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CHEMICAL POLISHING SOLUTION AND METHOD

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This invention relates to an improved method of polishing aluminum, aluminum alloys and steels, involving the use of chemical solutions.

Heretofore, certain solutions have been used for polishing copper, aluminum and aluminum alloys and pickling solutions for steel are well known. For example, nitric acid has been used for polishing copper and its alloys, and meta-phosphoric acid in a water solution and hydro-fluoric acid have been used to produce mirror-like surfaces on aluminum. The theory of the above mentioned chemical means for obtaining a smooth polished surface is that under certain conditions difficultly soluble or insoluble salts are formed which adhere to the slightly depressed parts of the surface of the metal. This allows the action of the solution on the raised portion to produce an even surface. This is different from merely cleaning the surface which is common in the pickling action of said metals.

It is an object of the present invention to produce a polished or mirror-like surface on certain metals commonly classed as non-reactive. It is also an object of the present invention to produce such a surface by chemical means in a comparatively short length of time.

Generally speaking, this process contemplates the use of a bath containing reactive chemicals which, when contacted with a metal surface that is more or less uneven, will act on the metal to produce a smooth, even mirror-like surface on the metal. Such steels as stainless steel and other steels containing large percentages of chromium, which are very difficult to react with ordinary polishing solutions, respond to treatment with said bath to produce a high polish in a short space of time. Ordinary carbon steels also react with this solution to produce the desired effect.

It has been found possible to react aluminum and aluminum alloys with suitable baths containing the solutions that are the subject matter of this invention.

According to the invention, this bath is maintained at a temperature of 120° C. to 260° C. This temperature must of necessity be within the melting point of the ingredients of the bath so as to maintain the bath in a liquid condition, and the time of immersion of the metal in the bath depends upon the temperature of the bath, the higher the temperature the less time the metal must be in contact with the bath to produce the desired results.

As may be seen in the examples, certain specific temperatures and certain times of immersion

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will give the desired results, but if the temperature is raised the time may be shortened.

It has been found that under suitable temperature conditions a solution containing specific forms of an acid having phosphorus in its composition is effective in polishing the metals referred to above. The type of phosphorus containing acids that have been found desirable are the two types containing the least amount of water of composition, that is, meta-phosphoric and pyro-phosphoric acid. Meta-phosphoric acid is the phosphoric acid anhydride with one molecule of water and pyro-phosphoric acid is the anhydride with two molecules of water. It has been found undesirable to use ortho-phosphoric acid, which is the anhydride with three molecules of water. Phosphoric acid is not desirable as it produces an effect known as "parkerizing."

Pyro-phosphoric acid is therefore preferred, but the meta form may be used. A small quantity of an organic acid, such as tartaric acid or oxalic acid, hastens the reaction and has the desired results. In treating certain types of steel it is also desirable to include a small amount of ferrous sulphate, or as a substitute therefor, a small amount of sulfuric acid.

To better illustrate the invention as described above, the following examples are included. This invention is not to be limited to these examples, which are cited primarily as illustrations:

EXAMPLE I

(1) *Example of carbon steel*

$H_4P_2O_7$ or HPO_3	100 cc. or weight 100 g.
$C_6H_8O_7$ or $(COOH)_2$	2 g.
Temperature	160° C.
Time	5 sec.

EXAMPLE II

(2) *Example of stainless steel and* Cr *steel*

$H_4P_2O_7$ or HPO_3	100 cc. or weight 100 g.
$C_6H_8O_7$	2 g.
$FeSO_4$	5 g.
Temperature	200° C.
Time	15 sec.

EXAMPLE III

(3) *Example of* Al, *and* Al-*alloys*

$H_4P_2O_7$ or HPO_3	100 cc. or weight 100 g.
$(COOH)_2$	10 g.
Temperature	120° C.
Time	7 sec.

The term polishing as used in this specification does not mean cleaning, as is usual in common pickling processes, but denotes a chemical reaction on the surface of the metal to remove the raised portions from the surface and to give a highly polished mirror-like surface which differs from an etched surface. Etching usually results in an uneven surface produced by removing certain constituents preferentially.

The novel solution disclosed in the present application acts rapidly to produce the highly polished surface desired. It reacts with aluminum, aluminum alloys and steel to produce the desired surface in a few seconds and allows the use of continuous methods of handling the products from one bath to another, and gives a high lustre on a stainless steel which has heretofore been unobtainable except after prolonged treatment.

What is claimed is:

1. The method of producing a high lustre on a metal selected from the group consisting of carbon steel, special steel, aluminum, and aluminum alloys, which consists of immersing said metal in an anhydrous bath at a temperature of 120° C. to 260° C. for a period of time less than 60 seconds, said bath consisting of an acid selected from the group consisting of meta-phosphoric acid and pyrophosphoric acid and at least one substance selected from the group consisting of tartaric acid, oxalic acid, ferrous sulphate and sulfuric acid.

2. A method of polishing carbon steel which comprises contacting the steel for about 5 seconds at a temperature of 160° C. with an anhydrous solution containing about 100 parts of an acid selected from the group consisting of metaphosphoric acid and pyrophosphoric acid and about 2 parts of an acid selected from the group consisting of tartaric acid and oxalic acid.

3. A method of polishing stainless steel which comprises immersing the steel in an anhydrous bath at a temperature of 200° C. for about 15 seconds, said bath consisting of 100 parts of an acid selected from the group consisting of metaphosphoric acid and pyrophosphoric acid, about 2 parts of tartaric acid and about 5 parts of ferrous sulphate.

4. A method of polishing aluminum and aluminum alloys which comprises immersing the metal in an anhydrous bath for about 7 seconds at a temperature of 120° C., said bath consisting of 100 parts of an acid selected from the group consisting of meta-phosphoric acid and pyrophosphoric acid and 10 parts of oxalic acid.

5. A bath for polishing stainless steel containing ferrous sulphate, an acid selected from the group consisting of meta-phosphoric acid and pyro-phosphoric acid and at least one substance selected from the group consisting of oxalic acid, tartaric acid, and sulfuric acid, said bath being maintained at a temperature of 120° C. to 260° C.

6. An anhydrous composition for polishing carbon steel consisting of 100 parts of metaphosphoric acid and about 2 parts of tartaric acid.

7. An anhydrous composition for polishing carbon steel consisting of 100 parts of pyrophosphoric acid and about 2 parts of oxalic acid.

8. An anhydrous composition for polishing stainless steel consisting of 100 parts of metaphosphoric acid and 2 parts of tartaric acid and about 5 parts of ferrous sulphate.

9. An anhydrous composition for polishing stainless steel consisting of 100 parts of pyrophosphoric acid, about 2 parts of tartaric acid and about 5 parts of ferrous sulphate.

10. An anhydrous composition for polishing an aluminum containing metal comprising 100 parts of pyrophosphoric acid and 10 parts of oxalic acid.

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