252. COMPOSITIONS.
104
Cross Reference
Examiner

Patented July 24, 1934

1,967,394

UNITED STATES PATENT OFFICE

1,967,394

DETERGENT COMPOSITION

William S. Calcott, Penns Grove, N. J., and George Henry Cheney, Newport, Del., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del., a corporation of Delaware

No Drawing. Original application October 23, 1929, Serial No. 401,971. Divided and this application April 5, 1930, Serial No. 442,033

9 Claims. (Cl. 87—5)

This invention relates to detergent or cleaning compositions, and more particularly to such compounds as are suitable for removing oily or greasy deposits of dirt or rust from metallic surfaces such as, for example, the radiators of automobiles. This case is a division of applicants' prior application Serial No. 401,971, filed October 23, 1929.

The prior art describes commercial cleaning compounds which may be roughly divided into two separate classes, acids, usually with an additional substance present to prevent the excessive corrosion of the acid upon metal; and alkaline detergents, such as sodium silicate, sodium carbonate, either with or without the addition of rosin or similar substances. The cleaning of sheet metal surfaces or simple metal shapes or containers presents no great problems. The cleaning of automobile radiators, however, because of the function of the radiator and its proximity to the engine is an operation which does not lend itself readily to the employment of acid cleaning solutions because of potential danger to the radiator and delicate parts of the engine. When alkaline cleaners are resorted to by garage attendants or mechanics, commercial cleaning preparations or washing soda, borax or lye are more frequently used. Mechanical methods, such as blowing out the tubes or water passages with air and water, are frequently employed, probably more so than the alkaline cleaning compounds, which at best are none too effective.

Our invention has for an object the provision of a cleaning compound or detergent compound which may be used in an aqueous solution and readily removes dirt and rust deposits on metal surfaces even where, as in automobile radiators, the dirt and corrosion products are gummed together with oil and grease.

A further object is the creation of a compound which is capable of, and a process of, removing dirt, rust and grease from the cooling systems of internal combustion engines. Further objects will appear as this description proceeds.

We accomplish these objects of our invention by the use of a composition of matter, which in one of its broad aspects comprehends the addition of a wetting-out agent to a detergent, with or without the addition of an organic solvent which is immiscible with water.

In order to establish comparative results for the various compositions of matter which fall within the contemplation of our invention, we have evolved the following method of testing: We simulated the conditions which exist in a fouled automobile radiator by coating small metal strips with equal areas, and to uniform depths, of a paste consisting of iron oxide (Fe_2O_3) and lubricating grease. The weight of the deposits was determined by weighing each metal strip before and after coating with the paste. The strips were then suspended in the cleaning fluids, which were to be tested, and the solutions were boiled for ten minutes. At the end of this time the strips were removed, rinsed and air-dried. The loss in weight of the deposits was obtained by again weighing the strips. A measure of the cleaning power of the liquid, determined as the percentage loss in weight of the deposit, was thus obtained for comparison with the cleaning power of other compositions. According to our method of testing, the loss with water alone, with water plus a detergent, such as sodium carbonate or with various prior art commercial cleaners, varies from 4 to 20%, with the latter percentage the maximum loss obtained by any prior art composition. The addition to the detergent solution of even small amounts of a wetting-out agent greatly increased the removal of the paste, as is shown in the following table:

Table 1

Salt	Wetting agent	Loss
		Percent
4.0% Na_2CO_3	None	14.4
Do	0.4% 1-isopropyl-naphthalene-2-sodium sulfonate	82.1
Do	0.4% 1-isobutyl-naphthalene-2-sodium sulfonate	88.2
Do	0.4% 4-propyl diphenyl-4'-sodium sulfonate	87.6
None	0.4% 1-isopropyl-naphthalene-2-sodium sulfonate	8.9

The experiment E in Table 1, above, illustrates the fact that the wetting-out agent by itself possesses no unusual properties in removing the paste from a metallic surface. It is evident that the greatly increased removal of the paste is due to the combined presence of the detergent and wetting-out agent.

We have found that not only the wetting-out agents appearing in Table 1 but all compounds belonging to a class of compounds which may be defined as the sulphonic acid derivative of alkylated aromatic hydrocarbons, and specifically such hydrocarbons which contain at least two benzene nuclei, are effective wetting-out agents. Our invention contemplates any member of the class falling within the definition given just

above, and embraces other compounds which we have tested and found to be effective, such as:

1-Iso propyl naphthalene-2:4-disodium disulfonate
1-4-Di-isopropyl naphthalene-2-sodium sulfonate
1-Iso-butyl naphthalene-2:4-disodium disulfonate
1:4-Di-isobutyl naphthalene-2-sodium sulfonate
4-Propyl diphenyl-2:4'-disodium disulfonate
4:4'-dipropyl diphenyl-2-sodium sulfonate

We have also found that the cleansing action of a detergent and a wetting-out agent is enhanced by the addition to the cleansing solution of an organic solvent which is immiscible with water. Any organic solvent which is immiscible with water falls within the contemplation of our invention. Examples of the increased cleansing action obtained by the use of such organic solvents appear in the following Table 2.

(It may be stated that the results given in Table 2 are not exactly comparable with the results shown in Table 1 because a heavier coating of paste was employed in all of the work which was tabulated outside of Table 1.)

Table II

Detergent	Wetting agent	Solvent	Loss
			Percent
4.0% Na_3PO_4	0.4% 1-isopropyl-naphthalene-2-sodium sulfonate.	None	49.0
Do	do	1.0% kerosene	87.6
Do	do	1.0% dichlorbenzene.	75.7
Do	do	1.0% amyl alcohol	99.4
Do	do	1.0% cyclohexanol	95.8

The action of the wetting-out agent and the immiscible organic solvent is not specific to sodium carbonate and trisodium phosphate, but, combined with all classes of salts and alkalis having detergent properties, serves to produce compositions of matter having remarkable cleaning powers. Examples of such compositions of matter appear in the following Table 3:

Table III

Salt	Wetting agent	Solvent	Loss
			Percent
None	0.4% 1-isopropyl-naphthalene-2-sodium sulfonate.	1.0% dichlorobenzene.	10.8
4.0% $NaHCO_3$	do	do	37.6
4.0% Na_2SO_4	do	do	74.4
4.0% $NaNO_3$	do	do	82.0
4.0% $(NH_4)_2SO_4$	do	do	71.6
4.0% $Al_2(SO_4)_3$	do	do	59.1
4.0% $NaHSO_4$	do	do	57.8

It will be understood that the inorganic salts and alkalis listed above have been used for the purpose of illustration only, and that other alkalis and salts having detergent properties fall within the contemplation of our invention.

We have found that the addition of the wetting-out agent in any concentration is beneficial to the cleansing compound or cleansing solution. We prefer, however, to employ not more than 7.5% of wetting-out agent, the percentage being based upon the weight of the mixture of detergent wetting-out agent and organic solvent when solvent was used. Greater amounts than 7.5% wetting-out agents may be employed, but little additional advantage is obtained by increasing the percentage beyond that amount. The presence of any amount of solvent beyond that amount necessary to saturate the water to which it is added has no ill effect, and in fact produces good results, but no better results are produced than those obtained by increasing the percentage of organic solvent beyond 20% of the mixture. No particular order need be followed in mixing the materials since the same ultimate mixture will result from any order of mixing. We have found that generally, however, a somewhat more homogeneous mass will result if the organic solvent is added last.

We have found that mixtures of salts with one or more wetting-out agents and one or more solvents in any proportions may be used. Some mixtures which we have found to be exceptionally efficient appear in the following Table 4:

Table IV

Mix No.	Salt	Wetting agent	Solvent
1	75% Na_3PO_4	7.5% 1-isopropyl naphthalene 2-sodium sulfonate.	17.5% Dichlorbenzene.
2	75% Na_2CO_3	7.5 1-isobutyl naphthalene 2-sodium sulfonate.	17.5 kerosene.
3	37.5 Na_2CO_3 + 37.5 Na_3PO_4	7.5 1-isopropyl naphthalene 2-sodium sulfonate.	17.5 dichlorbenzene.
4	75 Na_3PO_4	do	5.5 amyl alcohol. 12.0 kerosene.
5	75 Na_3PO_4	do	3.5 cyclohexanol. 14.0 kerosene.

It will be understood that the mixtures listed in Table 4 have been used for the purpose of illustration only, and that other combinations fall within the contemplation of our invention.

The composition of matter which we have invented may be used to remove any deposits of dust, dirt or rust which adhere to metallic surfaces. The compounds are unusually effective where the dirt or corrosion products are mixed with oil or grease to form pastes or gums which prior art detergent solutions heretofore removed with great difficulty, if at all. Thus, sodium silicate or carbonate solutions of standard concentrations for detergent purposes removed between 5 and 20% and never more than 20% of greasy paste from metallic surfaces, whereas solutions formed from the compositions of matter which we have invented removed from 80 to 95% of the greasy paste under identical conditions. Automobiles which have been treated by commercial cleaners without effect have been put into good running order by the use of our compositions of matter. For example, a car of well-known make which was overheating badly was treated with a 5% solution of mixture 1, Table 4, at a temperature approximating the boiling point of the solution. Before treatment the drain water from the radiator of the car analyzed 0.046% Fe as Fe_2O_3, while after treatment with the above mentioned mixture the drain water analyzed 0.274% Fe as Fe_2O_3. After washing out the cleaning solution and filling the radiator with fresh water, a road test at 45 to 50 miles an hour failed to show any recurrence of the previous heating.

Although we have shown in this last example the use of a 5% solution of the compositions of matter which we have invented, any concentra-

252. COMPOSITIONS.
104
Cross Reference
Examiner

tion of solution may be employed, depending upon the amount of corrosion products and grease present on the metallic surface and the persistence with which the corrosion products and grease adhere to the surface. We have illustrated the use of a 5% solution to show that solutions of concentration as low as that figure and even lower effectively remove the undesirable deposits.

As many apparently widely different embodiments of this invention may be made without departing from the spirit thereof, it is to be understood that we do not limit ourselves to the foregoing examples or descriptions except as indicated in the following patent claims:

We claim:

1. A composition of matter, useful in cleaning metallic surfaces, containing about 4 parts of trisodium phosphate, about 0.4 parts of a sulphonic acid derivative of an alkylated aromatic hydrocarbon containing at least two benzene nuclei, and about 1 part of an organic solvent immiscible with water.

2. A composition of matter, useful in cleaning metallic surfaces, containing about 4 parts of a tri-alkali metal phosphate detergent, about 0.4 parts of a sulphonic acid derivative of an alkylated aromatic hydrocarbon containing two benzene nuclei, and about 1 part of an organic solvent of the group consisting of amyl alcohol and cyclohexanol.

3. A composition of matter, useful in cleaning metallic surfaces, containing about 4 parts of trisodium phosphate, about 0.4 parts of a sulphonic acid derivative of an alkylated aromatic hydrocarbon containing two benzene nuclei, and about 1 part of an organic solvent of the group consisting of amyl alcohol and cyclohexanol.

4. A composition of matter, useful in cleaning metallic surfaces, containing about 4 parts of a tri-alkali metal phosphate detergent, about 0.4 parts of a sulphonic acid derivative of an alkylated naphthalene, and about 1 part of amyl alcohol.

5. A composition of matter, useful in cleaning metallic surfaces, containing about 4 parts of trisodium phosphate, about 0.4 parts of a sulphonic acid derivative of an alkylated naphthalene, and about 1 part of amyl alcohol.

6. A composition of matter, useful in cleaning metallic surfaces, containing about 4 parts of a tri-alkali metal phosphate detergent, about 0.4 parts of sulphonic acid derivative of an alkylated aromatic hydrocarbon containing two benzene nuclei, and about 1 part of an organic solvent immiscible with water.

7. A composition of matter, useful in cleaning metallic surfaces, containing about 4 parts of trisodium phosphate, about 0.4 parts of isopropyl naphthalene-sodium sulphonate, and about 1 part of an organic solvent immiscible with water.

8. A composition of matter, useful in cleaning metallic surfaces, containing about 4 parts of a tri-alkali metal phosphate detergent, about 0.4 parts of isopropyl naphthalene-sodium sulphonate and about 1 part of an organic solvent of the group consisting of amyl alcohol and cyclohexanol.

9. A composition of matter, useful in cleaning metallic surfaces, containing about 4 parts of trisodiu 1 phosphate about 0.4 parts of isopropyl naphthalene-sodium sulphonate, and about 1 part of an organic solvent of the group consisting of amyl alcohol and cyclohexanol.

WILLIAM S. CALCOTT.
GEORGE H. CHENEY.