Feb. 27, 1934. K. A. LINDNER 1,949,391

DEZINCING MACHINE

Original Filed Aug. 22, 1930

Fig. 1

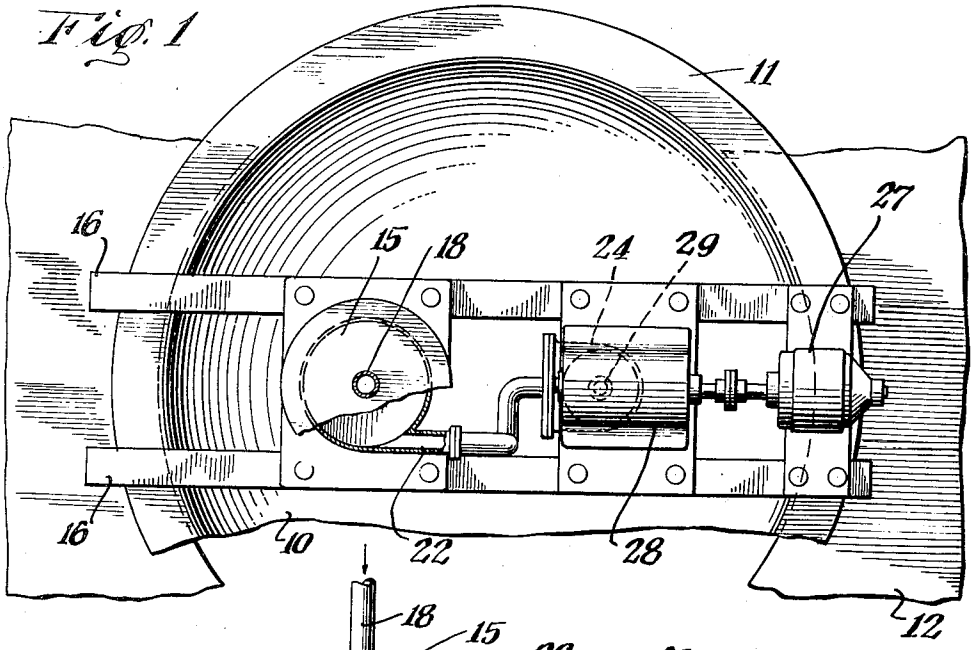
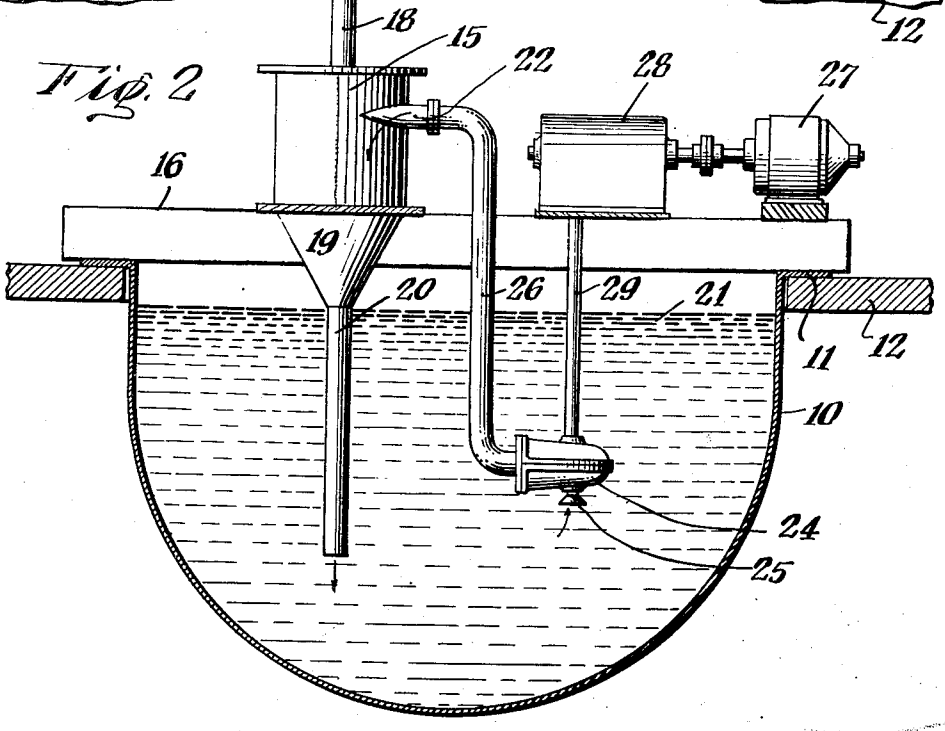


Fig. 2



Inventor
Karl Arden Lindner
By his Attorneys
Austin & Dick

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DEZINCING MACHINE

Karl Arden Lindner, Perth Amboy, N. J., assignor to American Smelting & Refining Company, New York, N. Y., a corporation of New Jersey

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11 Claims. (Cl. 266—34)

This invention relates to metal refining, and more particularly to an apparatus for introducing a gaseous reagent into a liquid, such as a molten metal.

The invention particularly provides for the introduction of chlorine into a bath of molten lead for the removal of impurities, such as zinc, as for example, in accordance with the process disclosed in the patent of Jesse O. Betterton, Patent No. 1,792,210, dated February 10, 1931, for Method for dezincing lead. For this purpose a cylindrical reaction chamber is provided into into which the gaseous chlorine is introduced. A stream of lead is pumped out of the bath of molten metal and is applied to the reaction chamber tangentially whereby it is caused to whirl therein and to come into intimate contact with the chlorine.

The reaction chamber is also provided with a conical base which extends almost to the level of the molten metal. This permits the slag to be washed out of the chamber by means of the molten metal and prevents the apparatus from becoming clogged. Furthermore, the construction permits the apparatus to be started when the lead is at a temperature just above the melting point thereof, inasmuch as danger of lead freezing in the chamber and interrupting the operation of the apparatus is avoided.

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

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 drawing forming a part thereof, in which

Fig. 1 is a plan view of a kettle showing the refining apparatus applied thereto; and

Fig. 2 is a side elevation of the apparatus showing the kettle in section and illustrating the relative position of the different elements.

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

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 drawing more in detail the invention is shown as applied to a kettle 10 which is supported by a rim 11 from any suitable framework 12 and may be heated in any manner well-known in the art.

The refining apparatus comprises a cylindrical reaction chamber 15 which is supported on a pair of beams 16 extending across the kettle and resting on the rim thereof. Said chamber 15 is provided with a gas inlet pipe by means of which the gaseous reagent may be applied thereto and has a conical bottom 19 terminating in a discharge pipe 20 which extends below the surface of the bath 21 whereby the molten metal may completely react with the gaseous reagent and escape of said reagent from the top of the bath is avoided.

The reaction chamber is also provided with a tangential inlet pipe 22 by means of which the molten metal is pumped into the chamber and caused to whirl around therein and to be broken up into small particles whereby an increased surface contact between the metal and the gaseous reagent is obtained. For removing a stream of metal from the bath and applying the same to inlet pipe 22 a pump 24 is provided, preferably of the centrifugal type, having an intake 25 and a discharge pipe 26 which extends from said pump into engagement with pipe 22. Pump 24 is driven by motor 27 through a reducing gear 28 and a driving shaft 29 which are all mounted on beams 16. Said driving shaft serves to support the pump, whereby the entire mechanism including the reaction chamber 15, pump 24, motor 27 and gear 28 may be removed from the kettle as a unit.

In the operation of the above described apparatus in connection with the dezincing of lead the pump may be started when the lead has been heated to a comparatively low temperature, as for example, 635° F. Since the discharge pipe 20 is immersed in the molten lead and the level of the molten lead practically reaches the conical base 19 there is but little tendency for the metal within the chamber to freeze when the apparatus is started, even though it is applied to the bath at a temperature not greatly above the melting point thereof.

In reacting lead with chlorine a considerable amount of heat is evolved and the temperature of the bath gradually increases. It is accordingly an advantage to start the apparatus at as low a temperature as possible in order to complete the dezincing operation before the bath has reached an excessively high temperature. The operation should preferably be discontinued when the lead reaches a temperature of approximately 775° F. inasmuch as above this temperature the tendency of the lead to react with the chlorine is increased

and the zinc chloride slag tends to be volatilized.

The tangential feed of the lead breaks up the flow of the metal and allows an intimate contact to be made with the chlorine. Furthermore, the tangential flow on the side of the chamber removes all slag particles and maintains the chamber free therefrom. It is obvious that the centrifugal force resulting from the pumping of the metal in a tangential direction against the curvilinear surface of the chamber combined with the force of gravity will cause the metal to follow a substantially spiral path against the walls of the chamber and to spread out and form a substantially continuous surface thereover. A continuously changing cylinder of metal is thus provided which serves as a lining for the chamber and shields the walls from contact with the reagent. The gaseous reagent within the cylinder contacts with the exposed surface of this metal lining and the products of the reaction, which are lighter than the metal itself, are separated therefrom by the centrifugal action of the moving metal and are caused to segregate toward the center of the chamber, thereby forming essentially an inner cylindrical coating which is drawn downwardly as a continuous core at the bottom of the chamber. This core is withdrawn as such through discharge pipe 20 into the sub-adjacent bath of metal and is permitted to float to the surface of said bath. Due to the fact that slag or reaction products are initially separated and agglomerated in the reaction chamber there is substantially no dispersion of slag particles through the bath of treated metal and a substantially complete separation of the two products is thereby facilitated.

It will be noted that the moving lining of molten metal and slag forms a protective coating over the inner surface of the chamber and thereby prevents the reactive gas from coming into contact with the metal walls and reduces the amount of corrosion which would otherwise take place due to the corrosive properties of the reactive gas. This materially increases the life of the reaction chamber and decreases the maintenance cost. Furthermore, the products of the reaction are swept out of the chamber, together with the unreacted metal and are prevented from accumulating at the bottom of the chamber and clogging the same or otherwise interfering with the operation of the apparatus.

By pumping the lead at the side and exposing a large surface to the chlorine, it is possible to admit the chlorine at a comparatively rapid rate. For example, in a particular installation using a 100 ton kettle the chlorine was admitted at an average rate of 510 lbs. per hour. During the first two hours when the charge is saturated with zinc a larger quantity is admitted, for example, 600 lbs. per hour, but as the zinc becomes depleted the rate of feed of chlorine is reduced to prevent it from escaping through the outlet pipe 20. When the zinc has been depleted to .02% less zinc chloride begins to form and indicates to the operator that the charge has been completely dezinced. At this point the chlorine is shut off and the lead flow continued until all slag has been washed from the chamber.

The above apparatus has been particularly described as applied to the dezincing of lead by the introduction of chlorine and the formation of zinc chloride. However, it is not to be limited to this use, but is suitable for the reaction of various gases with a liquid. The above use has been described by way of illustration only.

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 reacting a gas with a liquid comprising a container adapted to hold a bath of said liquid, a circular reaction chamber, adapted to receive a gaseous reagent, a tangential inlet means associated with said chamber, means for removing portions of said liquid from said container and introducing the same into said chamber through said tangential inlet means so that the liquid is caused to whirl in said chamber and present a large surface to the action of the gas, and a discharge means associated with said chamber and extending a substantial distance below the surface of the liquid in said container so that escape of unreacted gas is prevented.

2. An apparatus for reacting a gas with a liquid comprising a cylindrical reaction chamber adapted to receive the gaseous reagent, a tangential inlet pipe associated therewith, means for applying liquid to said chamber through said inlet pipe so that the liquid is caused to whirl in said chamber and present a large surface to the action of the gas, said reaction chamber having a conical bottom terminating in a discharge pipe, said bottom permitting the chamber to be swept free from reaction products, whereby clogging of the apparatus is prevented.

3. An apparatus for reacting a gas with a liquid, comprising a container adapted to hold a bath of said liquid, a cylindrical reaction chamber adapted to receive the gas, tangential inlet means associated with said chamber, means for removing portions of said liquid from said container and applying the same to said chamber through said tangential inlet means so that the liquid is caused to whirl in said chamber and present a large surface to the action of the gas, said cylindrical reaction chamber being mounted with its axis vertical and having a conical bottom terminating in a discharge means extending below the surface of the liquid in said container, said conical bottom permitting the chamber to be swept free from reaction products whereby clogging of the apparatus is prevented, said discharge means terminating a substantial distance below the liquid level in said container so that escape of unreacted gas is prevented.

4. An apparatus for refining molten metals comprising a cylindrical reaction chamber adapted to receive a gaseous reagent, a tangential supply pipe associated with said chamber and means for applying molten metal to said tangential supply pipe so that the metal is caused to whirl about in said chamber and to present a substantially continuous surface within said chamber and to shield the metal walls of said chamber from heated gas for reaction with the gas.

5. An apparatus for refining molten metals comprising a closed reaction chamber adapted to receive a gaseous reagent, a tangential supply pipe associated with said chamber and a pump adapted to remove molten metal from below the surface of a bath of said metal and apply the same to said tangential supply pipe whereby the metal is caused to whirl about in said chamber and to present a large surface for reaction with the gas, said chamber having a conical base ter-

minating adjacent the surface of said bath into a discharge pipe, the bath serving to heat said base so that freezing of the molten metal is prevented when the initial temperature of said metal is only slightly above the melting point thereof, said conical base permitting the reaction chamber to be swept free from reaction products.

6. An apparatus for applying a gaseous reagent to a bath of molten metal comprising a reaction chamber having a curvilinear surface and adapted to receive said reagent, a tangential supply pipe associated with said chamber, a pump immersed below the surface of said bath and adapted to feed molten metal from said bath through said supply pipe to said chamber so that a substantially continuous lining of molten metal is formed over said curvilinear surface, said chamber having a conical base terminating adjacent the surface of said bath in a discharge pipe which extends substantially below said surface, the heat of said bath serving to heat the lower part of said chamber and preventing the molten metal from freezing therein when the apparatus is started, the discharge pipe serving to prevent escape of excess gas, the arrangement being such that the whirling metal in said chamber separates the reaction products from the metal and discharges the same into said bath.

7. An apparatus for applying a gaseous reagent to a bath of molten metal comprising a closed reaction chamber having a curvilinear surface and adapted to receive said reagent, a tangential supply pipe associated with said chamber, a pump immersed below the surface of said bath and having a discharge pipe connected to said supply pipe and adapted to remove the molten metal from said bath and apply the same tangentially to said chamber whereby a substantially continuous coating of molten metal is formed over the surface of said chamber and an intimate contact between said metal and said gas is obtained, said chamber having a base terminating adjacent the surface of said bath in a discharge pipe which extends substantially below said surface, the heat of said bath serving to heat the lower part of said chamber and preventing the molten metal from freezing therein when the apparatus is started, the discharge pipe serving to prevent escape of excess gas, the arrangement being such that the whirling metal in said chamber carries away the reaction products and leaves the chamber in a substantially clean condition, a framework mounted over said bath, said chamber and said pump being supported on said framework, and a driving mechanism for said pump also mounted on said framework whereby said apparatus may be removed as a unit.

8. A reaction chamber for reacting a liquid and a gas comprising a chamber having a curvilinear surface and adapted to receive said gas, means for tangentially applying liquid to said chamber and causing said liquid to spread out over the walls thereof, said chamber having a conical base from which said liquid together with the reaction products is discharged.

9. A reaction chamber for reacting a liquid and a gas comprising a chamber having a curvilinear surface, means for applying said gas to said chamber and means for applying said liquid to said chamber, said means causing said liquid to spread out over the surface thereof and to shield the surface from contact with said gas and to present a large surface area to said gas whereby the reaction therewith is facilitated, and means for withdrawing said liquid and the products of reaction from said chamber.

10. A device for reacting a liquid and a gas comprising a chamber having a curvilinear surface, means for applying said gas in controlled quantities to said chamber, means for applying said liquid to said chamber, said means causing the same to flow around said surface in a substantially spiral path and to spread out and substantially cover said surface and shield the same from contact with said gas, the centrifugal force of said liquid due to the flow of said liquid around the walls of said chamber causing the products of reaction to substantially separate therefrom, and means for continuously withdrawing said liquid and said products of reaction while maintaining them in said substantially separated condition.

11. A device for reacting a liquid and a gas comprising a chamber, means for applying said gas in controlled quantities to said chamber, means for applying said liquid to said chamber, said means causing said liquid to spread out and substantially cover said surface and shield the same from contact with said gas, and means for substantially separating the products of reaction from said liquid, and means for continuously withdrawing said liquid and said products of reaction while maintaining them in said substantially separated condition.

KARL ARDEN LINDNER.