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DETERGENT COMPOSITION

Eric Eichwald, New York, N. Y., assignor to Arrow Laboratories, Inc., New York, N. Y., a corporation of New York

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This invention relates to detergent compositions and has particular relation to detergent compositions adapted to be used for cleaning automobile radiators.

Automobile radiators must be subjected from time to time to an efficient cleaning in order to remove from them various kinds of impurities, such as dirt, rust scale, grease, tar, calcium salts originating from the natural hardness of the water supply, and other deposits and foreign matter. An efficient detergent composition must be capable of loosening and removing all these impurities within a relatively short time. It is likewise important that the composition should have no corrosive or other harmful effect on the human skin and the metallic and non-metallic materials with which it comes in contact during its application to cleaning. Finally, the composition should be chemically and physically stable and preferably non-deliquescent in solid condition in order to be capable of being stored without undesired changes for a considerable period of time.

While there are quite a number of known detergents which are suitable for removing one or the other of the above mentioned impurities and/or deposits, no composition was hitherto known which meets all necessary requirements, i. e. quick removal of all impurities which may be present in automobile radiators and have entirely different chemical compositions and different physical structure and properties; absence of any corrosive or other harmful effect on the human skin, the radiator walls or parts and other materials with which the detergent composition comes in contact, and sufficient stability on storage in solid or dissolved condition. As far as I am aware, the known compositions do not meet these requirements, which are necessary for their satisfactory practical use in cleaning radiators of automobiles.

Some of the known radiator cleaners contain acids or acid salts in combination with an alkaline neutralizer. Such compositions are inefficient and harmful. They may cause corrosion and deterioration of the radiator, the radiator block and the rubber hose, particularly if permitted to remain in the radiator for a relatively long period of time, for example two or more days, as often prescribed in the use of known radiator cleaners. Moreover, irrespective of the period of time, during which they are left in the radiator, the products generally on the market at present are inefficient, because they do not remove impurities which obstruct and clog the

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radiator. They remove only rust scale and that incompletely.

The main object of the present invention is to provide a detergent composition which is capable of thoroughly cleaning radiators of automobiles and can be successfully used for the removal from automobile radiators of scale and other deposits formed on the walls of the radiator or on the surface of radiator parts, and the simultaneous removal of other impurities or foreign matter, such as dirt, grease, tar, oil and products originating from the natural hardness of the water supply.

Another object of this invention is to provide a detergent composition of the above mentioned type, by means of which cleaning of an automobile radiator can be carried out within a relatively short time, for example 30 minutes.

It is also an object of the invention to provide a detergent composition for the cooling system of automobiles, which has no corrosive or other harmful effect on the radiator, and other metallic or non-metallic parts or materials with which it comes in contact, and does not do harm to the human skin, clothes or to the finish of automobiles.

A further object of the present invention consists in providing a detergent composition of the beforementioned type, which can be economically manufactured, is chemically and physically stable on storage, can be easily dissolved in cold or hot water to yield a stable, non-corrosive solution.

Other objects and the advantages of the invention will be apparent from the appended claims and the following specification which describes, by way of example, some preferred embodiments of the invention.

As briefly mentioned above, an efficient detergent composition for cleaning automobile radiators must be capable of removing from the cooling system all deposits, impurities or foreign matter, which cause obstruction in the cooling system of the automobile. These substances principally include rust scale, lime, iron and other metallic deposits, grease, tar, oil and dirt.

Strong alkalis, such as sodium hydroxide or potassium hydroxide are not effective. They are capable of emulsifying some grease and oil residues, but are not effective in the removal of other substances which are generally involved in radiator obstructions. On the other hand, such strong alkalis are harmful to and cause deterioration of the radiator, radiator block and the rubber hose.

In a thorough investigation of the cleaning and other effects of various chemicals it has now

been found that in order to obtain a satisfactory detergent composition for cleaning the cooling systems of automobiles, several ingredients must be used in a specific combination, in which these ingredients are so balanced that they mutually contribute to the desired unitary effect and act upon each other in such a manner that a satisfactory cleaning effect, as well as absence of corrosion and other harmful effects, and stability of the composition in solid as well as in dissolved condition is obtained.

The chemical substances used in the compositions according to the present invention are the following:

(1) Trisodium phosphate or trisodium orthophosphate of the formula $Na_3Po_4.12H_2O$, a water-soluble salt of the orthophosphoric acid.

(2) Soda ash, i. e. commercial anhydrous sodium carbonate containing about 99% Na_2CO_3.

(3) The double salt $NaHCO_3.Na_2CO_3.2H_2O$, which is a water-soluble commercial product forming snowflake crystals and is known under the name sesquicarbonate of soda.

(4) Sodium borate or borax of the formula $Na_2B_4O_7.10H_2O$.

(5) Sodium bicarbonate of the formula $NaHCO_3$.

(6) Sodium citrate of the formula

$$2Na_3C_6H_5O_7.11H_2O$$

or potassium citrate of the formula

$$K_3C_6H_5O_7.H_2O$$

(7) Potassium tartrate, $C_4H_4O_6K_2.\frac{1}{2}H_2O$.

(8) Sodium tartrate, $Na_2C_4H_4O_6.2H_2O$.

It was found that owing to the balanced condition of compositions containing the above ingredients in the proportions stated hereinafter, such compositions satisfy all necessary requirements in the cleaning of cooling systems of automobiles.

The following examples specifically illustrate the proportions and ranges of proportions which have been used with advantage in carrying out the present invention. However, the invention is not limited to the particular proportions shown in the following examples. The figures given are percentages by weight and refer to compounds of the formulas stated in the following table of examples.

No. of example	1	2	3	4	5	6	7
(a) Trisodium phosphate ($Na_3PO_4.12H_2O$)	46	48	45	45	44	38	40
(b) Soda ash (Na_2CO_3)	45¼	47½	45	40	44	38	30
(c) Sodium sesquicarbonate ($NaHCO_3.Na_2CO_3.2H_2O$)	2	1	3	2	2	3	2
(d) Sodium borate ($Na_2B_4O_7.10H_2O$)	3	1	2	2	2	3	2
(e) Sodium bicarbonate ($NaHCO_3$)	3	1	2	2	2	3	2
(f) Sodium citrate ($2Na_3C_6H_5O_7.11H_2O$) or potassium citrate ($K_3C_6H_5O_7.H_2O$)	¼	½	1	3	2	5	7
(g) Potassium tartrate ($C_4H_4O_6K_2.\frac{1}{2}H_2O$)	¼	½	1	3	2	5	8
(h) Sodium tartrate ($Na_2C_4H_4O_6.2H_2O$)	¼	½	1	3	2	5	9

As shown by the above examples, trisodium phosphate is used in amounts of 38–46%, and soda ash in amounts of 30–47.5%, while the rest of the compositions consist of 1–3% of sodium sesquicarbonate, 1–3% of sodium borate, 1–3% of sodium bicarbonate, 0.25–7.0% of sodium citrate or potassium citrate, 0.25–8.0% of potassium tartrate and 0.25–9.0% of sodium tartrate.

The compositions made according to the present invention readily dissolve in cold water and much more readily in hot water. Upon dissolution of the composition, the water used for dissolution is softened and this effect is necessary in order to obtain an efficient cleaning. The compositions remove dirt and rust scale, and leave a lustre on the inner surface of the radiator after application. Grease, tar and oil are also dispersed and removed with the cleaning solution. The chemical action of the ingredients is so balanced that the solid composition does not cake, while the solution has an optimum cleaning effect, and no harmful effect on the human skin, on the rubber hose used, the enamel of the automobile and the metals with which the solution may come in contact, such as aluminum, copper, nickel, chromium and their alloys. Without committing myself to any theory, it seems that the sodium sesquicarbonate acts as a stabilizer, while the sodium citrate (or potassium citrate) and the potassium tartrate and sodium tartrate prevent the occurrence of corrosion of the metals or their alloys.

I want to emphasize that according to my investigations the use of all of the above described ingredients and their use in the proportions and ranges stated above is necessary in order to obtain a satisfactory cleaning effect, i. e. an effect on all customary impurities and deposits, in the absence of corrosive or other harmful effects.

Trisodium phosphate and sodium carbonate are well recognized as cleansers, rinsers, and water softeners. But they do not have sufficient cleansing power in themselves to remove all obstructing ingredients and deposits occurring in cooling systems of automobiles, and, moreover, when used in form of the mixtures now on the market, they are harmful to the radiator, radiator hose and radiator block.

In preparing the compositions of the present invention, I have found it convenient to first form a substantially homogeneous mixture from trisodium phosphate and sodium carbonate, then add sodium bicarbonate, sodium borate and sodium sesquicarbonate, and finally the remaining chemicals. All the chemicals have to be of good quality and free flowing and free from foreign substances. The chemicals are preferably sifted through an appropriate mesh screen. The mixing may be done in a turbine power mixer, for example for a period of 10 to 15 minutes until the ingredients are thoroughly mixed and blended.

The solution of the composition is preferably used in hot condition and preferably forced through the automobile cooling system under pressure. The application of the solution under pressure increases the efficiency of the compositions, which, however, may also be used without the application of pressure, by introducing it into the radiator to be cleaned and removing it, for example, after 30–60 minutes. During this time the motor is preferably kept running.

The concentration of the cleaning solution may vary, for example 8 oz. to 16 oz. of the compositions may be dissolved in 1–2 gallons of water.

It will be apparent that the present invention

is not limited to the specific details described above and may be carried out with various modifications without departing from the scope of the invention as defined in the appended claims. The compositions according to the invention may be used for cleaning any cooling systems similar to the cooling system of the present automobile engines.

What is claimed is:

1. A detergent composition consisting substantially of 38–46% by weight of trisodium phosphate, 30–47.5% of soda ash, 1–3% by weight of sodium sesquicarbonate, 1–3% by weight of sodium borate, 1–3% by weight of sodium bicarbonate, 0.25–7.0% by weight of an alkali salt of citric acid selected from the group consisting of sodium citrate and potassium citrate, 0.25–8.0% by weight of potassium tartrate and 0.25–9% by weight of sodium tartrate.

2. A detergent composition for cleaning the cooling system of automobile engines and the like, said composition consisting substantially of 46 parts by weight of trisodium phosphate, 45¼ parts by weight of soda ash, 2 parts by weight of sodium sesquicarbonate, 3 parts by weight of sodium borate, 3 parts by weight of sodium bicarbonate, ¼ part by weight of an alkali salt of citric acid selected from the group consisting of sodium citrate and potassium citrate, ¼ part by weight of potassium tartrate, and ¼ part by weight of sodium tartrate.

3. A detergent composition for cleaning the cooling system of automobile engines and the like, said composition consisting substantially of 45 parts by weight of trisodium phosphate, 40 parts by weight of soda ash, 2 parts by weight of sodium sesquicarbonate, 2 parts by weight of sodium borate, 2 parts by weight of sodium bicarbonate, 3 parts by weight of an alkali salt of citric acid selected from the group consisting of sodium citrate and potassium citrate, 3 parts by weight of potassium tartrate, and 3 parts by weight of sodium tartrate.

4. A detergent composition for cleaning the cooling system of automobile engines and the like, said composition consisting substantially of 40 parts by weight of trisodium phosphate, 30 parts by weight of soda ash, 2 parts by weight of sodium sesquicarbonate, 2 parts by weight of sodium borate, 2 parts by weight of sodium bicarbonate, 7 parts by weight of an alkali salt of citric acid selected from the group consisting of sodium citrate and potassium citrate, 8 parts by weight of potassium tartrate, and 9 parts by weight of sodium tartrate.

ERIC EICHWALD.

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