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1,899,734

① ALK + OX AGENT

② ACID

UNITED STATES PATENT OFFICE

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REMOVAL OF OXIDS FROM FERROUS METAL

No Drawing.

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This invention relates to the treating of ferrous metal to remove the oxid or scale and while not limited thereto, relates more particularly to a method of treating ferrous metal articles having an oxid or scale thereon which is particularly resistant to acid and, therefore, is not readily removable by the ordinary or well-known acid pickling without the use of excessively strong acid solutions and long time immersions which result in badly etched or acid eaten surfaces on the articles.

The present invention is an improvement on the method described and claimed in United States Patent No. 1,572,848, issued to Rudyard Porter and Joshua C. Whetzel on February 9th, 1926, and has for its object the provision of an improved method whereby the acid resisting oxid or scale of the most resistant nature, such as that found on some classes of stainless steel, will have its acid resisting qualities broken down prior to acid pickling, thus eliminating the use of exceedingly strong acid pickling solutions and materially reducing the time of immersion in the acid bath. The present method permits a considerable saving in acid and produces a superior quality of oxid-free and scale-free articles, the faces of which are not etched by the acid.

This invention is particularly adaptable to removing the oxid or scale formed on stainless steel (in which term I include numerous steel alloys known by this or other names which are highly resistant to corrosion), especially the oxid resulting from annealing stainless steel since such oxid is especially resistant to acid removal.

In carrying out this invention the metal containing the oxid is first immersed in a strong alkaline and oxidizing solution, a solution of a caustic alkali such as sodium hydroxid (NaOH) and an oxidizing agent such as potassium permanganate (KMnO_4) is preferable. The strength of the solution may vary but it has been found that a solution having approximately 20 per cent. sodium hydroxid and approximately 1 per cent. potassium permanganate is very efficient when heated to a temperature of approxi-

mately 190 degrees Fahrenheit. The action of this solution is to break down the resistance of the oxid or scale to acid so that it is readily removable by acid pickling.

In practicing the method of the Porter and Whetzel patent noted above, it was found that it was extremely difficult to break down the acid resistant quality of the more adherent types of scale on stainless steel, while the present method will efficiently break down the acid resistant quality of the most resistant oxids.

In the treatment of stainless steel it has been found that immersion of the oxid or scale coated article in the above solution for approximately 10 to 15 minutes is sufficient to break down the resistance of the oxid to the acid. The same results may be accomplished, however, with a weaker or cooler solution with longer time of immersion. In other words, the time of immersion varies inversely to the strength and temperature of the solution.

It will, of course, be understood that with oxids less resistant than those found on stainless steel, the period of immersion in the above solution is materially shorter.

After the article has been treated by sufficient immersion in the above described alkaline solution it is then immersed in an acid pickling bath to completely remove the oxid or scale, and, due to the fact that the resistance of the oxid to the acid has been broken down by the prior alkaline and oxidizing solution, a comparatively short immersion in a weak acid solution is all that is necessary to remove the oxid.

The acid pickling bath is preferably composed of aqueous hydrochloric acid containing an inhibitor and this bath is maintained at approximately 180 degrees Fahrenheit. The metal is preferably maintained in the above acid bath from five to ten minutes.

It will be understood that this method is not limited to the use of a hydrochloric acid bath since any fairly strong acid, such as sulfuric or nitric, may be used instead of the hydrochloric acid.

The use of a hydrochloric acid pickle bath is preferable due to the fact that it results in

the metal surface having a slightly superior color or luster. The preferred minimum concentration of the hydrochloric acid bath is approximately 2 per cent. while the preferred minimum temperature is approximately 120 degrees Fahrenheit.

It will be understood that this invention is not limited to the use of an alkaline and oxidizing solution having the preferred ingredients and proportions set forth above since other alkaline materials and varying proportions of the sodium hydroxid may be used. Also, various concentrations of potassium permanganate are effective ranging from 0.1 per cent. to practically a saturated solution in the alkali. It will also be noted that good results may be obtained by substituting other oxidizing agents such as manganese dioxide for the potassium permanganate.

Heretofore in the acid pickling of stainless steel to remove the oxid or scale, relatively strong acid solutions have been necessary with long immersions, which resulted in badly etched surfaces, while with the present method the surfaces of the pickled articles are substantially free from etching.

In carrying out this method the surfaces of the sheets have been cleaned with various strengths of acids, by varying the temperature and time of immersion, using higher strength acid at the lower temperatures and lower strength acid at the higher temperatures.

It will be understood that the percentages and temperatures given herein are only given for purposes of illustration and not as limitations, and also while the method has been particularly described in connection with the treatment of stainless steel, it is not limited to the treatment of such steel, but may be used in the treatment of any or all ferrous metals.

I claim:

1. The method of removing oxid in the form of scale resulting from heating ferrous metal articles from said articles which includes as a step the immersion of the articles in a solution containing approximately 20 per cent. sodium hydroxid (NaOH) and approximately 1 per cent. potassium permanganate (KMnO_4).

2. The method of removing oxid from ferrous metal articles consisting in first immersing the articles in a hot bath consisting of approximately 20 per cent. sodium hydroxide (NaOH) and approximately 1 per cent. of potassium permanganate (KMnO_4) to break down the resistance of the oxid, and then immersing the articles so treated in a hot acid pickling bath consisting of a solution of one of the usual pickling acids such as hydrochloric, nitric or sulfuric.

In witness whereof, I have hereunto set my hand.

FRANKLIN STOCKTON.