Oct. 27, 1925. 1,559,342

R. MATTICE

METHOD OF AND APPARATUS FOR PURIFYING MOLTEN METAL

Filed Aug. 21, 1925

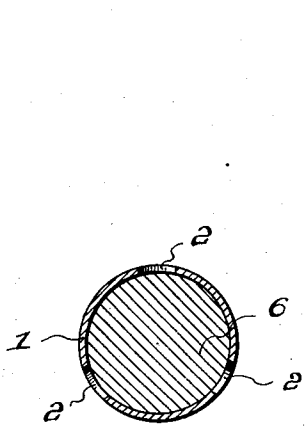

Fig. 4

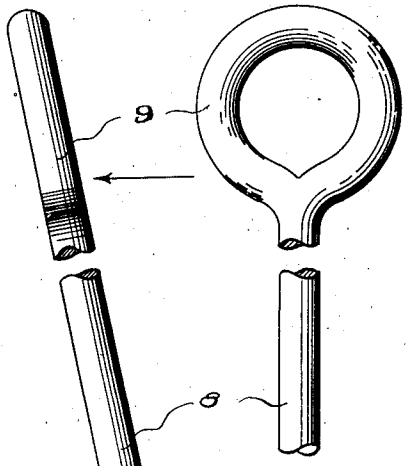

Fig. 2

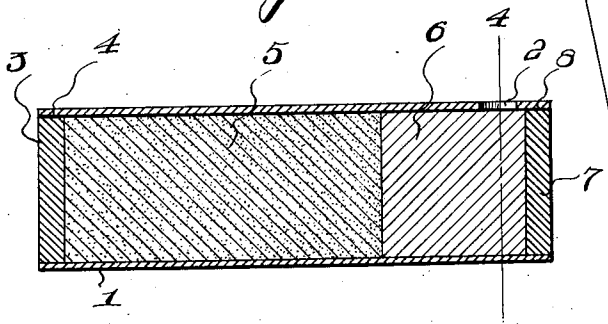

Fig. 3

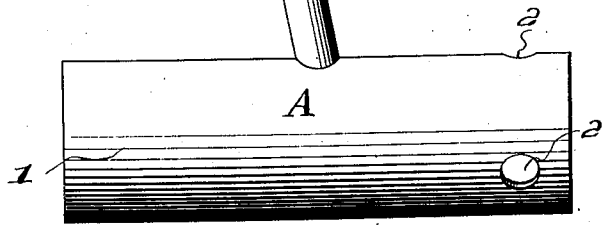

Fig. 1

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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR PURIFYING MOLTEN METAL.

Application filed August 21, 1925. Serial No. 51,657.

To all whom it may concern:

Be it known that I, ROYAL MATTICE, a citizen of the United States of America, residing at Bethlehem, in the county of Northampton and State of Pennsylvania, have invented certain new and useful Improvements in Methods of and Apparatus for Purifying Molten Metal, of which the following is a specification.

This invention relates to a method of and apparatus for purifying molten metal, and refers more particularly to the cleansing of ferrous metal and is a continuation in part of my application for method of and apparatus for purifying molten metal, filed December 23, 1924, Serial No. 757,686.

Attempts have heretofore been made to purify, cleanse or comb molten metal to remove the impurities therefrom and while the methods have been partly satisfactory the results have been more or less incomplete so far as an effectual cleansing is concerned. It is believed that the unsatisfactory results obtained by the prior methods are due principally to the fact that the impurities rise to the surface of the metal in what is commonly known as a sleazy slag, or more particularly, a stringy viscous slag which is extremely difficult to remove from the surface of the metal. Furthermore, the prior methods have been incomplete to such an extent that invariably some of the impurities have remained in the metal, such impurities eventually becoming mixed with the metal when the same is cast and hence defective castings are often times produced as a result thereof.

In the art, it is a well established fact that impurities in molten metal assume their particular specific gravity strata and unless some method or means is provided for overthrowing the balance of the impurities which are scattered through the metal in their various strata and force them to the surface of the metal, such impurities remain scattered throughout the molten metal and obviously pass off with such molten metal when the same is poured.

Attempts have been made to purify molten metal by the use of aluminum, more particularly powdered aluminum; such powdered aluminum being of a mesh less than 150. It is well known in the art that the action of such powdered aluminum is very rapid; it working almost flashily with substantially the effect of an explosion. Obviously such a rapid action cannot effectually and completely cleanse a ladle of molten metal and it has been found that a vast percentage of the impurities present in the molten metal are not removed by such methods.

It is therefore the primary object of this invention to provide a method of purifying molten metal whereby substantially all the impurities thereof may be forced to the surface of the molten metal from whence they may be removed.

It is a still further object of the present invention to provide a method of purifying or cleansing molten metal whereby the impurities therein are forced to the surface of the metal in concentrated well defined masses.

It is a still further object of the present invention to provide a method of treating molten metal to remove the impurities therefrom; the purifying action being a relatively slow one in contradistinction to the extremely rapid action of the purifying medium of prior methods.

Another object of the invention is the provision of means whereby the treatment of the molten metal by the ingredients of the present invention may be controlled with nicety.

Another object of this invention is the purification or cleansing of molten metal by metallic aluminum.

Another object of the present invention is the purification of molten metal by the employment of aluminum of a greater mesh than 150.

A still further object of the invention is the provision of a cartridge or package containing the materials necessary to effect the purification of molten metal.

Other objects and advantages of this invention will be apparent from the following description taken in conjunction with the accompanying drawings and the particular features of novelty will be pointed out in the appended claims.

In the drawings:

Fig. 1 is a side elevation of the cartridge of the present invention.

Fig. 2 is a front elevation of the upper end of the handle shown in Fig. 1.

Fig. 3 is a sectional view of the cartridge shown in Figure 1 and

Fig. 4 is a sectional view on the line 4—4 of Fig. 3.

Referring now more particularly to the

drawings, the cartridge or package containing the materials necessary to carry out the hereinafter described method is indicated generally at A and comprises mainly an open ended tubular body portion 1 having near one end thereof a plurality of apertures 2. As shown clearly in Figure 3, one end of the body portion 1 is sealed by a plate 3 which may be received within the end of the cartridge and may be welded thereto at 4. The numeral 5 indicates a powder which will be more fully described hereafter and the numeral 6 indicates a block of aluminum which is inserted adjacent the powder 5 and which is in the end of the cartridge adjacent the openings 2. The end of the cartridge adjacent the openings 2 and the aluminum 6 is sealed by a plate 7 which is preferably received within the body portion 1 and may be welded to said body portion as shown at 8.

In the drawings, and more particularly Fig. 3 the aluminum 6 is indicated as a block or cake of metallic aluminum. However this is for illustrative purposes only and the invention is not restricted to a block or cake of metallic aluminum and wherever reference appears to aluminum it is to be understood that any type of aluminum of a greater mesh than 150 is meant. This invention contemplates the use of any aluminum of a greater or coarser mesh than 150.

In Fig. 1 I have shown the cartridge A as connected to a handle 8 which terminates in a ring 9. This structure is optional and the handle is provided in order that the cartridge A may be forced to the bottom of a ladle of molten metal or that the cartridge may be raised or lowered as desired within a ladle of molten metal whereby to control to a great extent the cleansing or purification of the metal. It will be obvious that by providing a handle for the cartridge A the cartridge may be left in the molten metal as long or as short a time as desired in accordance with the metal being purified.

However, the addition of the handle is not absolutely essential in all cases and a cartridge without the handle and such as shown in Fig. 3 may be provided where it is desired to leave the cartridge at the bottom of the ladle of molten metal.

Referring now to the ingredients used in the purification of molten metal, the powder 5 comprises a mixture of borax and lime, the latter having been previously baked to expel the moisture therefrom.

The proportions of lime, borax and aluminum which are employed in the present invention may vary according to the nature of the metal which is being cleansed but as a concrete example, for purifying one ton of 30 carbon steel, I use 5.6 ounces per ton of borax and ten ounces per ton of lime. In the purification of the ton of 30 carbon steel and together with the borax and lime just mentiond, I employ 1.85 pounds per ton of aluminum of a greater or coarser mesh than 150. I have discovered that molten metal can be effectually cleansed by lime and aluminum alone but it is necessary to use a larger amount of aluminum in this method than is necessary when borax is added in the process. In other words I have found that by using borax in combination with lime I am enabled to reduce the amount of aluminum necesary in the effectual cleansing or purification of molten metal to an appreciable extent.

The proportions of lime, borax and aluminum to be used for the purification of various kinds of metal are the result of experimentation and any foundry man skilled in the art can readily ascertain the correct amounts to be used for particular kinds of metal.

In use, with the molten metal in a ladle the cartridge shown in Fig. 3 is placed on the bottom of a ladle, and the cap or seal 3 becomes loosened due to the heat of the molten metal and permits the lime and borax to trickle slowly up through the metal coagulating the impurities therein, which, as before mentioned, have assumed their specific gravity strata throughout such metal, the lime and borax carrying a large percentage of the impurities to the surface of the metal. Meanwhile, the aluminum which is adjacent the openings 2 has commenced to melt and being of lighter specific gravity than the molten metal will float to the surface of the metal and during its passage therethrough will attract to it the impurities remaining throughout the molten metal and which have not been removed by the lime and borax. In other words, the balance of these impurities will be upset, and instead of falling to the bottom of the ladle they will be carried to the surface by the aluminum. It has been found that by the use of the ingredients hereinbefore stated, the slag which is formed on the surface of the molten metal is not a stringy, viscous slag but is a slag of well defined separate and concentrated masses which can easily be removed by a foundry man with a small ladle.

While the results are as specified above, the exact chemical reactions are not apparent at this time. However, it is known that by the use of the mixture described the purifying action is a retarded one in contradistinction to the rapid flashy action present by the use of aluminum in the methods heretofore known which aluminum is of a mesh less than 150.

In the purifying methods heretofore known, that is, the rapid flashy action, a great amount of danger attended the operation of purifying metal, which danger is not present in this invention due to the fact

that the action of the materials is a retarded one.

From the above, it is believed that the invention will be fully apparent to those skilled in the art but I desire it understood that various changes may be made within the scope of the appended claims without departing from the spirit of the invention.

What I claim is:

1. An apparatus for use in purifying molten metal comprising a container having aluminum and lime therein, the aluminum being of coarser mesh than 150.

2. An apparatus for use in purifying molten metal comprising a container having aluminum and baked lime therein, the aluminum being of coarser mesh than 150.

3. An apparatus for use in purifying molten metal comprising a container having aluminum, borax, and lime therein, the aluminum being of coarser mesh than 150.

4. An apparatus for use in purifying molten metal comprising a container having aluminum, borax, and baked lime therein, the aluminum being of coarser mesh than 150.

5. An apparatus for use in purifying molten metal comprising a container having therein aluminum of coarser mesh than 150 and materials which will form a slag with aluminum oxide.

6. An apparatus for use in purifying molten metal comprising a container having aluminum therein of coarser mesh than 150, and a handle secured to said container.

7. An apparatus for use in purifying molten metal comprising a container having aluminum and lime therein, said aluminum being of coarser mesh than 150, the container having a plurality of openings therein adjacent the aluminum and exposing the same.

8. The method of purifying molten metal which includes treating the same with a mixture consisting of aluminum of a coarser mesh than 150 and a basic material.

9. The method of purifying molten metal which includes treating the same with a mixture consisting of aluminum of a coarser mesh than 150 and a basic material of such character to form a slag on the surface of the metal in well defined separate masses.

10. The method of purifying molten metal which includes treating the same with a mixture consisting of aluminum of a coarser mesh than 150, borax and lime.

11. The method of purifying molten metal which includes treating the same with a mixture consisting of aluminum of a coarser mesh than 150, borax and baked lime.

12. The method of purifying molten metal which includes treating the metal in a container successively with lime and then with aluminum of a coarser mesh than 150.

13. The method of purifying molten metal which includes treating the metal in a container successively with baked lime and then with aluminum of a coarser mesh than 150.

14. The method of purifying molten metal which includes treating the metal first with a mixture of borax and lime and subsequently with aluminum of a coarser mesh than 150.

15. The method of purifying molten metal which includes treating the metal first with a mixture of borax and baked lime and subsequently with aluminum of a coarser mesh than 150.

16. The method of purifying molten metal which comprises treating the same in a container successively with a basic material and then with aluminum of a coarser mesh than 150.

17. The method of purifying molten metal which comprises treating the same with aluminum of a coarser mesh than 150 and with materials which will form a slag with aluminum oxide.

18. The method of purifying molten metal which comprises treating the same with aluminum of a coarser mesh than 150, borax and lime whereby to form on the surface of the molten metal a slag in well defined separate masses.

19. The method of purifying molten metal which comprises treating the same with aluminum of a coarser mesh than 150 and with materials which will form a slag with aluminum oxide on the surface of the molten metal in well defined separate masses.

20. The method of purifying molten metal which includes treating the same with solid aluminum and slag forming materials, said aluminum and slag forming materials acting on said molten metal slowly.

21. The method of treating molten metal which comprises purifying the same slowly with solid aluminum and slag forming materials.

22. The method of treating molten metal which comprises purifying the same slowly with solid aluminum and materials which will form a slag with aluminum oxide.

23. The method of treating molten metal which comprises purifying the same slowly with solid aluminum of a coarser mesh than 150 and materials which will form a slag with aluminum oxide whereby to form on the surface of the molten metal a slag in well defined separate masses.

24. Apparatus for use in purifying molten metal comprising a hollow body portion closed at each end thereof and provided with a plurality of circumferentially arranged openings near one end thereof, and aluminum and a basic material within said body portion.

25. Apparatus for use in purifying molten metal comprising a hollow body portion closed at each end thereof and provided with

a plurality of circumferentially arranged openings near one end thereof, a basic material within said body portion and aluminum within said body portion and adjacent the circumferentially arranged openings.

26. Apparatus for use in purifying molten metal comprising a hollow body portion closed at each end thereof and provided with a plurality of circumferentially arranged openings near one end thereof, aluminum within said body portion and materials which will form a slag with aluminum oxide within said body portion.

27. Apparatus for use in purifying molten metal comprising a hollow body portion closed at each end thereof and provided with a plurality of circumferentially arranged openings and aluminum of a coarser mesh than 150 within said body portion.

28. Apparatus for use in purifying molten metal comprising a hollow body portion closed at each end thereof and provided with a plurality of circumferentially arranged openings and aluminum of a coarser mesh than 150 within said body portion and adjacent said openings.

29. Apparatus for use in purifying molten metal comprising a hollow body portion closed at each end thereof and provided with a plurality of openings at one end thereof, borax and lime within said hollow body portion and aluminum within said body portion and adjacent said openings.

30. Apparatus for use in purifying molten metal comprising a hollow body portion closed at each end thereof and provided with a plurality of openings at one end thereof, borax and baked lime within said hollow body portion and aluminum within said body portion and adjacent said openings.

31. Apparatus for use in purifying molten metal comprising a hollow body portion closed at each end thereof and provided with a plurality of openings at one end thereof, borax and baked lime within said body portion and aluminum of coarser mesh than 150 in said body portion adjacent said borax and lime and said openings.

32. Apparatus for use in purifying molten metal comprising a hollow body portion closed at each end thereof and provided with a plurality of openings at one end thereof, borax and lime within said body portion and aluminum within said body portion adjacent said borax and lime and said openings and a handle secured to said body portion.

33. Apparatus for use in purifying molten metal comprising a hollow body portion closed at each end thereof and provided with a plurality of openings at one end thereof, borax and baked lime within said body portion and aluminum within said body portion adjacent said borax and baked lime and said openings and a handle secured to said body portion.

34. Apparatus for use in purifying molten metal comprising a hollow body portion closed at each end thereof and provided with a plurality of openings at one end thereof, borax and baked lime within said body portion and metallic aluminum within said body portion adjacent said borax and baked lime and said openings and a handle secured to said body portion.

35. Apparatus for use in purifying molten metal comprising a hollow body portion closed at each end thereof and provided with a plurality of openings at one end thereof, borax and baked lime within said body portion and aluminum of coarser mesh than 150 in said body portion adjacent said borax and lime and said openings and a handle secured to said body portion.

36. Apparatus for use in purifying molten metal comprising a container having metallic aluminum and lime therein.

37. Apparatus for use in purifying molten metal comprising a container having metallic aluminum and baked lime therein.

38. Apparatus for use in purifying molten metal comprising a container having metallic aluminum, baked lime and borax therein.

39. An apparatus for use in purifying molten metal comprising a container having therein metallic aluminum and materials which will form a slag with aluminum oxide.

40. The method of purifying molten metal which comprises treating the same with a mixture consisting of metallic aluminum, borax and lime.

In testimony whereof I hereby affix my signature.

ROYAL MATTICE.