

UNITED STATES PATENT OFFICE

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OXIDE REMOVING BATH

Irvine C. Clingan, Baltimore, Md., assignor to
Eastern Stainless Steel Corporation, Baltimore,
Md., a corporation of Maryland

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1 Claim. (Cl. 252—135)

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The present invention relates to the cleaning of metals, notably stainless steels.

More particularly, this invention provides means whereby molten scale removing baths containing caustic alkali and an alkali metal nitrate, such for example as disclosed in the patent to McKay, No. 2,271,375, January 27, 1942, do not deteriorate because of the decomposition of the nitrate radical to form lower oxides of nitrogen. That is, while conditions of use of such baths result in decomposition of the nitrate radical, I have found that small amounts of borax in the bath will serve to continuously reoxidize the lower oxides of nitrogen so that the amount of nitrate present will be maintained substantially constant, and thus the descaling action of the bath is maintained uniform over greatly extended periods of time.

A further object is to provide such a bath that possesses a combination of beneficial properties consisting of high oxidizing capacity and maximum softening ability.

A still further object is to provide a molten bath consisting of an anhydrous mixture of caustic alkali, a minor proportion of an alkali metal nitrate and a small amount of a stabilizing agent, e. g. borax, which agent acts to not only stabilize the bath but also to rejuvenate the bath.

Various other objects and advantages of this invention will become apparent from the following description.

The use of molten sodium and/or potassium hydroxides from temperatures ranging from 600° F. to 1000° F. has been employed for a number of years in the various metal industries as an aid in descaling steels, particularly stainless steels. Scales or metals oxides that form on stainless steels during hot working or heat treatment are sometimes difficult to remove in acid solutions. The scale that forms on stainless steels during hot working is heavy, very hard and brittle and the use of molten alkali metal hydroxides at temperatures ranging from 600° to 1000° F. has been found to be very beneficial in effecting the partial removal of this type of scale.

A difference in expansion that develops between the parent metal and the scale in this temperature range produces a cracking of the scale that permits the alkali metal hydroxide to flow in and around the cracked scale particles. Some of these will flake off in the caustic solution and many more are dislodged when the steel is removed from the molten solution and rapidly quenched in water. The reaction between the hot alkali metal hydroxides and the water, pro-

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duces super-heated steam that further shatters and blows the scale from the metal surface. The alkali metal hydroxides do not, however, produce any chemical change in the composition of the scale or the parent metal. Their action is wholly physical and residual scale is always present after the treatment. Thus, removal of this residual scale requires the use of acid solutions for complete scale removal and cleaning.

My invention provides a method for stabilizing the nitrate radical of a molten-caustic-nitrate bath without impairing, in any manner, the oxidizing capacity of the nitrate radical under the conditions of use. I have discovered that small inclusions of sodium borate in the solution will promote stabilization of the nitrate radical. It has been noted that this effect is apparently enhanced when very small amounts of iron are present along with the sodium borate. The amount of sodium borate present in the bath may be from about 0.1 to 4% by weight of the total weight of the bath, and as indicated above the presence of only spectroscopic amounts of iron apparently improves the oxidizing of the lower oxides of nitrogen back to the nitrate.

A preferred caustic nitrate bath would contain:

90 parts by weight sodium hydroxide
10 parts by weight sodium nitrate
4 parts by weight sodium borate ($\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$)

A preferred treatment of a scale covered metal in the preferred molten solution outlined supra, would be the immersion of the metal in this molten bath maintained at a temperature between 830° F. and 870° F., preferably 850° F. for approximately eight minutes. Next, the metal is quickly removed and rapidly quenched in cold water. This quenched metal is immersed for three to five minutes in one of the usual acid pickling baths, e. g. a 10% by volume sulfuric acid solution at a temperature of 160° F. to 175° F., the solution containing a good commercial inhibitor. The acid immersed metal is then removed and washed in running water. The next treatment step consists in immersing the metal for five to seven minutes in another customary acid pickling bath, e. g. a 6 to 8% by weight nitric acid solution containing 1 to 2% by weight hydrofluoric acid at 140° F. to 160° F. Again the metal is removed and washed in cold running water.

By the use of the fused substantially anhydrous bath set forth above and by the use of this bath followed by the preferred treatment in acid washing, a descaled metal is obtained which is

smooth, uniform, of maximum cleanness, and very pleasing in surface appearance. It has also been found that the surface of this metal has been improved in its resistance to rusting or corrosion and to its reception of surface coatings of various sorts. Further, the provision of the small amount of sodium borate clearly improves the stability of the bath and aids in regenerating the nitrate content of the bath.

The words employed in this specification are for the purpose of description and not of limitation. The scope of the invention is set forth in the claim.

I claim:

A molten bath for removing oxides from the surface of metals which comprises a fused sub-

stantially anhydrous mixture of 90 parts by weight of sodium hydroxide, 10 parts by weight of an alkali metal nitrate, and about .1 to 4 parts by weight of sodium borate and a spectroscopic amount of iron.

IRVINE C. CLINGAN.

References Cited in the file of this patent

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