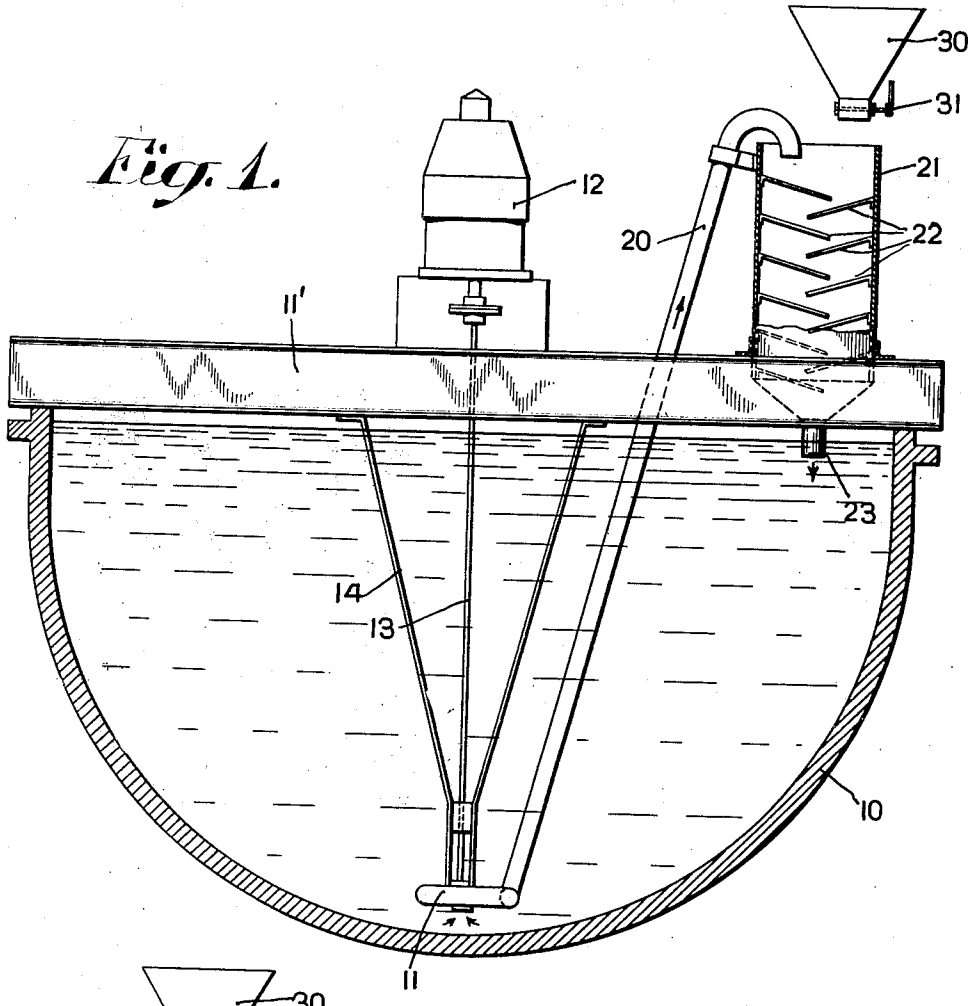
Oct. 29, 1929. H. W. YORK 1,733,522

APPARATUS FOR REFINING METALS

Filed Feb. 9, 1927

Fig. 1.



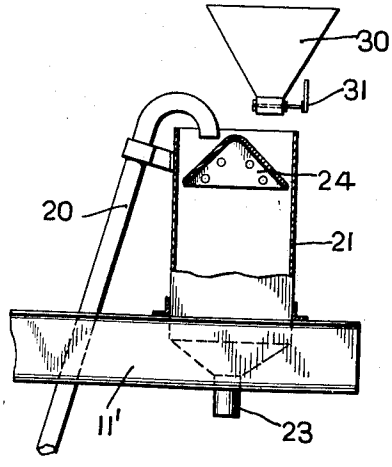


Fig. 2.

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APPARATUS FOR REFINING METALS

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This invention relates to metal refining, and, more particularly, to a method and apparatus for removing impurities from molten metals by the addition of a suitable reagent thereto.

The invention relates more specifically to the refining of metals by passing them, in a molten condition, over a suitable surface to form a thin film, and adding the reagent to said film.

The invention further consists in the new and novel features of operation and the new and original arrangements and combinations of steps in the process hereinafter described and more particularly set forth in the claims.

In certain types of metallurgical processes, for example in the refining of lead, it is desirable to remove impurities by the addition of a suitable reagent for uniting with the impurities to produce a compound which floats upon the surface of the molten metal as a dross. In lead refining, impurities such as copper may be removed as a dross by reacting the molten metal with sulphur under suitable conditions for causing the sulphur to readily unite with the copper content of the metal.

In accordance with the present invention, which will be described as applied to the removal of copper from lead by the addition of sulphur, although it is applicable generally to processes requiring the addition of a reagent to a fluid substance, the molten metal is caused to pass, in a comparatively thin film, over a suitable surface. The reagent may be added to the flowing film, which presents a large surface area per unit of mass, and, by reason of the thin film, may be brought into intimate contact with the various portions of the metal. It may be further mixed with the metal by causing agitation of the film before returning the same to the bath.

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 representation of one form of apparatus which may be employed in carrying out this process; and,

Fig. 2 represents a modified form of mixing-chamber which may be employed therein.

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 figures more in detail, the material to be treated, such as molten lead, may be contained in a suitable kettle 10, which is adapted to be heated by a furnace or other means (not shown). Molten metal may be removed from kettle 10 by means of centrifugal pump 11, which is supported in the lower portion of said kettle from beam 11′, extending across and resting upon the rim of said kettle. Pump 11 may be driven by motor 12, which is supported by and carried upon said beam, and is driven by means of rod 13 connecting said motor and said pump. Suitable bracing means 14 may be employed, if desired, for maintaining pump 11 in the desired position.

The molten metal may be discharged by said pump through pipe 20 into a reaction or mixing chamber 21. Chamber 21 may be provided with a series of baffle-plates 22, which are inter-leaved in such manner that metal, in flowing from pipe 20 over the various successive plates, falls from one plate to another and is agitated in so doing. The area of said baffle-plates 22 should be such that the metal introduced from pipe 20 may flow in a comparatively thin film thereover. After flowing over the various baffle-plates, the metal may be discharged into kettle 10 by means of discharge pipe 23, which preferably extends a comparatively small distance below the surface of the metal contained therein whereby agitation of the metal is prevented.

The required reagent may be added to the metal in the reaction-chamber by any suit-

able means, such as by hopper 30, the rate of addition of said reagent being controlled by valve mechanism 31 in the lower portion of said hopper.

By means of this process, a reagent may be added to the metal during the refining process without causing agitation of the mass of metal or interfering with the formation of the dross on the surface thereof. Furthermore, a complete reaction may be had with each part of the metal, due to the intimate contact obtained between the reagent and the metal itself, which ensures the efficient removal of the undesired substances without the use of an excessive quantity of reagent.

By removing the metal in small quantities from the mass of metal present in the kettle and acting upon the small quantity removed independently of the remaining portions, the rate of the reaction may be controlled practically independently of the total amount of metal present, and the quantity of reagent required for the removal of impurities may be determined by the rate of flow rather than by the total amount of metal present.

By mixing the flowing stream of metal with the reagent in the reaction-chamber, it is possible to obtain a much more intimate contact between the various elements than would be possible by introducing the reagent into the mass of molten metal itself. Furthermore, should the reagent be introduced directly into the molten metal, it would be necessary to provide suitable means for agitation in order to cause a complete reaction over the entire mass.

In Fig. 2, the various parts corresponding to parts shown in Fig. 1 are given corresponding reference numbers. Reaction-chamber 21 in Fig. 2, however, instead of being provided with a series of baffle-plates 22, contains an inverted cone 24, over the surface of which the metal discharged from pipe 20 is caused to flow and is mixed with the reagent which may be discharged from hopper 30. The reaction between the metal and the reagent is facilitated in this case by producing a thin film over the surface of inverted cone 24 and by allowing the metal to drop, in the form of a comparatively fine spray, from the edges of said cone to the lower part of reaction-tank 21. The action of the various elements when passed through the apparatus shown in Fig. 2 will be similar to that described in connection with Fig. 1, the thin film and fine spray being employed for permitting an intimate contact between the various parts of the metal and the reagent.

In the drawings accompanying and forming part of this specification, a practical commercial embodiment of the invention is disclosed, but as such illustration is primarily for purposes of disclosure, it will be understood that the structure may be modified in various respects without departure from the broad spirit and scope of the invention as hereinafter defined and claimed.

What is claimed is:

1. An apparatus for the refining of lead comprising a kettle adapted to contain the molten lead, a reaction chamber, means for supporting said chamber on said kettle, a pump located in the lower portion of said kettle and supported from said supporting means, said pump being adapted to withdraw metal from said kettle and to discharge the same in the said reaction-chamber, and a series of inter-leaved baffle-plates in said chamber, the rate of discharge of said metal being such that a thin film of molten lead is formed over the surface of said plates.

2. An apparatus for the refining of lead comprising a kettle adapted to contain the molten lead, a reaction-chamber, means for supporting said chamber on said kettle, a pump located in the lower portion of said kettle and supported from said supporting means, said pump being adapted to withdraw metal from said kettle and to discharge the same in the said reaction-chamber, a series of inter-leaved baffle-plates in said chamber, the rate of discharge of said metal being such that a thin film of molten lead is formed over the surface of said plates, means for adding a reagent to said film, and means for collecting and discharging said metal and said reagent into said kettle.

3. An apparatus for refining metals, comprising, in combination, a container in which the metal is heated to the molten condition, means to continuously withdraw a stream of the molten metal from the container, a reaction chamber, baffle construction associated with the reaction chamber to convert the stream of molten metal into a relatively thin film and means to add a potentially reactive solid to the film of metal.

4. An apparatus for refining metals comprising, in combination, a container in which the metal is heated to molten state, a reaction chamber, means to withdraw molten metal from the container and discharge it to the reaction chamber, baffle plates associated with the chamber to spread the molten metal into a film, means to add a potentially reactive solid to the film, and means to discharge the metal from the reaction chamber to the container and below the liquid level therein.

In testimony whereof I have hereunto set my hand and seal.

HERBERT W. YORK.