

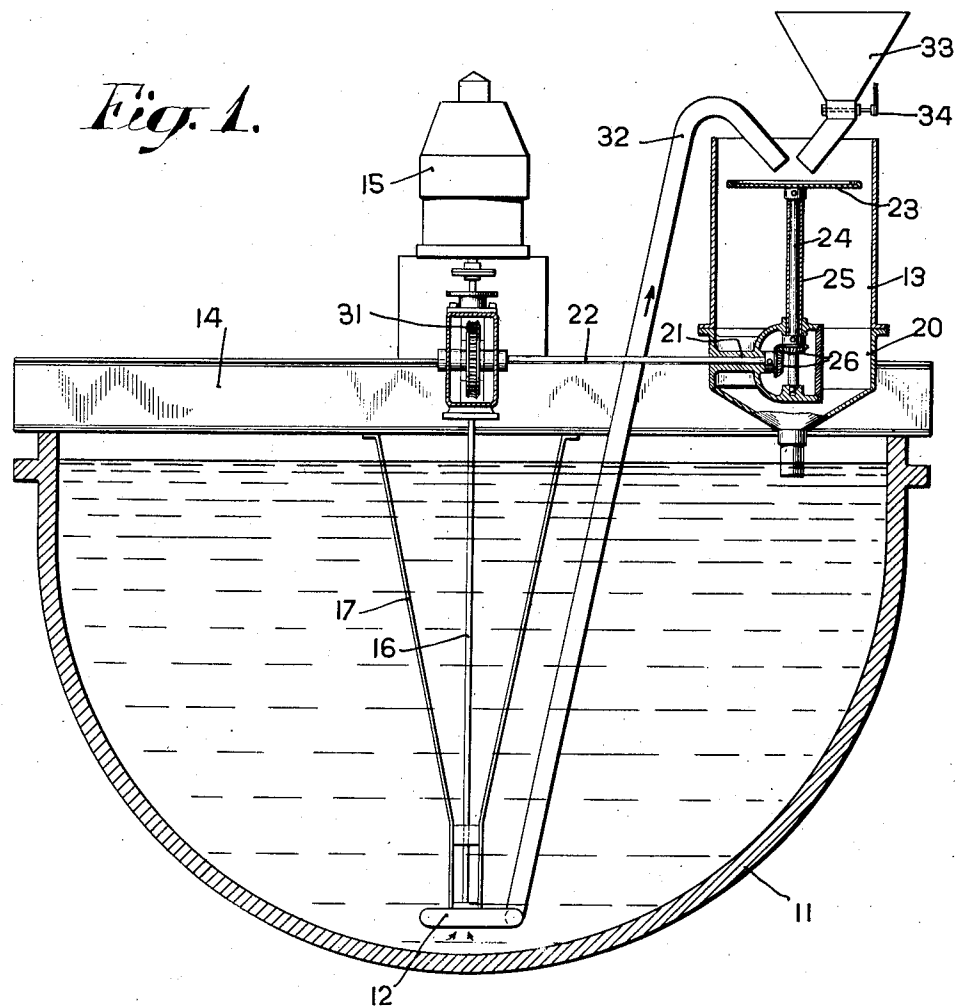
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H. W. YORK
MIXING APPARATUS

1,706,722

Filed Feb. 9, 1927

2 Sheets-Sheet 1



Inventor
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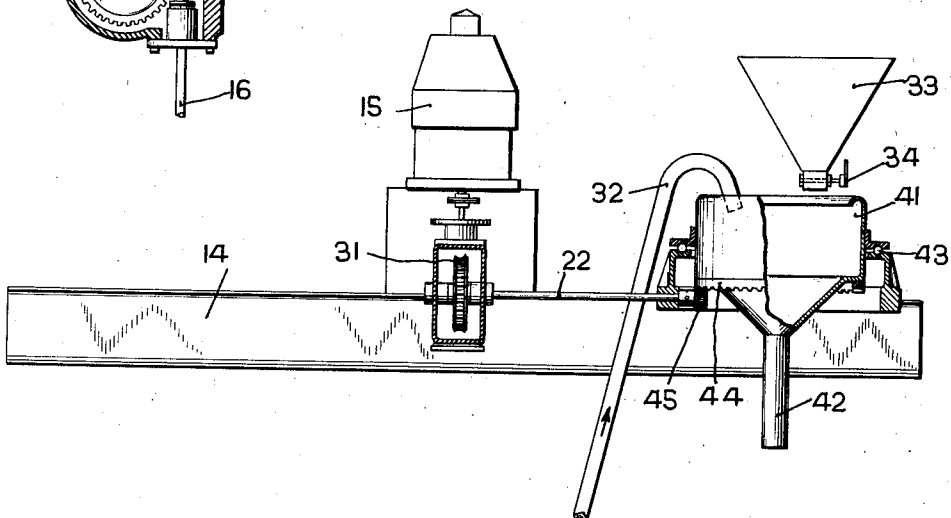
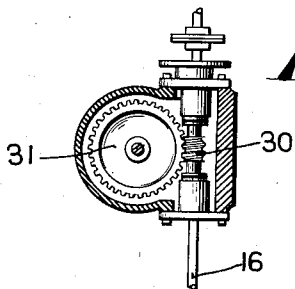
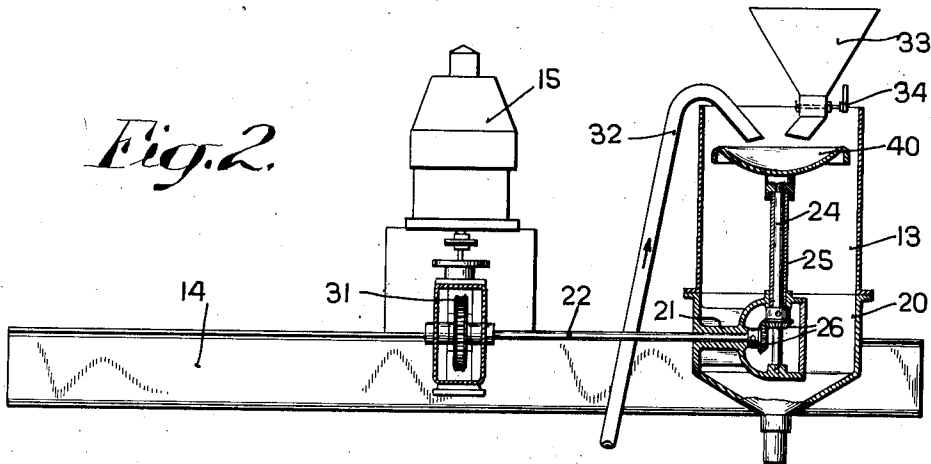
H. W. YORK

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

HERBERT W. YORK, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN SMELTING AND REFINING COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

MIXING APPARATUS.

Application filed February 9, 1927. Serial No. 166,893.

This invention relates to mixing apparatus and more particularly to an arrangement for mixing molten metals with various reagents whereby impurities may be removed from the metals in the form of a dross.

The invention relates more specifically to mechanical means for adding a reagent to a fluid material and thoroughly mixing the reagent with the various portions of the fluid.

The invention also consists in certain new and original features of construction and combinations of parts hereinafter set forth and claimed.

In accordance with the present invention, a reagent is mixed with the molten metal by passing a continuous stream of said metal into a mixing-chamber and discharging both the stream of metal and the reagent onto a rotating member. A film of metal is thereby produced upon said member, and the agitation of the film, while thereon, ensures a complete and intimate contact between the reagent and the various portions of the metal.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto the invention itself, as to its objects and advantages, the mode of its operation and the manner of its organization may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof, in which

Fig. 1 is a diagrammatic showing of one form of mixing apparatus constructed in accordance with this invention;

Fig. 2 is a fragmentary view, showing a modified form of mixing-chamber;

Fig. 3 is a detail view of the reduction-gears; and,

Fig. 4 is a fragmentary view of the mixing apparatus, showing a further modification of the reaction-chamber.

Like reference characters denote like parts in the several figures of the drawings.

In the following description and in the claims parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

Referring to the drawings more in detail, the invention as disclosed comprises a kettle

11, which is adapted to contain molten metal or other liquid substance which is to be mechanically mixed with another material or to be reacted therewith. The kettle may be heated for maintaining the metal in a molten condition by a furnace or other suitable means (not shown). Liquid from kettle 11 is removed by means of pump 12 and passed through a mixing-chamber 13, wherein the desired substance is incorporated therewith, and then is reintroduced into kettle 11.

Pump 12 may be supported from beam 14, which extends across and is carried by the rim of kettle 11. Pump 12 may be driven by motor 15, which is also supported by beam 14, a suitable connecting-rod 16 being provided for inter-connecting said pump and motor. Bracing means 17 may be included, if required, for rigidly attaching pump 12 to beam 14.

Reaction-chamber 13 may comprise a casing 20 having a housing 21 therein in which shaft 22 may be journaled. Rotary plate 23 may be rigidly connected to shaft 24 and supported by a tubular extension 25 carried by said housing. Suitable gears 26 may be attached to shafts 22 and 24 respectively and arranged in operative relationship. Housing 21 is preferably extended to completely surround said gears and prevent them from becoming contaminated with liquids present in said mixing-chamber. Tubular member 25, being fixed to housing 21, prevents the liquid contents of mixing-chamber 13 from passing around rod 24 and coming in contact with gears 26.

Rod 22 may be driven from motor 15 by means of a worm 30 carried by pump-shaft 16 (Fig. 3) and cooperating with driven-gear 31 attached to said shaft 22.

The liquid may be forced by pump 12 through pipe 32 and discharged therefrom onto rotating plate 23 near the center thereof. A second material, such as the reagent, may also be discharged upon said plate 23 from hopper 33, the rate of discharge of said material being controlled by valve mechanism 34 carried thereby.

In the operation of the above-described apparatus, a stream of material in liquid condition is constantly discharged from pipe 32 upon rotating plate 23, and is caused to flow by centrifugal force over the edges of said plate and drop through mixing-cham-

ber 13, being collected in the bottom thereof and reintroduced into kettle 11.

The reagent may be added to the metal as it passes over plate 23, and, since the metal is then in a comparatively thin layer or film, it presents a large surface area to the reagent. The centrifugal force produced by rotating plate 23 further serves to mix the reagent and the liquid, and to ensure a complete reaction taking place therebetween. Since the materials flowing from the edge of plate 23 and dropping through the mixing-chamber are in a comparatively fine condition, the reaction may be completed in said chamber.

By means of the construction shown, wherein tubular member 25 attached to housing 21 extends around shaft 24 substantially to the lower surface of rotating plate 23, the material within the mixing-chamber is positively prevented from contacting with the driving-gears, and the necessity for tight packings is avoided. The only access to gears 26 is at the upper portion of member 25, which is sufficiently close to the under side of plate 23 to prevent liquid from discharging thereon from said plate. The gears are therefore effectively protected from all contact with the substances under treatment.

In the modification shown in Fig. 2, the various parts corresponding to parts described in connection with Fig. 1 are indicated by similar reference numerals. Reaction-tank 13, however, is shown as provided with a dished rotating member 40, on which both the liquid under treatment and the reagent are introduced. Member 40 may be rotated by motor 15 at a sufficient speed to cause the liquid contained therein to pass by centrifugal force over the rim thereof, whence it may fall to the bottom of chamber 13 and be discharged into kettle 11. By the employment of a dish-shaped member, the time of contact of the metal with the reagent may be increased, since the rate of flow of the metal from the rotating member to the mixing-chamber may be controlled by the speed of rotation of the member.

In the modification shown in Fig. 4, mixing-chamber 41 is provided with a cone-shaped bottom terminating in a suitable discharge pipe 42, whence the materials in said chamber may be returned to kettle 11. Chamber 41 may be mounted for rotational movement on bearings 43 and provided with a suitable rack 44 for cooperating with pinion 45 on shaft 22. Rack 44 may preferably be located below the cone-shaped bottom of mixing-chamber 41, and thereby prevented from coming in contact with any materials which may be contained in said chamber.

In this type of apparatus, both the liquid itself and the reagent are discharged onto

the cone-shaped bottom, and are sufficiently agitated by the rotation thereof to cause them to thoroughly mix and to promote the required reaction. The speed of rotation of said chamber should be so chosen that the materials are prevented by centrifugal force from flowing into pipe 42 until the reaction has been completed.

By means of the above-described apparatus it is possible thoroughly to mix a material in a liquid state, such as a molten metal, with another substance, such as a reagent, in either a solid or a liquid form. Furthermore, the mixing may be accomplished without agitating the liquid within the kettle and without disturbing the surface thereof. Formation of the dross on the surface is therefore not interrupted.

The invention is particularly applicable to the refining of lead by the addition of solid sulphur thereto, whereby a dross is formed on the surface of the lead. The invention is, however, not to be limited to those particular elements, inasmuch as it is of general application for the addition of a reagent to a liquid material, or for the mechanical mixing of a liquid material with a second material either in the solid or the liquid state.

While certain novel features of the invention have been shown and described and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes in the forms and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. An apparatus for adding a reagent to a liquid material comprising a container for said liquid, a rotating member, means for removing portions of said liquid from said container and passing said portions over said rotating member whereby a thin film is produced, and means for adding said reagent to said film.

2. An apparatus for refining metals comprising a container adapted to hold said metal in molten condition, a mixing-chamber, means for supporting said chamber above said container, a rotating member in said chamber, means for removing portions of said molten metal from said container and discharging the same onto said rotating member whereby a thin film is produced, and means for adding a reagent to said film.

3. A mixing-chamber having a rotating member therein, a vertical shaft supporting said member, means for driving said shaft including a pair of gears, a casing surrounding said gears, and a tubular extension on said casing surrounding said shaft and extending to a point near the under surface of said rotating member whereby materials

falling from the edge of said member are prevented from entering said extension.

4. A mixing-chamber comprising a container having a rotating member therein, means for rotating said member including a pair of shafts and cooperating gears, means for discharging materials to be mixed upon said rotating member whereby they are caused to form a thin film over the surface thereof and to discharge by centrifugal force over the rim thereof and to drop by gravity to the lower portion of said mixing-chamber, and protective means for preventing said materials from coming in contact with said shafts and gears.

5. In an apparatus for refining metals, a kettle adapted to contain molten metal, a mixing-chamber, a support for said mixing-chamber carried by said kettle, a pump carried by said support and positioned near the bottom of said kettle, said pump being adapted to remove metal from the lower portion of said kettle and discharge the same into said mixing-chamber, a rotating member in said mixing-chamber, means for rotating said member, means for discharging said molten metal upon said rotating member whereby it is caused to form a thin film thereon, and means for discharging a reagent onto said rotating member whereby it is mixed with said film.

6. In an apparatus for refining metals, a kettle adapted to contain molten metal, a mixing-chamber, a support for said mixing-chamber carried by said kettle, a pump carried by said support and positioned near the bottom of said kettle, said pump being adapted to remove metal from the lower portion of said kettle and discharge the same into said mixing-chamber, a rotating member in said mixing-chamber, means for rotating said member comprising a train of gears, means for protecting said gears from the material within said chamber, means for discharging said molten metal upon said rotating member whereby it is caused to form a thin film thereon, and means for discharging a reagent onto said rotating member whereby it is mixed with said film.

7. In an apparatus for refining metals, a kettle adapted to contain molten metal, a mixing-chamber, a support for said mixing-chamber carried by said kettle, a pump positioned near the bottom of said kettle, a motor for driving said pump, said pump being adapted to remove metal from the lower portion of said kettle and discharge the same into said mixing-chamber, a rotating member in said mixing-chamber, means for rotating said member comprising a train of gears driven by said motor, means for protecting said gears from the material within said chamber, means for discharging said molten metal upon said rotating member whereby it is caused to form a thin film

thereon, and means for discharging a reagent onto said rotating member whereby it is mixed with said film.

8. In an apparatus for refining metals, a kettle adapted to contain molten metal, a mixing-chamber, a support for said mixing-chamber carried by said kettle, a pump carried by said support and positioned near the bottom of said kettle, a motor carried by said support for driving said pump, said pump being adapted to remove metal from the lower portion of said kettle and discharge the same into said mixing-chamber, a rotating member in said mixing-chamber, means for rotating said member comprising a train of gears driven by said motor, means for protecting said gears from the material within said chamber, means for discharging said molten metal upon said rotating member whereby it is caused to form a thin film thereon, and means for discharging a reagent onto said rotating member whereby it is mixed with said film.

9. In an apparatus for refining metals, a kettle adapted to contain molten metal, a mixing-chamber, a support for said mixing-chamber carried by said kettle, a pump carried by said support and positioned near the bottom of said kettle, a motor carried by said support for driving said pump, said pump being adapted to remove metal from the lower portion of said kettle and discharge the same into said mixing-chamber, a rotating member in said mixing-chamber, means for rotating said member comprising a train of gears driven by said motor, means for protecting said gears from the material within said chamber, means for discharging said molten metal upon said rotating member whereby it is caused to form a thin film thereon, means for discharging a reagent onto said rotating member whereby it is mixed with said film, and means for discharging said materials from the lower portion of said chamber into said kettle.

10. In an apparatus for refining metals, a kettle adapted to contain molten metal, a mixing-chamber, a support for said mixing-chamber carried by said kettle, a pump carried by said support and positioned near the bottom of said kettle, a motor carried by said support for driving said pump, a rotating member in said mixing-chamber, means for rotating said member comprising a train of gears driven by said motor, a housing for protecting said gears from the material within said chamber, a pipe for receiving metal from said pump and discharging said metal upon said rotating member whereby it is caused to form a thin film thereon, means for discharging a reagent onto said rotating member whereby it is mixed with said film, and means for discharging said materials from the lower portion of said chamber into said kettle.

11. In an apparatus for refining lead, a kettle adapted to contain molten lead, a mixing-chamber, a support for said mixing-chamber carried by said kettle, a pump carried by said support and positioned near the bottom of said kettle, a motor carried by said support for driving said pump, a rotating member in said mixing-chamber, means for rotating said member comprising a train of gears driven by said motor, a housing for protecting said gears from the material within said chamber, said pump being adapted to pass a stream of molten lead over said rotating member whereby it is caused by centrifugal force to flow in a thin film thereover, a hopper for containing and discharging sulphur onto said rotating member whereby it is mixed with said film, and a discharge pipe in the lower portion of said chamber for reintroducing said materials into said kettle.

In testimony whereof I have hereunto set my hand.

HERBERT W. YORK.