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METHOD OF TREATING A CASTING MOLD AND THE TREATED MOLD

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This invention relates to a mold wash composition and a method of treating molds which are to be used in casting metals.

Most metals and metal alloys undergo a casting step at some point during their fabrication into finished articles; in some cases the raw metal is cast into ingots, while in others the finished article itself may be a casting. In pouring such metal castings, numerous difficulties are encountered. The molten metal stream, as it strikes the surface of the mold—which may be made of any conventional mold material such as steel or other suitable metal, sand, resin-bonded sand, etc.—frequently spatters, chills, or even oxidizes, resulting in small masses of metal or metal oxide adhered to the side of the mold above the level of the main body of molten metal in the mold. Although these masses become submerged as the molten metal fills the mold, they frequently fail to blend or weld completely into the mass of metal, causing flaws in the casting, particularly in the case of iron or steel castings. In addition, it is found that oxidation frequently occurs at the edge of the meniscus at the surface of the molten metal as it rises in the mold; and the resulting oxides, particularly in the case of iron or steel castings, become entrapped in the finished casting. In addition, undesired gases which may be present in the metal either at the time it is poured or as a result of an interaction at the edge of the meniscus are frequently trapped in the casting.

In an effort to overcome these difficulties, a variety of coatings have been applied to the mold surface prior to casting of the metal, but in general these coatings have not been entirely satisfactory for a number of reasons. Not only do these conventional coatings fail to provide a completely effective solution to the existing problems enumerated above, but in addition their use frequently introduces additional problems and disadvantages. For example, in the case of the mold coatings most commonly employed which include a tarry substance such as bitumastic, the coating decomposes when contacted by the molten metal, liberating great quantities of smoke which reduce visibility and make it difficult for the operator to pour the molten metal accurately into the mold opening with a minimum of spatter or contact with the sides of the mold.

One object of the present invention is to provide a mold wash composition for use in coating metal-casting molds to minimize spattering and casting defects.

Another object is to provide a mold wash composition and a method of coating molds in order to minimize defects such as slivers and scabs in the casting while at the same time minimizing the effect of surface irregularities in the mold itself and eliminating or greatly reducing the quantity of smoke liberated during the pouring operation.

Still another object is to provide a mold wash composition and a method of coating metal-casting molds which facilitates elimination of surface gases from the molten metal mass and minimizes oxidation of the surface of the metal while it is filling the mold.

Other and further objects will be apparent from the description which follows.

It has been found that a mold wash composition containing a selected resinous condensation product material

in combination with a carbohydrate and with a selected acidic material provides a mold wash composition which is effective to achieve the objects of this invention as set forth above. The composition preferably is in the form of an aqueous dispersion or solution containing the three essential ingredients. While other ingredients may be added in some cases if desired in order to provide specific advantages, they are not essential. The composition preferably is of such a fluidity that it may be applied to the mold surface to be protected by a spraying operation. When it is desired to apply the composition in other ways, as by brushing, it will be desirable to modify the fluidity of the composition somewhat in order to make it suitable for such application, as is well known to those skilled in the art.

The resinous materials which may be employed as one ingredient of the present composition include urea-formaldehyde, melamine-formaldehyde and dicyandiamide-formaldehyde condensation products and mixtures thereof, these resinous condensation products being in finely divided form.

The carbohydrate ingredient includes a wide variety of materials such as starch, dextrin, carbohydrate gums, modified starches, carboxymethylcellulose, and preferably is either water-soluble or readily dispersible in water.

The acidic materials which may be employed as the third essential ingredient of the composition include monoammonium phosphate, diammonium phosphate, phosphoric acid, ammonium sulfate, sulfamic acid, ammonium sulfamate, ammonium bromide.

The exact extent of condensation of the resinous condensation product is not critical, although products in what is usually called the "B" stage are normally preferred. The mole ratio of formaldehyde to the remaining constituent of the resinous condensation product may vary from 1:1 to 2.5:1. The relative proportions of resinous material, carbohydrate, and acidic material are not critical. Optimum results may be obtained with compositions containing from 50 to 125 parts by weight of the resinous condensation product, 5 to 50 parts by weight of carbohydrate, and 150 to 200 parts by weight of acidic material, together with 50 to 200 parts by weight of water.

Wetting agents may be employed to facilitate dispersion of the water-insoluble ingredients and to stabilize the resulting dispersion. Thickening agents such as gum tragacanth and the like may also be employed to achieve the desired fluidity, and pigments or fillers such as talc or titanium dioxide may be included if desired in order to facilitate complete covering of the desired mold surface by making the coating readily visible to the operator as it is applied.

Following application of the mold wash composition to those surfaces of the mold which are to come in contact with the molten metal, the mold is allowed to dry either by simply permitting it to stand in air at room temperature or, if desired, by heating it at an elevated temperature. Preferably, the compostion is applied while the mold is still warm to accelerate the drying.

When the coated mold has dried completely, the mold may be employed in the usual manner for making metal castings.

The following specific examples will illustrate more fully the nature of the present invention.

Example 1

There was prepared a mixture of 5 parts by weight of carboxymethylcellulose and 3½ parts of gum tragacanth with 260 parts of water. To this was added 10 parts by weight of triethanolamine as a dispersing and stabilizing agent. The mixture was stirred until a homogeneous mass was obtained, whereupon there were added 75 parts

by weight of urea-formaldehyde resin, 162 parts of monoammonium phosphate, 20 parts of starch, 40 parts of talc and 12 parts of titanium dioxide. The mixture was stirred until a smooth coating preparation suitable for spraying was obtained.

This composition was applied to the surface of a conventional mold employed for casting iron and steel ingots by a spraying operation, and the mold was allowed to dry overnight at room temperature.

Molten steel was then cast into the mold in the conventional manner, and it was found that not only was the smoke associated with conventional casting operations completely eliminated, but the quality of the casting was substantially improved. Large-scale operations with this composition have shown that the number of defective castings which it is necessary to reject was substantially reduced by the use of the new mold wash composition, and indeed the quality of the steel was improved.

Example 2

A mold wash composition was prepared as described in Example 1 except that the urea-formaldehyde resin was replaced with a resinous condensation product of dicyandiamide with formaldehyde.

The composition provided substantially the same results as the composition of Example 1.

Example 3

A mold wash composition was prepared as described in Example 1 except that the urea-formaldehyde resin was replaced by a resinous condensation product of melamine with formaldehyde.

The composition produced substantially the same results as the composition of Example 1 when used on molds for casting steel and iron.

Similar results were obtained by employing mixtures of the several resinous materials in a wide variety of proportions.

Although specific embodiments of the invention have been described herein, it is not intended to limit the invention solely thereto, but to include all of the obvious variations and modifications within the spirit and scope of the appended claims.

What is claimed is:

1. The method of treating a mold for use in casting metals which comprises applying to the surface of the mold which is to come into contact with the molten metal a coating of a mold wash composition comprising an aqueous dispersion containing (1) a carbohydrate; (2) an acidic material selected from the class consisting of monoammonium phosphate, diammonium phosphate, phosphoric acid, ammonium sulfate, sulfamic acid, ammonium sulfamate and ammonium bromide; and (3) a resin selected from the class consisting of urea-formaldehyde, melamine-formaldehyde, and dicyandiamide-formaldehyde condensation products and mixtures thereof, and drying said coated mold.

2. The method of treating a mold for use in casting metals which comprises applying to the surface of the mold which is to come into contact with the molten metal a film of the mold wash composition defined in claim 1 in which said acidic material comprises monoammonium phosphate, and drying said mold.

3. The method of treating a mold for use in casting metals which comprises coating the mold surfaces to be contacted by molten metal with the mold wash composition defined in claim 1 in which said carbohydrate comprises carboxymethyl-cellulose, and drying the coated mold.

4. The method of treating a mold for use in casting metals which comprises coating the mold surfaces to be contacted by molten metal with the mold wash composition defined in claim 1 in which said carbohydrate comprises starch, and drying the coated mold.

5. The method of treating a mold for use in casting metals which comprises coating the mold surfaces to be contacted by molten metal with the mold wash composition defined in claim 1 in which said resin comprises urea-formaldehyde resin.

6. The method of treating a mold to be used in casting metal which comprises applying to the surface of the mold which is to come into contact with the molten metal a coating of a mold wash composition comprising an aqueous dispersion containing (1) 5 to 50 parts by weight of a carbohydrate; (2) 150 to 200 parts of an acidic material selected from the class consisting of monoammonium phosphate, diammonium phosphate, phosphoric acid, ammonium sulfate, sulfamic acid, ammonium sulfamate and ammonium bromide; (3) 50 to 125 parts of a resin selected from the class consisting of urea-formaldehyde, melamine-formaldehyde, and dicyandiamide-formaldehyde condensation products and mixtures thereof; and (4) 50 to 200 parts of water; and drying said coated mold.

7. A mold for use in casting metals having on the surface of the mold which is to come into contact with the molten metal a dry coating containing (1) a carbohydrate; (2) an acidic material selected from the class consisting of monoammonium phosphate, diammonium phosphate, phosphoric acid, ammonium sulfate, sulfamic acid, ammonium sulfamate and ammonium bromide; and (3) a resin selected from the class consisting of urea-formaldehyde, melamine-formaldehyde, and dicyandiamide-formaldehyde condensation products and mixtures thereof.

8. A mold for use in casting metals having on the surface of the mold which is to come into contact with the molten metal a dry coating as defined in claim 7 in which said carbohydrate comprises carboxymethylcellulose.

9. A mold for use in casting metals having on the surface of the mold which is to come into contact with the molten metal a dry coating as defined in claim 7 in which said carbohydrate comprises starch.

10. A mold for use in casting metals having on the surface of the mold which is to come into contact with the molten metal a dry coating as defined in claim 7 in which said acidic material comprises monoammonium phosphate.

11. A mold for use in casting metals having on the surface of the mold which is to come into contact with the molten metal a dry coating as defined in claim 7 in which said resin comprises urea-formaldehyde resin.

12. A mold for use in casting metals having on the surface of the mold which is to come into contact with the molten metal a dry coating containing (1) 5 to 50 parts by weight of a carbohydrate; (2) 150 to 200 parts of an acidic material selected from the class consisting of monoammonium phosphate, diammonium phosphate, phosphoric acid, ammonium sulfate, sulfamic acid, ammonium sulfamate and ammonium bromide; and (3) 50 to 125 parts of a resin selected from the class consisting of urea-formaldehyde, melamine-formaldehyde, and dicyandiamide-formaldehyde condensation products and mixtures thereof.

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