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SPRAY CLEANING METHOD FOR REMOVING OIL, GREASE, DIRT AND EMBEDDED OXIDES FROM PAINTED SURFACES

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ABSTRACT OF THE DISCLOSURE

Oil, grease, dirt and embedded oxides are removed from a painted metallic surface without adversely affecting the painted surface by applying an aqueous solution thereto in a high pressure spray, the solution consisting essentially of, within certain proportions, sulfuric acid, hydrofluoric acid, a sugar derived carboxylic acid selected from the group consisting of gluconic and glucoheptonic acids, a water soluble glycol ether, a wetting agent, and water.

A cleaning composition specifically adapted for use in cleaning painted metal surfaces such as railroad cars, railroad engines, wheel support trucks and the like, the composition being particularly designed for use with high pressure spray cleaning techniques wherein the composition develops a special froth of foam along the surfaces of the member being cleaned.

The present invention relates generally to a method and composition for performing cleaning, restoring, or other similar operations on painted surfaces or the like, and more particularly to a technique for cleaning and restoring the painted metal surfaces of high speed vehicles having soil embedded in hydrocarbons and other difficultly removable substances. These surfaces are found on vehicles such as railroad cars, railroad engines, wheel support trucks and the like wherein the surface soil is normally heavy, and is frequently combined with hydrocarbon oils or greases. In accordance with the present invention, a treatment technique and composition is available which removes the soil expeditiously, and restores the painted surface to a substantially newly painted appearance without having any substantial deleterious effect on the surface and without creating noxious odors or fumes in the cleaning zone.

Surfaces which are heavily weathered, highly oxidized, and embedded with soil such as particles of silicon dioxide, calcium oxide, magnesium oxide, and the like, such as are frequently found on the painted surfaces of railroad cars and the like, are extremely difficult to clean. These conditions are essentially always complicated by the presence of hydrocarbon base oils and greases which normally retain substantial quantities of soil in combination therewith. In the past, it has been generally accepted that the surfaces of these vehicles may be most expeditiously cleaned by means of acid cleaners utilizing citric acid, phosphoric acid, oxalic acid, sulfuric acid, hydrofluoric acid, sulfamic acid, sodium bi-sulfate and the like. These materials, as utilized, are not particularly suitable for use on hydrocarbon films. While the alkaline cleaners have certain merit in this regard, their over-all usefulness is limited inasmuch as they are not particularly suitable for oxide soils. The painted surfaces are therefore not restored to their original oxide-free condition, since the embedded oxides are not completely removed

in each instance. In accordance with the technique of the present invention, a spray cleaning composition having a low pH, such as in the range of 0.7 and 3.0 is obtained wherein the solution further contains a compound for increasing the solvency of the dirt retaining greases and oils, this composition being sprayed onto surfaces to be cleaned at a high pressure in order to dissolve organic soil and effectively penetrate and remove the dirt retaining substance. Pressures in the range of from 140 p.s.i. to about 400 p.s.i. have been found to be effective, and there is a sufficient frothing action available in the solution to prevent evaporation of the water and consequent increased concentration of the acid constituents.

The acids included are preferably hydrofluoric and sulfuric, although any acid compound containing the HSO_3 group, such as sulfonic acids or the like may be used. Because of the economic advantages of sulfuric acid, this compound will normally be utilized. Hydrofluoric acid is included in the composition to assist the removal of certain oxides. Because of the difficulties of handling hydrofluoric acid in a spray environment, this material is kept at a practical minimum in the over-all cleaning composition. In order to provide a streak-proof surface, a complexing agent comprising a carboxylic acid derived from a sugar derivative, such as gluconic or glucoheptonic acid is utilized. This material has been found to produce a complexing action in the mixture and hence is desirable as a component. If desired, a suitable wetting agent may be employed in the solution used. The wetting agent functions in the normal sense, and assists in thoroughly wetting the surface in order to improve the cleaning operation. In the technique of the present invention, a solution containing a suitable quantity of the working ingredients is applied by high pressure spray techniques to the soiled surface. The action of the cleaner is sufficient, including the frothing and the cleaning action, to restore and clean the soiled surfaces without adversely affecting the painted metal surfaces.

Therefore, it is an object of the present invention to provide an improved technique for restoring badly weathered and soiled painted surfaces.

It is a further object of the present invention to provide an improved technique for restoring, cleaning, and otherwise treating painted metallic surfaces.

It is yet a further object of the present invention to provide an improved high pressure spray treating technique for the restoration of painted metallic surfaces wherein an acidic cleaner is utilized.

Other and further objects of the present invention will become apparent to those skilled in the art upon a study of the following specification and appended claims.

In accordance with the preferred modification of the present invention, a working solution is prepared from a concentrate, these mixtures having the following ingredients:

TABLE I

Compound	Working solution, percent by weight	Concentrate, percent by weight
Sulfuric acid, 66 Bé	0.075–5.0	2.0–15
Hydrofluoric acid, (active basis)	0.400–8.0	11–15
Gluconic Acid, 50%	0.010–2.5	0.5–10
Octylphenoxy poly (ethylene oxy) ethanol having 9 mols of ethylene oxide	0.030–5.0	1.0–15
Ethylene glycol monobutyl: Ether	0.500–7.5	5.0–15
Water	Balance	Balance
pH	[1] 0.7–3.0	

[1] About.

As indicated previously, the composition may include a substitute for the sulfuric acid, however the cost of the sulfuric acid makes it extremely impractical to substitute anything for this ingredient.

The hydrofluoric acid is included in the composition in order to assist in oxide removal. This material is a particularly desirable ingredient for removing silicon dioxide, and other oxides which may be embedded, or otherwise retained on the surface being treated. The material is included at a lower working limit of 0.4 percent by weight according to Table I above, and any lesser quantity will tend to render the solution too slow to be deemed reasonably operative. An upper limit of 8.0 percent of hydrofluoric acid is deemed practical in the working solution, this limit being imposed because of the corrosive nature of the substance on the surfaces being treated, and also because of the difficulties encountered in the normal handling of this material during a spraying operation. In this connection, compositions with greater hydrofluoric acid composition may fume. While the odor of the acid mist is undesirable, it has been found that the odor may be effectively countered by the use of a glycol ether such as ethylene glycol monobutyl ether in the solution in the range of 0.5 percent or more. The wetting agent also assists in establishing a froth or foam to control the concentration of the acid mixture subsequent to the spraying operation.

The carboxylic acids which are derived from sugar derivatives appear to function as an agent which prevents or eliminates streaking of the cleaned surface; and in this connection, gluconic and glucoheptonic acids have been found to be extremely desirable.

The composition includes a wetting agent which is critical to the composition. In this regard, octyl or nonyl phenoxy poly (ethylene oxy) ethanol may be used, the octyl material being preferred. The compositions include from between 7 and 13 mols of ethylene oxide per mol of octyl phenol, or from between 9 and 13 mols of ethylene oxide per mol of nonyl phenol, and preferably 9 mols of ethylene oxide with either octyl or nonyl phenol. The wetting agent is present in the amount ranging from 0.03 to 15 percent in the composition.

The glycol ether utilized increases the solvency of the dirt retaining greases and oils, and is accordingly used to dissolve organic soil and assist in the penetration of the hydrofluoric acid through the organic soil layer or film. In this regard, ethylene glycol monobutyl ether is preferred, however, other glycol ethers based on other than butyl alcohol and other glycols than ethylene glycol may be utilized. Diethylene glycol and ethanol or propanol may be used. It has been found that ethylene glycol monobutyl ether or other water soluble glycol ethers listed hereinabove together with the wetting agent assist in reducing the odor caused from the acid mist of the spray, particularly the hydrofluoric acid odor. In this regard, the material has been found to be extremely desirable in the product.

While the above solution has been utilized and specified generally, the following table, Table II, discloses a specific example of a preferred solution for use in accordance with the cleaning technique of the present invention.

TABLE II

Compound	Percent by weight
Sulfuric acid, Bé.	3
Hydrofluoric acid, 70%	6
Gluconic acid, 50%	1.2
Octylphenoxy poly (ethylene oxy) ethanol (having 9 mols of ethylene oxide)	3
Ethylene glycol monobutyl ether	5
Water	Balance

Mix with water in ratio of from 1:8 although from 1:5 up to 1:10 may be used for pH from 1.3–2.0.

It will be appreciated that the solutions indicated hereinabove may be shipped in concentrated form, and diluted at the cleaning site. In this regard, the concentrate may be prepared in such a way that a mixture of one part concentrate to from four parts to ten parts of water or more may be employed. Furthermore, it has been found that for extremely light soil conditions, a concentrate may be utilized which is diluted more completely such as is found in the lower limits of the concentrations set forth in Table I. For cases where heavy oxide conditions are found, it is generally preferable to keep the hydrogen fluoride concentration at the higher portions of the range. While the technique is most particularly adapted to cleaning of heavily soiled metallic painted surfaces, it will be appreciated that the composition may be utilized for cleaning wooden painted surfaces as well.

It will be appreciated that the examples given herein are for purposes of illustration only, and there is accordingly no intention of limiting the scope of this invention to these examples alone. Those skilled in the art may depart from these examples without departing from the spirit and scope of the present invention.

What is claimed is:

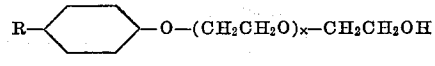
1. The method of removing oil, grease, dirt and embedded oxide from a painted metallic surface without adversely affecting the painted surface comprising applying an aqueous solution thereto by means of a high pressure spray, the solution consisting essentially of sulfuric acid, hydrofluoric acid, a sugar derived carboxylic acid selected from the group consisting of gluconic and glucoheptonic acids, a water soluble glycol ether having a structural formula $R—(OCH_2CH_2)nOH$ wherein R is an alkyl radical containing from 1 to 4 carbon atoms, and n is an integer from 1 to 2, preferably 1, a wetting agent, and water, said sulfuric acid being present in an amount ranging from between about 0.075 percent and 5 percent by weight, said hydrofluoric acid being present in an amount ranging from between about 0.4 percent to 8 percent by weight, said sugar derived carboxylic acid being present in an amount ranging from about 0.01 percent up to about 2.5 percent by weight, said water soluble glycol ether being present in an amount ranging from between about 0.5 percent and 10 percent by weight, and said wetting agent being present in an amount ranging from between about 0.03 percent and 15 percent by weight, with the remainder being water.

2. The method as set forth in claim **1** being particularly characterized in that the spray technique employs pressures in the range of from about 140 p.s.i. up to about 400 p.s.i.

3. The method of cleaning painted metallic surfaces as defined in claim **2** being particularly characterized in that said water soluble glycol ether is ethylene glycol monobutyl ether.

4. The method as defined in claim **3** being particularly characterized in that said ethylene glycol monobutyl ether is present in an amount constituting about 0.5 percent by weight of the solution.

5. The method as set forth in claim **3** being particularly characterized in that said wetting agent has a structural formula



wherein R is an alkyl radical containing from 8 to 9 carbon atoms, and wherein x is a quantity ranging from between 7 and 13, and wherein said solution is a concentrate consisting essentially of about 3 percent by weight of said sulfuric acid, about 6 percent by weight of said hydrofluoric acid, about 1.2 percent by weight of said sugar derived carboxylic acid, about 5 percent by weight of said ethylene glycol monobutyl ether, and about 3 percent by weight of said wetting agent with the re-

mainder water, said concentrate being diluted with additional water in the range of from about 1:5 up to about 1:10.

References Cited

UNITED STATES PATENTS

2,199,712	5/1940	Neilson.	
2,399,267	4/1946	Szatyn	134—40 XR
2,687,346	8/1954	McDonald	134—41 XR
2,942,956	6/1960	Kelly	134—3 XR
3,239,467	3/1966	Lipinski	134—41 XR
3,330,769	7/1967	Golben et al.	134—41 XR
3,438,799	4/1969	Eck et al.	134—41 XR

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