United States Patent Office

2,832,706

Patented Apr. 29, 1958

2,832,706

METAL CLEANING AND PHOSPHATING COMPOSITION AND METHOD OF CLEANING AND PHOSPHATING

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No Drawing. Application May 12, 1953
Serial No. 354,643

7 Claims. (Cl. 148—6.15)

This invention relates to metal cleaning and phosphating compositions and methods of treating metal articles therewith.

Although many different compositions and compounds have been proposed heretofore for cleaning metal surfaces, none have been entirely satisfactory. One of the chief disadvantages is that these prior compositions and methods have not always resulted in a truly rust-resistant surface that is tenaciously adherent to paint.

The compositions of the present invention are useful in cleaning metal and particularly ferrous metal, to remove rust from the surface thereof, provide a rust-resistant, phosphatized surface and to produce a surface that is tenaciously adherent to paint. Thus it has been found that the removal of rust from steel surfaces with aqueous solutions of such acid phosphates as monosodium phosphate, monoammonium phosphate, sodium acid pyrophosphate, and the like and wetting agents such as the alkali metal alkyl aryl sulfonates can be accomplished more quickly and produce a more rust-resistant metal surface when a small proportion of the acid phosphate is replaced with sodium oxalate.

For example, it has been found that a mixture of 70 to 85% monosodium phosphate, 10% of a sodium alkyl aryl sulfonate wetting agent and 5 to 20% sodium oxalate is more effective than the known mixture of 90% monosodium phosphate and 10% wetting agent for use in aqueous solution in the cleaning and phosphatizing of steel sheets and similar metal objects preparatory to applications of coatings of paint, enamel, lacquer and the like.

The new composition is particularly advantageous in the cleaning of metals where a dilute solution of the cleaning agent is heated and sprayed under pressure against the metal surface as the metal is being conveyed through a cleaning chamber.

To show the effectiveness of the new cleaning composition the following tests were carried out.

Uniform size pieces (2" x 6") of mild steel panels were first prepared by degreasing with carbon tetrachloride then treating with a strongly alkaline detergent and washing with distilled water. These test panels were then held in a salt spray for four hours to produce a uniformly rusted surface. The panels were then rinsed with distilled water, dried, and a uniform coating of cup grease applied over the rusted surface. The steel panels thus prepared were subjected for approximately 3 minutes to a 1% solution of the cleaning agent sprayed against the metal surface at a pressure of about 70 to 80 pounds per square inch at 180° F. The panels were then rinsed with distilled water and observed for grease and rust removal.

Rust removal was judged as very good, good, fair, and poor in the order of the amount of rust removed from the panel.

Example 1.—Four fully rust coated steel panels were suspended in a spray chamber and subjected to a 1% aqueous solution of a composition consisting of 80% monosodium phosphate, 10% commercial wetting agent (sodium salt of alkyl aryl sulfonate), and 10% sodium oxalate. 16 liters of the solution at 180° F. were sprayed on the panels at 72 p. s. i. pressure in a period of 3 minutes and 7 seconds. Rust removal was "fair."

Example 2.—In a similar test using a composition of 70% monosodium phosphate, 10% wetting agent, and 20% sodium oxalate, the rust removal was "good" with a spraying time of 3 minutes and 10 seconds.

In a comparative test without the sodium oxalate, a 1% solution of a mixture of 90% monosodium phosphate and 10% alkali metal alkyl aryl sulfonate wetting agent gave a "poor" rust removal, with a spraying time of 3 minutes and 16 seconds.

Example 3.—In a test using a 1% aqueous solution of a composition of 80% monoammonium phosphate, 10% wetting agent (sodium alkyl aryl sulfonate), and 10% sodium oxalate, the rust removal was "very good" with a spraying time of 3 minutes and 16 seconds, at 180° F. with a spray pressure of 69 pounds per square inch.

Example 4.—In a similar test using a 1% solution of a composition of 70% disodium acid pyrophosphate, 20% sodium oxalate, and 10% wetting agent (sodium alkyl aryl sulfonate) having a pH value of 5.3, the rust removal was "good" with a spraying time of 2 minutes and 53 seconds, at 180° F. with a spray pressure of 79 pounds per square inch.

In a comparative test with a 1% solution of a mixture of 90% disodium acid pyrophosphate and 10% wetting agent and rust removal was "poor" with a spraying time of 3 minutes and 23 seconds.

In all cases where the rusted panels were covered with grease and subjected to the spray treatment with the above cleaning compositions the grease was completely removed without effect on the efficiency of the rust removal.

In the above illustrated method of cleaning and removing rust from steel surfaces the resulting cleaned surfaces are substantially more resistant to further rusting than steel surfaces which have been cleaned with solutions of monosodium phosphate and wetting agents, without the added sodium oxalate. For example, four test panels which had been cleaned of all rust and grease by spray cleaning with a 1% solution of a mixture of 80% monosodium phosphate, 10% alkyl aryl sulfonate wetting agent, and 10% sodium oxalate, were subjected to the humid atmosphere of a humidity chamber for 10 days and the amount of rusting determined by visual observation. The degree of rusting was judged by an arbitrary number scale of 1 to 5 ranging from substantially no rusting to very severe rusting at the higher number. The four panels here tested had a corrosion rating of 1.75.

Comparative tests with four panels which had been cleaned with a 1% solution of a mixture of 90% monosodium phosphate and 10% wetting agent showed a corrosion rating of 2.75.

These comparative tests clearly indicate a distinctive advantage for the sodium oxalate containing cleaning composition.

Paint adhesion tests on steel surfaces cleaned with the new cleaning composition show excellent paint holding characteristics. For example, a series of four steel panels which had been cleaned with a 1% solution of a mixture of 80% monosodium phosphate, 10% wetting agent, and 10% sodium oxalate, were washed with distilled water, dried, and painted with a commercial paint (Sherwin-Williams 552-green). After the painted surface was thoroughly dry paint adhesion was tested by a modification of the method described in "Products Finishing" (vol. 16, No. 7, pages 82–90, April 1952). In this test the painted panel is supported horizontally 18"

above the table top. An 8" strip of ¾" Scotch cellophane tape was attached to the bottom of the test panel so that 1½" of the tape was pressed firmly to the paint surface. The loose end of the tape was looped around a ½" x 6" magnesium rod which maintains a constant tension on the tape. A 1000 gram weight with a 12" cord was hooked over the magnesium rod while holding the weight level with the rod. The weight was released thus jerking the tape from the paint surface of the test panel. The amount of paint removed when the tape is jerked free indicates how well the paint adheres to the metal surface. The results of this test showed no paint removal from the four test panels.

The acidic phosphatizing component of the new composition includes the acid phosphates such as the alkali metal and ammonium dihydrogen phosphates and acid pyrophosphates. Such acid phosphates give solutions within the pH range of 4 to 6 and are capable of phosphatizing ferrous metal surfaces without undue corrosion or pitting of the metal.

Suitable wetting agents include those which are active in the acidic solutions of the acid phosphates. The sodium salts of alkyl aryl sulfonates have been found quite suitable.

The sodium oxalate component of the new composition acts as an accelerator for both the removal of rust and improvement of the phosphatizing action, and does not reduce the grease soil removal qualities of the acid phosphate. As little as 5% of sodium oxalate in the composition produced effective combination results. However, no advantage was apparent by inclusion of more than 20% of sodium oxalate in the mixture although greater amounts can be used.

The concentrate which is the composition without the water may be prepared and sold as such. This concentrate may then be diluted with water to form the metal cleaning solution. Any dilution desired may be used up to a completely saturated solution. However, for economic reasons the solution preferably contains not more than about 5% by weight of the concentrate and for best results at minimum cost preferably contains about 1% of the concentrate.

The cleaning solution is heated during the cleaning operation. Any temperature above ordinary room temperature may be used. It is preferred, however, that the solution be heated to a temperature less than the boiling point so that the water will not be driven off.

Although the oxalate may be any alkali metal oxalate, the sodium and potassium compounds are preferred for economic reasons.

In the description of the invention given herein and in the claims the term "alkali metal acid phosphate" is intended to include such metals as sodium and potassium as well as ammonium.

The term "consisting essentially of" as used in the definition of the ingredients present in the composition claimed is intended to exclude the presence of other materials in such amounts as to interfere substantially with the properties and characteristics possessed by the composition set forth but to permit the presence of other materials in such amounts as not substantially to affect said properties and characteristics adversely.

Having described my invention as related to the embodiments set out herein it is my intention that the invention be not limited by any of the details of description, unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

I claim:

1. A composition suitable for cleaning and treating metal consisting essentially of about 70 to 85% by weight of an alkali metal acid phosphate, about 5 to 20% by weight of an alkali metal oxalate, and a minor proportion of an acid stable, synthetic organic wetting agent.

2. The composition of claim 1 wherein the alkali metal oxalate is sodium oxalate and the wetting agent is an alkyl aryl sulfonate.

3. A composition suitable for cleaning and treating metal consisting essentially of about 70 to 85% by weight of a member of the class consisting of monosodium phosphate, monoammonium phosphate and disodium acid pyrophosphate, about 5 to 20% by weight of an alkali metal oxalate, and a minor proportion of an acid stable, synthetic organic wetting agent.

4. The composition of claim 3 in which the alkali metal oxalate is sodium oxalate.

5. A composition usable in cleaning and treating metal consisting essentially of about 70 to 85% by weight of monosodium phosphate, about 10% by weight sodium alkyl aryl sulfonate, and about 5 to 20% by weight sodium oxalate.

6. The method of treating ferrous metal surfaces to render them rust-resistant comprising applying thereto a dilute aqueous solution of a composition consisting essentially of about 70 to 85% by weight of a member of the class consisting of monosodium phosphate, monoammonium phosphate and disodium acid pyrophosphate, a minor proportion of an acid stable, synthetic orgainc wetting agent and about 5 to 20% by weight sodium oxalate.

7. The method of treating ferrous metal surfaces to render them rust-resistant comprising applying thereto a dilute aqueous solution of a composition consisting essentially of a mixture of about 70 to 85% by weight of monosodium phosphate, about 10% by weight of an acid stable, sodium alkyl aryl sulfonate, and about 5 to 20% by weight sodium oxalate.

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U. S. DEPARTMENT OF COMMERCE

PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,832,706 Benjamin Toubes April 29, 1958

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 30, for "and" read -- the --; column 4, list of references cited, under the heading "FOREIGN PATENTS" add the following:

500,006 Belgium - - - - - - - Dec. 30, 1950

Signed and sealed this 1st day of July 1958.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents