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METHOD AND APPARATUS FOR ELIMINATING HARD SPOTS IN CASTINGS

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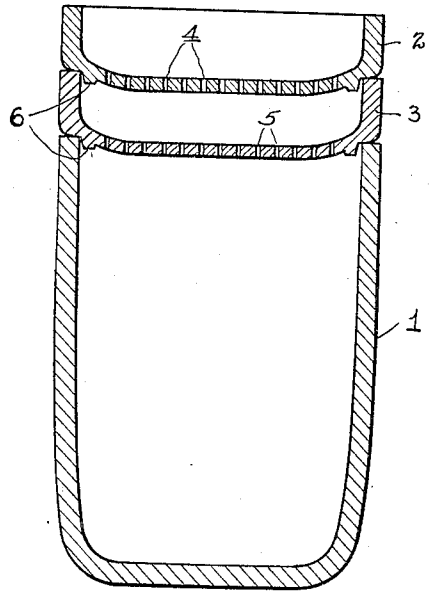


Fig. 1.

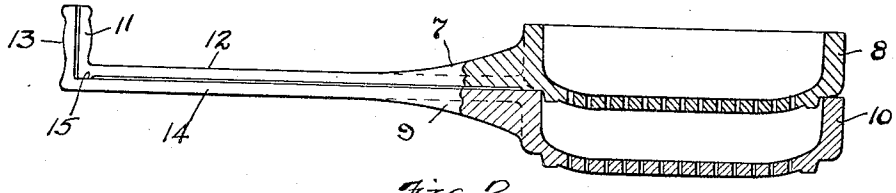


Fig. 2.

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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR ELIMINATING HARD SPOTS IN CASTINGS

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This invention as indicated relates to a method and apparatus for eliminating hard spots in castings, formed from various kinds of metal including ferrous and non-ferrous metals, and has more particular application to the production of castings of aluminum, and the like. The invention also includes the product so produced. In current practice it has often been found that when castings are machined, particularly castings of aluminum, and the like, that certain spots in such castings show extreme hardness which greatly interferes with the turning out of satisfactory work and also has the disadvantage of taking the edge off the tools. It has been found that the chief cause of this difficulty resides in the fact that impurities are introduced into the body of the casting after the metal leaves the furnace. Such impurities may comprise particles of slag or of fire brick, or small particles of iron in the case of non-ferrous metals, and, while they may not be of a size and quantity sufficient to visibly affect the general structure of the casting, they nevertheless cause certain portions of the casting to be of a greater degree of hardness than the main body of the casting, and prevent the even working of the metal in the course of manufacture.

The present invention has for its object to eliminate this difficulty through the method of and apparatus for handling the metal in the course of the casting operation, particularly in receiving the molten metal from the furnace in the casting pot in such a manner that any entrained particles of foreign matter flowing with the stream from the casting furnace will be separated from the body of pure metal in the casting pot and either intercepted prior to its flowing into such casting pot, or caused to float at the top of the mass of metal within said pot so that it may be readily removed therefrom by skimming.

Another object is to provide an improved casting substantially free of oxides and foreign particles and exhibiting substantially uniform metal texture, density, and hardness throughout.

Another object of the invention is to retard the speed at which the metal from the furnace flows into the casting pot so that as it enters the pot it will be traveling so slowly that it will not itself descend much below the surface of the metal in the pot, or carry with it into the body of the metal bath any foreign particles.

A further object of the invention is to provide a plurality of sieves having apertures of suitable size to retard the flow of metal into the casting pot and to provide changes of direction of flow of the metal through one screen or sieve into another, and thence through the second sieve, so that the stream of metal will be sub-divided and any particles of iron or fire brick or other foreign matter will be chilled through contact with the metal of the sieve and be attracted to the walls of the sieve and the oxide coatings thereon while the molten aluminum, or like metal flows freely through the apertures of said sieves.

Other objects of the invention will appear in the course of the following description. To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawing and the following description set forth in detail certain means and one mode of carrying out the invention, and one product resulting therefrom, such disclosed means, mode and product illustrating, however, but several of various applications of the principle of the invention.

In said annexed drawing:

Fig. 1 is a central vertical sectional view showing a casting pot or ladle with a pair of associated sieves positioned above the same, and embodying the principles of the invention; and Fig. 2 is a view, partly in section, of a pair of sieves of the type shown in Fig. 1 having separate handles, in overlapped relation to each other.

As is clearly shown in the drawing, a casting pot 1 of the usual form is provided above which are positioned a pair of screens or sieves 2, 3, preferably formed of cast iron of suitable alloy, such as an iron and nickel composition. Said sieves are relatively shallow basins with substantially flat bottom walls

which are provided with a large number of vertical apertures of small diameter. It has been found that a suitable diameter for the apertures 4 of the upper sieve is 1/8 of an inch, and for the apertures 5 of the lower sieve $\frac{3}{32}$ of an inch. The number of apertures in the lower sieve may be greater than of those in the upper sieve, so that at least an equal capacity to pass the molten metal therethrough will be provided and over supply of metal to the lower sieve prevented. The sieves may be of a depth of approximately from 2 to 3 inches when the metal to be handled is aluminum or aluminum alloys which are to be received in a casting pot, or ladle, of standard size. The sieves are shown substantially identical in cross-section and are preferably provided on their under sides with annular flanges 6 spaced from their outer edges, so that such flanges may fit within the open top of the casting pot or ladle, in the case of the lower sieve, and within the open top of the lower sieve, in the case of the upper sieve. In this way the screens or sieves will be securely positioned during the operation of tapping of the molten metal from the furnace.

The sieves may be formed as shallow receptacles which may be handled by suitable tongs, or they may be provided with integral handles such as are illustrated in Fig. 2 of the drawing. Where such handles are provided they are preferably so shaped that the handle 7 of the upper sieve 8 will overlie the handle 9 of the lower sieve 10 and will have a hand grip portion 11 at right angles to the shank portion 12 which will fit against a similar hand grip portion 13 on the shank 14 of the lower handle and permit the operator to grasp both hand grips and both shanks at the same time and handle the two sieves as a unit. A small projection 15 beneath the upper hand grip will serve to space apart slightly the parallel shank portions of the handles.

With an apparatus of the character just described, the flow of the molten metal into the casting pot or ladle will take place in such a manner that most of the impurities will be intercepted within the sieves and practically no foreign particles will be carried to any depth within the body of the metal received within the casting pot. As has been indicated the metal received in the upper sieve will flow through the numerous openings through its bottom into the lower sieve, its rate of flow being retarded and the original stream of metal being broken up into a large number of small streams. When the metal being handled is aluminum or its alloys, the fluidity of the heated metal is such that it will very rapidly pass through the openings in the bottom of the upper sieve, whereas such oxides and impurities as are present will unit in a single mass and tend to be retained in the oxide coating which forms on the top of the molten bath within the lower sieve. Substantially the same action will take place within the lower sieve, but with the further advantage that the retarded flow of metal into the lower sieve will bring about the chilling of the foreign particles and cause an adherence of such particles to the walls of the lower sieve or their uniting with such oxide coating as may be formed within the lower sieve. This oxide coating is of lighter specific gravity than the body of the metal passing through the sieve and such relatively small portion thereof as may flow through the apertures in the bottom of the lower sieve will not be carried into the metal bath to any depth, but will at once rise to the surface of the metal within the pot or ladle. Such impurities may be readily removed from the surface of the metal within the pot by skimming.

The sieves thus have the double effect of actually screening the foreign particles out of the stream of molten metal as well as retarding the speed of the metal stream therethrough to such an extent that the metal entering the body will not be carried downwardly to any great extent into the mass of the metal already in the pot, but will enter the pot without creating agitation or turbulence within the body of the metal in the pot. It is important that at least two screens or sieves, or equivalent retarding and intercepting means, be employed as a single screen having a construction suitable to the work in hand will not sufficiently retard the speed of the metal stream to have the desired effect of eliminating the foreign particles. The number of screens or equivalent elements may be increased beyond two depending on the conditions under which the work is being carried on.

The product which may be in the form of an ingot or of a finished casting will be found to be substantially free of oxides and foreign particles and of substantially uniform metal texture, density, and hardness throughout. These physical characteristics are of much importance when high speed machining operations are undertaken with such castings, as more uniform and accurate work can be accomplished, and greater speed of production brought about. The rate of wear on the cutting tools is also greatly reduced.

Other modes of applying the principles of my invention may be employed instead of the one explained, change being made as regards the means and the steps herein disclosed, and the forms of the product resulting therefrom, provided those stated by any of the following claims or their equivalent be embodied therein.

I therefore particularly point out and distinctly claim as my invention:

1. The process of eliminating hard spots from cast metal by separating impurities from a stream of molten metal, comprising flowing said stream vertically downwardly under the action of gravity to a point spaced above the top of a casting pot a limited distance, and then directing intercepted portions of said stream horizontally with the uniting of lighter less fluid particles thereof in a semi-fluid mass, flowing the more fluid portions of said stream away from said mass in subdivided form a limited distance downwardly toward the top of the casting pot, and directing intercepted portions of said retarded downwardly flowing streams horizontally with the uniting of less fluid particles thereof and interengaged and chilled foreign particles, and flowing the more fluid portions of said stream away from the semi-fluid portions thereof in a plurality of retarded non-turbulent streams of limited height into the casting pot for gravimetric separating thereof.

2. An apparatus of the character described having in combination a casting pot, a pair of superposed sieves positioned above the same, said sieves having apertures of relatively small diameter so as to retard the rate of metal flow therethrough and cause sub-division of the metal into successive series of streams of small cross-section, and the lower sieve providing a chamber with metal walls to chill the foreign particles and serving to re-unite faster flowing streams of purer metal and to retard the flow thereof into the melting pot.

3. An apparatus of the character described having in combination a casting pot, a pair of superposed sieves positioned above the same, the upper of said sieves having apertures of larger individual diameter, but of lesser number and total flow capacity than the apertures through the lower of said sieves, and the lower sieve providing a chamber with metal walls to chill the foreign particles and serving to re-unite faster flowing streams of purer metal and to retard the flow thereof into the melting pot.

4. An apparatus of the character described having in combination a casting pot, a pair of superposed sieves positioned above the same, the upper of said sieves having apertures of larger individual diameter, but of lesser number and total flow capacity than the apertures through the lower of said sieves, and means on the under side of each of said sieves for positioning the same relative to the supporting structure, and the lower sieve providing a chamber with metal walls to chill the foreign particles and serving to re-unite faster flowing streams of purer metal and to retard the flow thereof into the melting pot.

5. An apparatus of the character described having in combination a casting pot, a plurality of sieves positioned above the same, the upper of said sieves having apertures of larger individual diameter, but of lesser number and total flow capacity than the apertures through the lower of said sieves, and a handle provided on each sieve at one side thereof and adapted to cooperate with the handle on the companion sieve to provide a combined manipulating means for the assembled sieves.

6. An apparatus of the character described having in combination a casting pot, a pair of cooperating sieves positioned above the same, the upper sieve serving to retard the metal flow and the lower sieve providing a chamber with metal walls to chill the foreign particles in molten metal passing through the apparatus and to pass the metal at retarded speed into the casting pot, and a handle provided on each sieve at one side thereof and adapted to cooperate with the handle on the companion sieve to provide a combined manipulating means for the assembled sieves.

Signed by me this 2nd day of May, 1930.

JOHN SCHMELLER, SR.