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METHOD OF ANNEALING

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Our invention relates to a method and a composition for use in protecting metals such as steel against decarbonization during annealing or other heat treatment at high temperatures.

Heretofore some steel plants have employed borax as a coating for protecting steel and the like against decarbonization during annealing. In those instances where the borax is applied to the steel bars or the like in a dry condition, it is necessary to first heat the bars to from about 1300° F. to 1400° F. so that the dry borax will be fused or softened somewhat and adhere to the bar, the bar then being put into the annealing furnace. This method is open to the objection that the heating of the bars preliminary to coating is at such high temperature that decarbonization occurs to an objectionable degree.

Another prior method involves the application of a liquid or pasty coating of protective material to the bars previous to the annealing operation. While this method does not require preheating of the bars to high temperatures previous to the coating operation, time is lost in drying the coating before putting it into the annealing furnace.

In those cases where a base such as silica or clay is used as a carrying agent for the borax or other protective coating material, the coating is usually of such thickness that it has to be scraped from the steel after it leaves the annealing furnace and before it is passed through the rolls or into dies.

One object of our invention is to provide a method which does not require preheating of the steel bars or the like to decarburizing temperatures in order to cause a dry borax protective coating to be formed thereon.

Another object of our invention is to provide a method and a coating composition of such character that the bars can be placed in an annealing furnace or the like immediately after the application of the coating thereto, and wherein the coating is of such nature that it will not have to be scraped or otherwise removed from the heat treated steel before rolling or otherwise working the steel.

In the practice of our invention, we employ a mixture of borax and boric acid, the boric acid serving as a flux which will cause fusing of the borax to form a film on the steel, at temperatures which are not detrimental to the steel. Borax alone has a melting point of approximately 1368° F., but it is not necessary to preheat the bar to such a high temperature as in the prior method above referred to, since the presence of the boric acid (which starts to melt or fuse at 365° F.) causes the borax to be melted and thus form a coating on the bar at temperatures which need not be greatly in excess of 500° F., depending upon the percentage of boric acid employed in the mixture. In any event, the presence of a substantial percentage of boric acid in the mixture avoids the necessity of preheating the steel to such a high temperature that decarbonization thereof occurs to any appreciable extent.

By our method, the steel is first heated to a temperature of from 500° F. to some point below 1300° F., depending upon the percentage of boric acid employed in the mixture, and is then passed through a trough or chamber containing the mixture of borax and boric acid. The temperature of the steel is such that the coating of the mixture will be fused thereon and it can be immediately passed into the annealing furnace.

We prefer to use a dehydrated or anhydrous borax, in either a powdered or a granular state. While ordinary commercial borax can be used, the anhydrous borax is preferable because there is less danger of blistering or "popping" of the coating.

The boric acid can be either of powdered or granular form, but we preferably use the powdered.

One mixture which we have employed with satisfactory results comprises:

	Per cent by weight
Anhydrous borax	80
Boric acid	20

Other mixtures, depending upon the conditions and character of work, may comprise:

	Per cent by weight
Anhydrous borax	50 to 90
Boric acid	10 to 50

In some instances, boric acid in excess of 50% could be employed.

Contact between the mixture and the preliminarily-heated steel need be for only a few seconds—as for instance the three or four seconds required for a steel bar to be passed through a trough of the mixture, on its travel to an annealing furnace.

We claim as our invention:

1. The method which comprises applying a mixture that contains borax and boric acid to a steel bar or the like that is heated to such temperature that the mixture will fuse sufficiently

to form a coating on the bar, but at a temperature below the melting point of borax, and thereafter subjecting the bar to annealing temperatures.

2. The method which comprises heating a steel bar or the like to a temperature below that at which substantial decarbonization occurs, passing the bar through a mixture that contains borax and boric acid and thence into a heat-treating furnace, by continuous travel, the temperature of the bar and the duration of contact thereof with the mixture being such that a fused coating of borax will be formed thereon.

3. The method which comprises applying a mixture that contains 10% to 50% boric acid and 50% to 90% anhydrous borax to a steel bar or the like that is heated to such temperature that the mixture will fuse sufficiently to form a coating on the bar, but at a temperature below the melting point of borax, and thereafter subjecting the bar to annealing temperatures.

4. The method which comprises applying a mixture that consists mainly of borax and boric acid to a steel bar or the like, which is heated to such temperature that the mixture will fuse sufficiently to form a coating on the bar, but at a temperature below 1300° F., and thereafter subjecting the bar to annealing temperatures.

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