

UNITED STATES PATENT OFFICE

2,380,284

METHOD OF CLEANING FERROUS METAL ARTICLES

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No Drawing. Application December 21, 1942,
Serial No. 469,703

2 Claims. (Cl. 252-156)

This invention relates to metal cleaning, for example removal of oxides and other foreign material from the surface of iron, steel and other metal articles by treatment in certain novel fused baths.

Oxide coatings are commonly removed from iron and steel by acid pickling operations. This method of deoxidizing steel surfaces has the disadvantage that the acid tends to etch the metal after the oxide is removed and also tends to corrode steel equipment. After the pickling operations the pickled metal usually has to be subjected to an alkaline treatment to remove the last traces of acid. Aqueous alkaline solutions are also used in metal cleaning but with the exception of electrolytic methods these are useful only for the purpose of removing greasy impurities and are not effective for removing oxides.

An object of the present invention is an efficient method and composition for cleaning metals which is especially adapted for removal of oxide scale from iron or steel articles but which is also effective in removing other types of impurities from metal surfaces, including oils, greases and other organic impurities. Other objects will be apparent from the ensuing description of the invention.

The above objects may be attained in accordance with the present invention by contacting the metal surface to be cleaned with a molten mixture of alkali metal cyanide and alkali metal hydroxide at an elevated temperature. Ordinarily the treatment of ferrous metals in a fused bath containing alkali metal cyanide results in carburizing or nitriding, or both. However, I have discovered that fused alkali metal hydroxides containing relatively large amounts of alkali metal cyanide may be utilized as herein described substantially without any carburizing or nitriding effect. Under the conditions in my herein described process the cyanide acts as an active reducing agent to reduce and thereby remove oxide scale from the article to be cleaned while the fused alkali metal hydroxide component of the bath effectively removes organic impurities.

A metal cleaning bath may be prepared according to my invention by dissolving alkali metal cyanide, for example, in concentrations of about 20-80% by weight in fused alkali metal hydroxide preferably anhydrous. The melting point of such compositions will vary from slightly above 200° C. up to between 400 and 500° C., depending upon the particular alkali metal hydroxides and cyanides utilized. Such a mixture will have an eutectic point generally ranging

from about 40 to 60% by weight of alkali metal cyanide, depending on the ingredients chosen. For example, the eutectic mixture of sodium cyanide and sodium hydroxide contains about 40% by weight of sodium cyanide and melts at about 220° C.

If desired, for the purpose of adjusting the melting point of the bath or for other reasons, the bath may be diluted with various other fusible inorganic compounds which are substantially non-reactive towards alkali metal hydroxides and cyanides. For example, up to about 50% by weight of the alkali metal hydroxide may be replaced by an alkali metal carbonate, such as soda ash. After extended periods of use my cleaning baths invariably will contain more or less alkali metal carbonate caused by absorption of carbon dioxide from the atmosphere. Other diluent materials may be added to the bath in concentrations up to 20 to 50% by weight of the bath, for example alkali and alkaline earth metal halides, borates, phosphates, and the like. Specific examples of such diluents are: barium chloride, sodium chloride, potassium chloride, calcium chloride, and strontium chloride.

It is not necessary that the hydroxide and cyanide be derived from the same alkali metal and if desired mixtures of one or more different alkali metal hydroxides with one or more different alkali metal cyanides may be utilized in any desired combination. For example I have obtained excellent results with baths made by fusing together equal parts of sodium and potassium cyanide with various amounts of caustic soda. In this combination, the eutectic point corresponds to an alkali metal cyanide concentration of about 60% by weight and a melting point of about 240° C.

In order to clean iron or steel articles without carburization or nitriding, the cleaning bath must be operated at a temperature below 600° C., preferably at 300 to 500° C. For this reason and in order that the bath may have a suitable degree of fluidity I prefer to utilize a bath having a melting point not higher than about 400° C. Best results are usually obtained by using a substantially eutectic composition having a melting point between 200 and 300° C. Such baths will have more or less cleaning action at temperatures as low as the melting point, but effective cleaning action usually does not occur until the temperature has risen to around 300° C. Within the range of 300 to 500° C., the herein described baths effectively clean iron and steel by reduction of oxides and by decomposition and removal of or-

ganic impurities. Cleaning action also occurs at higher temperatures such as at 600° C. or higher, but at such temperatures iron or steel articles are also case hardened.

The herein described process is also effective for cleaning non-ferrous articles as well as ferrous metals. For example, it may be used for cleaning nickel, brass, copper, bronze, monel metal, and the like. This method, of course, is not suitable for treating metals such as zinc, which are highly reactive with molten alkali metal hydroxides.

While the metal articles may be contacted with the molten cleaning composition in any desired manner, it is ordinarily preferable to simply immerse the article to be cleaned in the fused bath for a sufficient time to effect the desired cleaning. For complete removal of oxide impurities, the time of treatment will vary depending on the nature and amount of the oxide present. Usually, a treating time may vary from 1 to 30 minutes.

After removal from the cleaning bath, the cleaned article may be cooled and washed with water or directly quenched in a water bath.

After washing to remove the alkaline cleaning composition, the cleaned article is ready for other operations, such as electroplating, galvanizing, painting or the like.

I claim:

1. The method of removing impurities in the form of oxides from a ferrous metal article which comprises subjecting said article to the cleaning action of a fused bath consisting essentially of a substantially homogeneous, anhydrous, eutectic mixture of alkali metal hydroxide and alkali metal cyanide, while maintaining said bath at a temperature below 600° C.

2. The method of removing impurities in the form of oxides from a ferrous metal article which comprises subjecting said article to the cleaning action of a fused bath consisting essentially of a substantially homogeneous, anhydrous, eutectic mixture of sodium hydroxide and sodium cyanide, in approximately 60-40 weight ratio, while maintaining said bath at a temperature substantially within the range of 300° to 500° C.

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