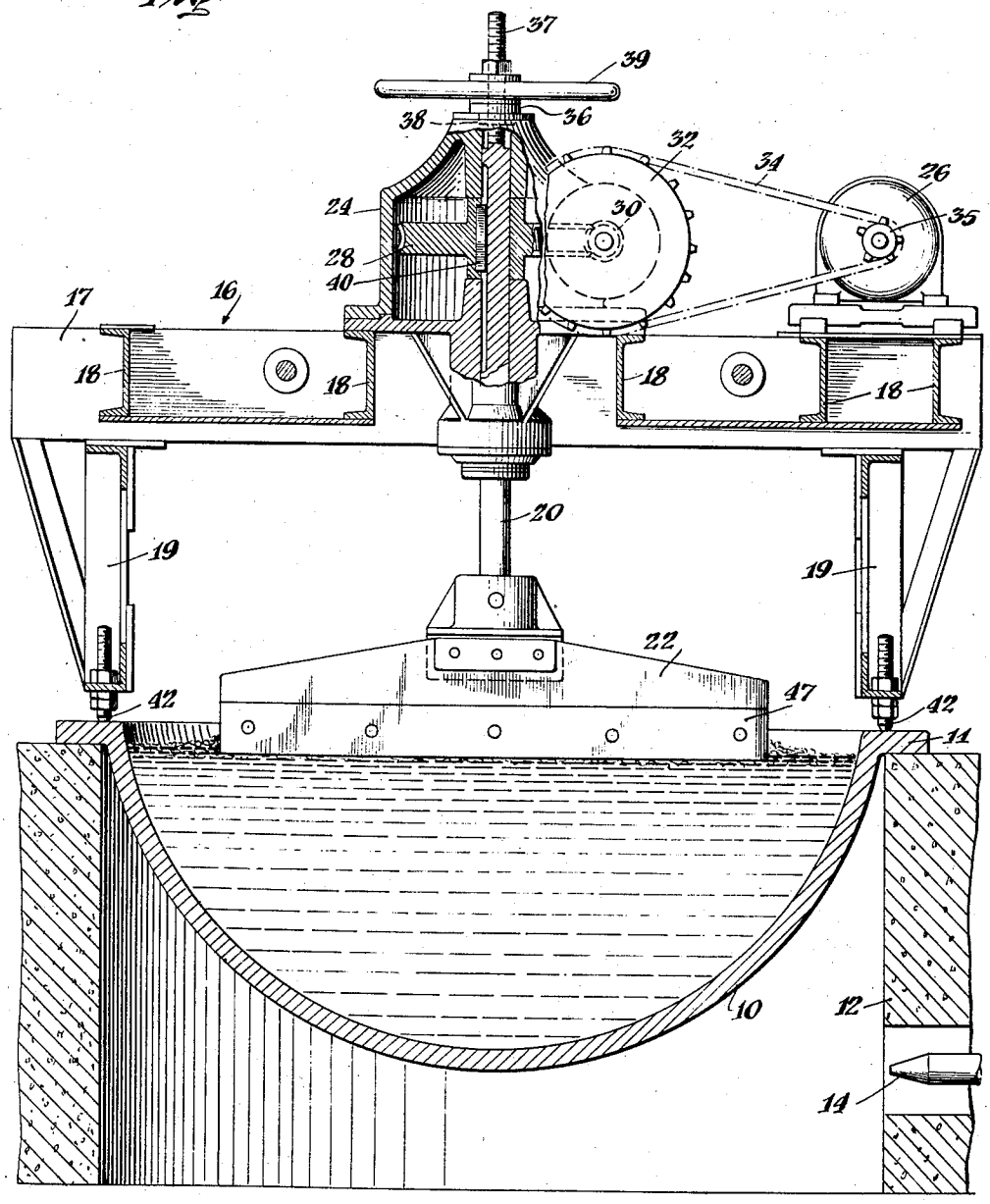
May 30, 1944. T. R. LISTER 2,349,972

APPARATUS FOR REFINING METALS AND ALLOYS

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Fig. 1



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Fig. 3

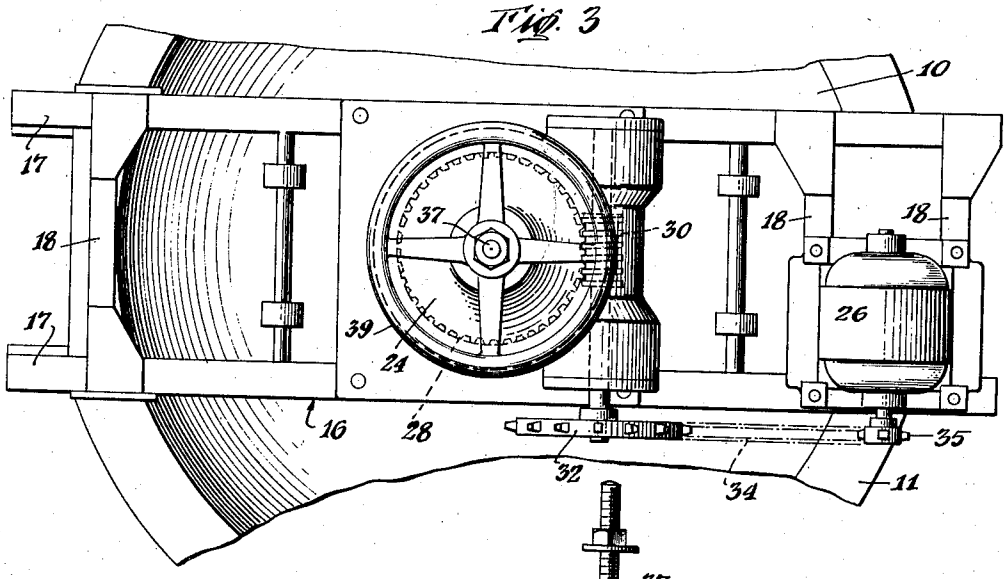
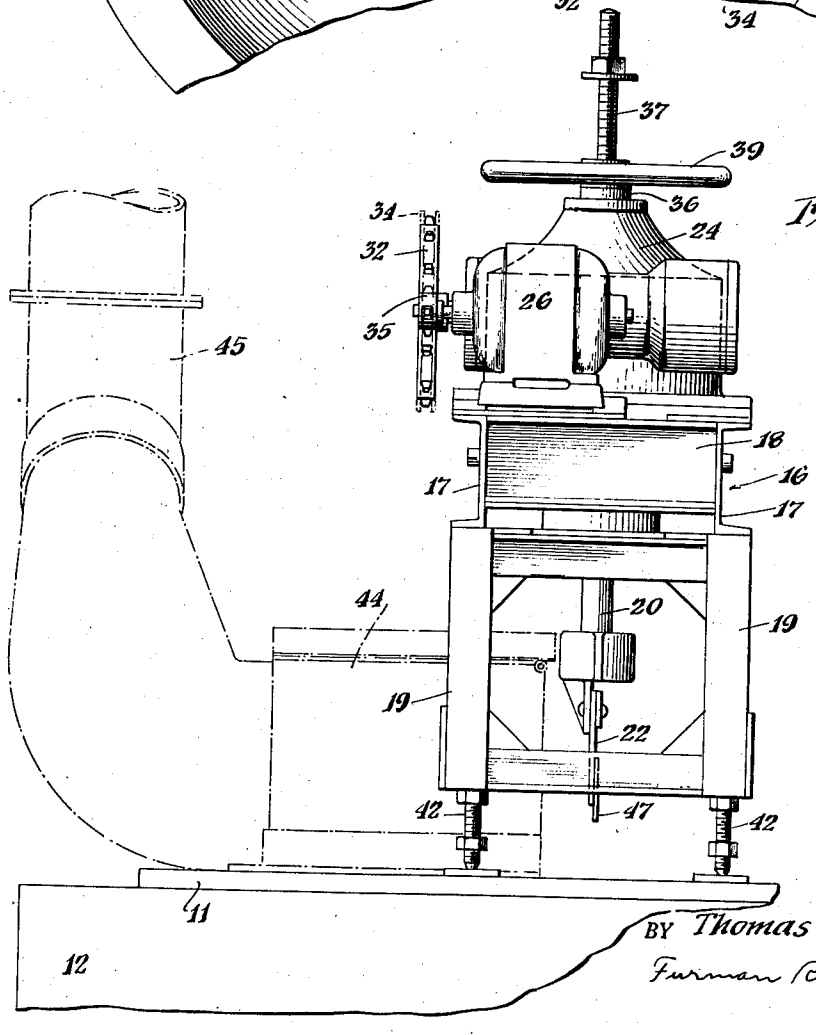


Fig. 2



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2,349,972

APPARATUS FOR REFINING METALS AND ALLOYS

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Application February 25, 1943, Serial No. 477,101

4 Claims. (Cl. 266—37)

This invention relates to the refining of metals or alloys and particularly to an improved apparatus for treating molten metal to effect the removal of undesirable ingredients which may be present in relatively small percentage amounts.

In the production of metals known commercially as type metal, babbitt, solder, terne, etc., and which consist principally of lead, tin and alloys thereof, it has been observed that the presence of various impurities, such as, sulphur, metallics, oxides, sulphides, etc., even in small amounts, i. e. on the order of 0.01% or less, substantially alters the physical properties of the finished metal and, in general, tend to produce inferior metal products. These undesirable ingredients, when present in very low concentrations, are not removed by the conventional liquation and drossing treatments. It has recently been discovered, however, that these residual impurities can be readily removed by subjecting a molten bath of the metal to be refined to a simultaneous liquation and continuous skimming treatment until the undesirable ingredients have been separated from the body of the melt and occluded in the dross or skimmings.

An object of my invention is to provide an improved apparatus for carrying out the aforesaid liquation and continuous skimming process.

Another object is to provide a metallurgical apparatus which is especially useful in connection with the refining of molten metals or alloys to mechanically separate residual impurities therefrom and produce a finished product of greater purity than has been possible heretofore with the conventional liquation and drossing metallurgical equipment.

A further object is to devise a relatively simple, inexpensive but effectual apparatus for refining metals and alloys which comprises a receptacle for holding molten metal having a skimmer mechanism detachably or fixedly arranged thereover, the mechanism being adapted to be operated continuously while the molten metal is maintained at such a temperature that the ingredients to be removed tend to separate from the melt and rise to the surface where they are gathered up with the skimmings.

The apparatus of the invention may be utilized to produce a metal or alloy of high purity wherein the impurities have been substantially entirely removed or their content lowered to a desired minimum.

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 further 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 vertical section view of the apparatus of the invention,

Fig. 2 is an end elevation of the apparatus showing its relative position with respect to the kettle and hood arrangement for carrying away vapor or fumes,

Fig. 3 is a plan view of the apparatus illustrated in Fig. 1.

Referring to the drawings in detail wherein like reference characters denote like parts throughout the drawings, 10 represents a receptacle, such as a kettle, for holding molten metal and which may be made of any suitable material. The kettle is supported along its flange or rim portion 11 by the furnace wall means 12 which is provided with suitable means for heating the kettle as generally illustrated at 14. Mechanism for mechanically processing the melt is arranged thereover, as shown in Fig. 1, and comprises a suitably rigid frame means 16 composed of the horizontally extending beams 17, cross frame members 18 and depending leg means 19, the latter being arranged to rest on the rim or ledge 11 of the kettle. Mounted on the frame means 16 is a vertically disposed shaft 20 upon the lower end of which is attached a skimmer blade or paddle means 22.

The shaft 20 is rotatively supported on the housing 24 which is disposed centrally of the frame 16, being suitably fastened thereto. A motor 26, mounted on the frame 16, is adapted to drive the worm 30, sprocket 32 and interconnecting roller chain drive means 34 running over the motor driven pulley wheel 35. The drive reduction ratio is such that the peripheral speed of the blade 22 can be maintained at about 40 to 45 R. P. M.

To provide for vertical adjustment of the blade 22, the shaft 20 comprises a threaded portion 37 which is arranged to pass upward through an opening 38 in the housing and receive the handwheel member 39 in threading engagement. During operation the handwheel is suitably fixed to the shaft portion 37 and turns therewith, the handwheel, shaft 20 and associated mechanism being supported for rotation by a suitable bearing member 36, as diagrammatically shown in Fig. 1. To raise or lower the blade 22, the handwheel 39 is loosened and turned so as to advance

the threaded shaft portion 37 in or out of the housing 24 as desired.

Relative movement between the shaft 20 and worm wheel 28 is permitted, while the parts are retained drivingly connected, by utilizing an elongated key means 40. Each leg member 19 is provided with a levelling screw means 42 so that the apparatus can be made to set level and the blade 22 evenly engage and skim the surface of the melt during use. The leg members 19 are spaced longitudinally of the frame means 17 to permit the apparatus to be positioned centrally over the kettle and operated without interfering with the canopy or hood means 44 which extends over a portion of the kettle and communicates with a stack means 45 as illustrated in Fig. 2. The lowermost part of the skimmer blade 22 which is adapted to contact the molten metal preferably comprises a stainless steel strip 47. This strip is bolted or otherwise suitably secured to the blade 22, a illustrated in Fig. 1.

In use the metal to be refined is placed in the receptacle 10 and heated to form a melt. The skimmer blade means 22 is then adjusted so that the lowermost portion or strip member 47 dips into the surface of the melt. While the melt is maintained at a temperature suitable to cause liquation, the skimmer means 22 is slowly and continuously rotated brushing aside the skimmings.

As this operation continues the undesirable ingredients migrate or float to the surface of the melt and are mechanically occluded in the skimmings which is formed repeatedly upon exposure of fresh metal. The rotational speed of the blade or paddle 22 used depends primarily on the surface area of the melt being treated and in each case is regulated so that the dross and skimmings formed are repeatedly scraped aside to expose fresh metal to oxidation. During this treatment the body of the melt is not agitated or stirred and is maintained at a liquation temperature such that the impurities or substances to be removed therefrom tend to separate out and move upwardly into contact with the skimmings whereby they are mechanically gathered up therewith and pushed aside by the rotating skimmer blade means. This procedure is continued until tests indicate the metal is of the desired purity.

The apparatus which I have devised is adapted for treating a wide variety of metals and alloys to remove residual impurities and the invention has found particular utility in treating linotype and stereotype metals to lower the sulphur content to below 0.0001%. The invention also provides a simple and efficient mechanical means for separating aluminum, zinc, nickel, tellurium and selenium, from lead, tin and lead-tin alloys. Hence, by utilizing the apparatus of this invention the undesirable ingredients, which may be present in very low concentrations, can be mechanically separated from the molten metal without the use of addition reagents which, besides being costly, introduce other foreign substances, requiring removal.

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

What is claimed is:

1. In liquating and skimming metallurgical apparatus for refining metals and alloys, receptacle means for holding a molten bath of the metal to be refined, frame means disposed over said receptacle, skimming means arranged on said frame comprising a vertically-disposed shaft and a horizontally-disposed skimmer depending therefrom, means for rotating said skimmer in a horizontal plane while in contact with the surface of said melt to repeatedly brush aside dross and skimmings which form thereon, and means for supplying heat to said bath to maintain said metal at a temperature such that the impurities in said melt will tend to separate from the body of the melt and rise to the surface.

2. In liquating and skimming metallurgical apparatus, a receptacle for holding metal or alloy to be refined in a liquid liquating state, means comprising a vertically adjustable paddle for engaging the surface of the melt concurrently as said melt is being liquidated, means for rotating said paddle at a predetermined speed to cause the dross and skimmings collected on the surface of the melt to be brushed aside to repeatedly expose fresh metal to oxidation, said paddle being carried by a rotatable shaft, said shaft being adapted to be driven at different vertical settings whereby said paddle can be arranged to engage the surface of said melt and scrape the skimmings aside without disturbing the body of the melt.

3. Metallurgical refining equipment having a frame adapted to rest upon a receptacle for holding molten metal, mechanism comprising a vertically adjustable shaft arranged over said receptacle, a horizontally-disposed blade carried by said shaft for engaging the surface of molten metal disposed in said receptacle, and means for rotating said shaft at a predetermined speed to cause said blade to scrape aside the skimmings and repeatedly expose fresh metal, and means for adjusting the position of said mechanism with respect to said receptacle.

4. Apparatus for treating molten metal comprising a kettle adapted to contain a bath of said metal, a framework adapted to rest upon the rim of said kettle, said framework carrying a rotatable mechanism including a depending means for skimming the surface of the metal bath and brushing aside the dross to repeatedly expose fresh molten metal to the bath surface, a motor carried by said framework operatively connected to drive said depending skimmer means, said depending skimmer means being vertically adjustable without disconnecting said driving motor and interconnected operating means, and means for levelling said mechanism while it rests on said kettle.

THOMAS R. LISTER.