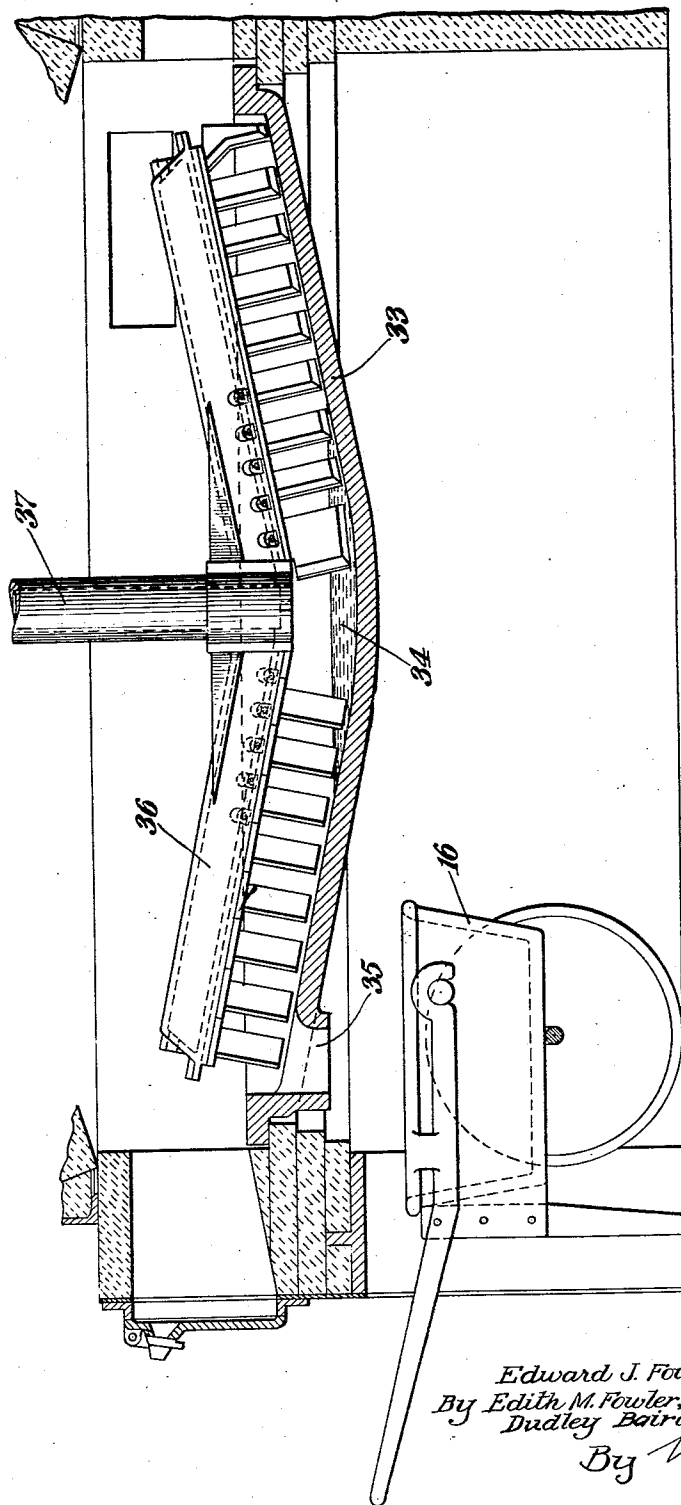


Fig. 3.

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UNITED STATES PATENT OFFICE

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ROASTING APPARATUS

Application filed May 16, 1928. Serial No. 278,220.

This invention relates to roasting apparatus which is particularly applicable to the oxidation of metals, for example, lead, for the formation of litharge. However, the invention is not limited to such particular uses.

The objects of the invention include the provision of apparatus of the class indicated which will be dependable, rapid and highly efficient in operation, and in which the operating conditions may be accurately controlled.

Various further and more specific objects, features and advantages will more clearly appear from the detailed description given below taken in connection with the accompanying drawings, which form a part of this specification.

The invention consists in such novel features, arrangements and combinations of parts as may be shown and described in connection with the embodiments of the invention herein disclosed by way of example only.

In the drawings Fig. 1 is a vertical sectional view through a furnace showing one embodiment of the invention;

Fig. 2 is a top plan view of the same furnace; and

Fig. 3 is a vertical sectional view through a furnace comprising another embodiment of the invention.

In the particular furnace shown in Fig. 1 a single hearth or pan may be provided as at 10 which may, for example, comprise a casting having a substantially conical central area with an upturned wall or peripheral flange as at 11. The conical area in conjunction with the peripheral wall provides an annular receptacle for retaining the molten lead or other metal under treatment in a relatively shallow layer as at 12.

The hearth or pan 10 may be suitably supported at its periphery by brick work as at 13, leaving an enclosure as at 14 of considerable area beneath the pan. The pan may be provided with a central discharge port as at 15 from which the product formed in the furnace may be allowed to drop to the enclosure 14 where it may be received in a suitable conveyor or receptacle as at 16 (see Fig. 3) and carried away through an opening as at 17.

A suitable dome as at 18 may be provided

over the furnace. Through a suitable central opening in the furnace dome as at 19, a rotatable rabble arm supporting shaft may be introduced as at 20. The shaft 20 may be rotatably mounted in suitable bearings as at 21 and 22 and driven by suitable gearing as at 23. At the lower end of the shaft 20 a pair of rabble arms as at 24 may be mounted and provided with suitable rabble teeth as at 25 for gradually advancing material treated on the hearth 10 toward the discharge opening 15.

A suitable oxidizing fluid, such as air, for oxidizing the metal under treatment on the hearth and also if desired for cooling the rabble arms, may be introduced by way of a conduit 26 through the hollow shaft 20 and through suitable cavities as at 27 provided in the rabble arms. From the cavities 27 the fluid may be discharged at a desired rate through openings as at 28 into proximity of the rabble teeth and the material being treated.

The furnace may be heated, as for example by an oil torch or other heating means which may be introduced tangentially of the hearth through an opening in the side wall of the furnace as at 29 (see Fig. 2). Supporting means for the oil torch or its equivalent is indicated at 30. The flame from the oil torch may be deflected peripherally around the pan and waste gases may be discharged to a stack as at 31. With the furnace shaped as shown, the flame when directed therein in this manner comes into contact with the molten metal over an extended area around the periphery of the pan, and with the stack outlet arranged as shown the flame is kept down very close to the molten material.

The metal to be treated, such as pig lead for example, may be introduced through an inclined trough as at 32 extending through the side wall of the furnace more or less tangentially of the hearth or pan.

It will be observed that the rabble arms 24 as joined to the rotating shaft 20 are suitably inclined so that the rabble teeth 25 attached thereto will operate when the shaft 20 is rotated in close cooperation with the hearth or pan surface so as to gradually advance any

solidified particles or masses of material other than liquid toward the central discharge opening at 15, yet during such advancement of the solidified material, the molten metal is given ample opportunity to drain off and to remain in the furnace.

The embodiment of the apparatus illustrated in Fig. 3 may be similar to that of Fig. 1, with the exception that an inverted substantially conical hearth is provided as at 33 whereby the mass of molten metal is lodged at the center of the hearth as at 34. In this embodiment a discharge opening or openings may be provided at the periphery of the hearth as at 35. This inverted substantially conical hearth is arranged to cooperate with rabble arms as at 36 extending upwardly from the center of the furnace at an angle corresponding to the angle of the conical hearth. The rabble arms 36 may be mounted on a rotatable hollow shaft 37 through which the cooling and oxidizing fluid may be admitted to the furnace as in the embodiment above described.

In both embodiments of the furnace the rotatable shaft 20 where it passes through the furnace dome may be provided with a suitable substantially gas-tight sealing arrangement as shown in Fig. 1. This may comprise an overhanging flange as at 38 secured to the shaft and having its lower edge extending into an annular body of powdered material as at 39 so as to substantially seal the furnace at the area around the shaft, notwithstanding the rotation of the shaft. Also, in both embodiments of the furnace, suitable frame members may be provided as at 40 at each side of the furnace and connected by cross beams as at 41 and 42 for supporting the bearings 21 and 22 respectively, thus relieving the furnace dome of the weight of the bearings, the rotatable shaft and the rabble arms, etc.

The usual practice as followed in the construction of roasting furnaces well known to the art, may be applied to features and details of construction which have not hereinabove been specifically referred to.

As above indicated, this invention although not limited thereto, is particularly applicable to processes such as the oxidation of lead in the formation of litharge. Such processes are described and claimed in our co-pending divisional application Ser. No. 278,219, filed of even date herewith. In order to illustrate the operation of the apparatus of the above described embodiments of our invention, such a process will also be now described herein.

According to our process, the lead or the like metal to be treated (in the form of pigs or otherwise) may, when the process is started, be loaded into the pan or hearth for melting. The furnace temperature is thereupon raised to a suitable degree and maintained,

for example, in the neighborhood of 1600° F. by oil torches or otherwise, and a plentiful supply of air is admitted to the conduit 26 and discharged into the furnace through the rabble arm openings 28 as the rabble arms rotate. In passing through the hollow shaft 20 and the hollow rabble arms 24, the air cools these parts and becomes itself gradually heated. This heated air, it will be observed, may be discharged through the openings 28 in substantial volumes directly at the points of rabbling, thereby continuously maintaining very desirable conditions for efficient oxidation. As the rabble teeth rotate, the oxide will be relatively quickly skimmed from the surface of the molten metal exposing additional metal to the fresh supplies of hot air, and meanwhile the oxide will be gradually raked over the hearth or pan toward the discharge opening; but before it is actually discharged, there will be ample time for any unoxidized globules of molten metal to drain back toward the periphery of the pan if such globules do not in the meantime also become oxidized.

As the process proceeds, additional pigs of metal may be regularly admitted through the trough 32. It will be observed that at the periphery of the pan, considerable capacity is available for receiving the solid pieces of metal which are enveloped by the molten material and thus are quickly melted, but without interfering with, or coming into direct proximity of the thin layers of material nearer the discharge opening where the oxidation process may be more nearly completed. As the process proceeds, the rabble arms will remove the oxidized material, thus not only making way for the introduction of fresh metal but also exposing the remaining molten metal to the supplies of hot fresh air. The oxidized material may thus be substantially continuously discharged and conveniently conveyed away without cooling the furnace or otherwise interfering with its operation.

The conical pan having the central discharge opening is particularly adaptable to this process in that symmetrical operation of the furnace may be secured with but a single central discharge opening, and also sufficient capacity is available at the periphery of the hearth to permit the maintaining of a sufficient volume of molten lead to utilize the oxidizing capacity of the furnace to substantially its fullest possible extent. However, under some conditions the use of the hearth as of Fig. 3 may be found to be more desirable. The temperatures within the furnace may be accurately regulated by adjusting the rate of supply of air through the conduit 26 as by the manipulation of a suitable valve as indicated, and also, of course, by adjusting the gas flame or torch.

The furnaces above described, in addition to being adaptable to oxidation processes,

may of course also be utilized for the various roasting and drying operations as necessary in various industries. For example, furnaces with either one or a plurality of hearths of this type may be used for de-watering operations, as well as for the treatment of ores and materials other than liquids or in molten form, such as finely divided fuller's earth, various forms of activated carbon, kieselguhr, etc.

While the invention has been described in detail with respect to certain particular preferred examples which give satisfactory results, it will be understood by those skilled in the art after understanding the invention that various changes and modifications may be made without departing from the spirit and scope of the invention and it is intended therefore in the appended claims to cover all such changes and modifications.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A furnace for the treatment of molten metals comprising a pan having a substantially conical bottom, the lower areas of which are designed to receive, and to be covered by, the molten metal, a discharge opening at the higher areas of the conical bottom, rotatable rabbling means mounted concentrically with the conical bottom, said rabbling means having rabble teeth for stirring the metal and skimming surface formations on to the higher conical areas and thence out through the discharge openings, and means carried by said rabbling means for discharging streams of oxidizing fluid on to the material under treatment.

2. A furnace for treating molten material, comprising a hearth pan having a substantially conical liquid retaining bottom inclined upwardly from its periphery toward the center, a discharge opening at the center, rotatable rabbling means mounted concentrically with said conical bottom and having rabble teeth, and supporting arms for said rabble teeth extending from the axis of rotation outwardly and downwardly over the pan, the lower ends of said teeth terminating along a line which extends at an angle substantially corresponding to the angle of the conical bottom and adjacent thereto, for stirring the material on the hearth and skimming surface formations on to the higher conical areas and thence out from the discharge opening.

3. A furnace construction adapted for the treatment of molten materials comprising a hearth having an annular depression for receiving the molten material surrounded by cylindrical furnace walls, means for introducing a flame substantially tangentially of the hearth whereby the flame is directed circumferentially of the furnace around the annular body of molten material on the hearth, trough means for replenishing the supply of

material at the outside of the hearth, and a discharge opening at the center of the hearth.

4. A furnace for the treatment of molten metals comprising a pan having a substantially conical bottom, the peripheral portions of said bottom being raised and having a discharge opening, and the lower central area being designed to receive and to be covered by the molten metal, rotatable rabbling means mounted concentrically with the conical bottom, said rabbling means having rabble teeth for stirring the metal and skimming surface formations from the center of the pan to the higher peripheral areas and thence out through said discharge opening, and means carried by said rabbling means for discharging streams of oxidizing fluid on to the material under treatment.

5. A furnace for treating molten material, comprising a hearth pan shaped substantially in the form of an inverted cone with liquid retaining areas at the center inclined upwardly toward peripheral draining areas, a discharge opening at the periphery, rotatable rabbling means mounted concentrically with said conical bottom and having rabble teeth, and supporting arms for said rabble teeth extending from the axis of rotation outwardly and upwardly over the pan, the lower ends of said teeth terminating substantially along a line which extends at an angle corresponding to the angle of the conical bottom and adjacent thereto for stirring the material on the hearth and skimming surface formations on to the higher peripheral areas and thence out through said discharge opening.

In testimony whereof we have signed our names to this specification.

EDITH MARY FOWLER,
Executrix of the Last Will and Testament of
Edward J. Fowler, Deceased.

DUDLEY BAIRD.