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CARBURETOR AND ENGINE CLEANING COMPOSITION

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This invention relates to a composition for cleaning carburetors and internal combustion engines, such as gasoline engines and diesel engines, and particularly for cleaning carburetors and engines which have been fouled in service by deposition of gums and carbonaceous deposits. In the operation of internal combustion engines, particularly of the automotive type, it has been found that there accumulates in the engine and in the fuel induction system, particularly the carburetor, deposits of carbonaceous matter and inorganic materials derived from dust in the atmosphere and from materials dissolved in the fuel and/or the lubricating oil or a combinaiton of these sources. Most gasoline motor fuels employed today contain tetraethyl lead as an anti-knock agent which burns to form lead oxides and other lead compounds which deposit about the heads of the cylinders and on the valves and spark plugs. In gasoline engines, these deposits result in increasing the octane rating requirement of the fuel for smooth operation, usually by about 5 to 10 octane numbers or more.

Many gasolines also contain non-vaporizable, gummy materials which collect in the small passages of the carburetor and interfere with its action in properly metering fuel and air charged to the engine. The sluggish action of the carburetor may result in an excessively rich fuel mixture thereby aggravating the formation of carbon deposits about the valves and in the cylinders.

Begining with a clean engine and carburetor, the undesirable effects of gum and carbon deposition become significant after about 5,000 miles of operating the motor vehicle, and after a period of operation of 10,000 to 20,000 miles it becomes necessary to overhaul the carburetor and clean out the head of the engine in order to return the engine to its original smooth operating condition and eliminate roughness, excessive knocking, pre-ignition, stalling, etc.

One object of this invention is to provide a cleaner for the carburetor of gasoline engines which will make unnecessary this expensive overhauling job which sometimes requires replacement of the carburetor by a new carburetor because of the difficulty of cleaning the fine passages by ordinary means.

Another object of the invention is to provide a cleaning composition which will rapidly effect removal of gums and deposits from carburetors and engines without loss of service of the engine and the automotive vehicle involved. Still another object of the invention is to provide a carburetor and engine cleaner which will leave the cleaned parts in such a condition that they are protected against rust and corrosion resulting from atmospheric moisture, particularly in cases where a freshly cleaned engine is allowed to remain standing idle for a period of time. Still another object of the invention is to provide a liquid cleaner which will not damage or corrode any of the mechanical parts of the engine, particularly the bearings, cylinder walls, valves, valve guides, hydraulic valve lifters,

etc., and which will serve to remove from the valve mechanism, gums which cause sluggish valve action or sticking valves.

Numerous cleaners for carburetors and fouled engines have heretofore been tried but they have largely failed to solve the problems encountered. Some have attempted to provide a high solvency action for removal of gummy deposits and have employed for the purpose a volatile solvent mixture. The result has frequently been that the gummy deposit has simply been transferred from one part to another part of the engine, often with disastrous results. Other cleaners made from volatile solvents have left the metal of the cylinder walls and other exposed parts so completely devoid of protection by lubricating oil that severe corrosion and rusting have resulted. Other cleaners have contained corrosive acids which not only attack the deposit but also attack the finely finished surfaces of the engine, such as the cylinder walls and valve guides, sometimes penetrating to the crankcase where they have attacked the bearings. Other cleaners comprised of volatile solvents have succedeed in loosening gummy and carbonaceous deposits but have had no effect on the inorganic deposits of lead and iron salts, metal oxides, dust and dirt which have entered the engine with the combustion air.

It is the purpose of our invention to provide a cleaner which will not only dissolve and remove gum deposits in the carburetor and intake passages, but will also loosen carbonaceous deposits and deposits of inorganic salts, oxides, etc., to such an extent that they will be largely swept out of the combustion spaces of the engine during operation.

We can also loosen and remove deposits from the crankcase of the engine by withdrawing the lubricating oil and adding the cleaner to the crankcase. Idling the engine serves to circulate the cleaner throughout the lubricating system, oil pump and bearings, removing gummy, carbonaceous deposits and loosening stuck rings. The fouled cleaning liquid is withdrawn with dissolved gums and dispersed carbon particles. The crankcase is then recharged with lubricating oil and is ready for further service.

Our carburetor and engine cleaner is comprised of a combination of ingredients which cooperate to accomplish the above purposes. We have discovered that a high concentration of water and hydrocarbon oil can be made to be compatible in a clear solution by the combined action of certain alcohols, alkoxy alcohols and soaps of ammonia or its closely related amine derivatives known as the volatile nitrogen bases. The following general and specific formulas show our composition:

	Composition, Parts by Volume	
	General Formula	Specific Example 1
Alkoxy alcohol	5–12	9 butyl Cellosolve.
Aliphatic alcohol, 4–6 atoms	5–12	9 methyl, isobutyl carbinol.
Hydrocarbon oil	35–55	45 heavy naphtha—325° F. average boiling point.
Liquid fatty acid	6–12	10 oleic acid.
Volatile nitrogen base	1–4	2.1 aqua ammonia—28% NH_3.
Water	15–35	24.9
		100.0

The following additional examples illustrate specific compositions with various ingredients falling within the class of materials and proportions set forth in the general formula above:

Example 2

	Parts by volume
Secondary butyl alcohol	10
Butyl Cellosolve	10
Oleic acid	9
Aromatic naphtha—280° F. average boiling point	45
Ammonium hydroxide—28% NH_3	2
Water	35

This product was quite clear and did not become opalescent until the water component was increased to 45 parts.

Example 3

	Parts by volume
Cyclohexanol	10
Ethyl Cellosolve	10
Oleic acid	9
Petroleum naphtha—325° F. average boiling point	46
Ammonium hydroxide—28% NH_3	2
Water	25

This product was clear but clouded on addition of 5 parts more water.

Example 4

	Parts by volume
Dipropylene glycol monobutyl ether	10
Methyl isobutyl carbinol	10
Oleic acid	10
Naphtha—325° F. average boiling point	45
Ammonium hydroxide—28% NH_3	2.2
Water	25.0

Example 5

	Parts by volume
Methyl isobutyl carbinol	10
Butyl Cellosolve	10
Oleic acid	9
Morpholine	2
Petroleum naphtha—325° F. average boiling point	45
Water	25

When 10 parts more water was added, the mixture still remained clear.

Example 6

	Parts by volume
Tetrahydrofurfuryl alcohol	10
Butyl Cellosolve	10
Tall oil, refined	12
Ammonium hydroxide	2.5
Kerosene	45
Water	25

Example 7

	Parts by volume
Diethylene glycol monethyl ether ("Carbitol")	10
Secondary butyl alcohol	10
Oleic acid	13
Ammonium hydroxide—28% NH_3	2.5
Petroleum naphtha—325° F. average boiling point	45.0
Water	25

This product was clear and remained clear after adding 10 parts more water.

The order of mixing the ingredients in the above formulas is not very important, but we prefer to add the water last. The resulting solution will be brilliantly clear and, when diluted with an equal volume of water, the solution will be an opalescent, white emulsion. For cleaning engines, removing carbon deposits, etc., greater effectiveness is obatined by limiting the amount of water to about 35%.

The hydrocarbon oil ingredient can be a high flash naphtha, kerosene, olefine polymer, or an aromatic solvent such as xylene or an aromatic petroleum naphtha rich in xylenes, alkyl naphthalenes, etc., such as the solvent extracts from petroleum distillates and the product known as "hydroformer bottoms"—the fraction from the reforming process boiling above gasoline. The use of aromatic hydrocarbons increases the solvency of the cleaner for varnishes and gums found in the induction system of the engine.

We prefer that a minor proportion of the hydrocarbon ingredient be a lubricating oil, preferably a distillate oil of 60 seconds Saybolt (100° F.) viscosity and upward, the purpose of which is to leave a non-volatile film of oil on exposed metal surfaces in the engine, providing lubrication and preventing rust. The rust protection can be increased still further by adding to the composition a small amount of an alkaline earth metal petroleum mahogany sulfonate, preferably about 1 to 3 percent of alkaline earth metal mahogany sulfonate in solution in about 60 percent of oil. Formulas of such a composition are presented below:

	Composition, Parts by Weight	
	General Formula	Specific Example 8
Alkoxy alcohol	5 to 10	6.34 butyl Cellosolve.
Aliphatic alcohol—4 to 6 carbon atoms	5 to 10	6.34 isobutyl carbinol.
Water	15 to 35	26.4
Aromatic naphtha, boiling above 250° F	30 to 40	36.96 350° F. initial B.P.
Liquid fatty acid	6 to 12	8.13 oleic acid.
Light mineral lubricating oil	10 to 20	12.67 100 pale oil.
Petroleum sulfonate—40% in oil	1 to 3	1.58 calcium sulfonate (8% ash).
Volatile nitrogen base	1 to 3	1.58 aq. ammonia—28% NH_3.

	Composition—Parts by Volume	
	Example 9	Example 10
Petroleum naphtha—35/42° API	51.68	
Petroleum naphtha—odorless—347°—409°		38.3
Butyl Cellosolve	6.4	6.25
Methyl isobutal carbinol	6.4	8.61
Pentasol	0.71	.69
Water	23.6	23.0
Oleic acid	7.92	7.74
Calcium mahogany sulfonate	1.48	1.44
Ammonium hydroxide—28% NH_3	1.81	1.77
Distillate lubricating oil—60 pale oil		12.16

In making up these compositions, the ingredients may be combined in several ways. Thus, the volatile base and the fatty acid can be combined to form a soap which is then mixed with the water, butyl Cellosolve and alcohol. The petroleum sulfonate can be dissolved in the light lubricating oil which may be slightly heated to accelerate the solution. This solution can then be diluted with the aromatic naphtha and finally combined with the soap mixture.

It is sometimes convenient, in commercial practice, to first mix all the ingredients except the volatile base, for example, ammonia, which is added last with thorough mixing. Agitation with air or mechanically in a tank for a period of 15 to 30 minutes is usually sufficient. Part of the mineral lubricating oil can be withheld to follow the addition of volatile base to insure complete addition of the latter when pumping through a line. The product is a clear, stable solution which can be kept in closed containers indefinitely without separation. Inasmuch as the water and naphtha are present in the form of a transparent emulsion, the product has a powerful wetting and penetrating action for either oil-wet or water-wet surfaces which enables the liquid to loosen deposits from surfaces where they are accumulated.

The volatile base can be ammonia, gaseous or liquid, usually aqua ammonia (28% NH_3), or it can be an organic amine such as butylamine, morpholine, trimethylamine, etc. The amount of the base should be sufficient to neutralize the liquid fatty acid employed. Hydroxy-

alkylamines such as the ethanol amines are avoided because of their low volatility and their precipitating action on sludge, causing the sludge to deposit in the ring grooves of the piston.

In addition to isobutyl carbinol, other aliphatic alcohols of 4 to 6 carbon atoms can be employed, such as amyl alcohol, Pentasol, cyclohexanol, tertiary butyl carbinol, secondary butyl alcohol, normal butyl alcohol, etc. Methyl isobutyl carbinol is favored because of its pleasant odor.

Alkoxy alcohols are ether alcohols in which the alkyl group has from two to five carbon atoms. Examples are ethyl hydroxyethyl ether (ethyl Cellosolve); ethoxy ethoxy ethyl alcohol (ethyl Carbitol); butoxy ethoxy ethyl alcohol (butyl Carbitol); propoxy propyl alcohol and hydroxy ethyl amyl ether. They may contain more than one ether oxygen and usually two or three carbon atoms in the alcohol group. Butyl Cellosolve (butyl hydroxy ethyl ether) has been found very satisfactory.

In our preferred composition employing aromatic naphtha solvent, it may be a fraction from coal tar distillate containing xylene or boiling above xylene, but the aromatic naphthas of petroleum origin are preferred because of their low cost. These are usually derived from solvent extracts or from hydroformer or aromatizer distillates. For most purposes, where odor is not important, it is preferred to use aromatic distillates of upwards of 50% aromatic content having a flash point above about 110° F. (closed cup) and initial boiling point above about 300° F. Two examples of aromatic naphthas suitable for this purpose had the following characteristics:

	Sample 1	Sample 2
Gravity, °API	30.5	36.7
Flash Point (cc.), °F	138	110
Aniline Point, °F	9	31
Percent Aromatic hydrocarbons	72	57
Distillation:		
Initial point	350	320
10%	360	324
50%	373	330
90%	396	342
End Point	415	378

The odor of aromatic petroleum solvents can be improved by a mild treatment with sulfuric acid, for example, 10 pounds per barrel. Thus, an aromatic distillate boiling in the range of 440° to 590° F. was so treated and neutralized before using in the above formulas.

When a light lubricating oil is employed in our composition, it is preferably a pale oil having a viscosity within the range of about 60 to 150 SSU at 100° F. This may be obtained from any ordinary crude but lubricating distillates from naphthenic or aromatic base crudes are preferred. Heavy lubricating oils can be used in small amounts, however. For the liquid fatty acids, we may use the "red oil" of commerce or other liquid fatty acids such as fish oil fatty acid, soy bean fatty acid, tall oil fatty acid, corn oil fatty acid, linseed oil fatty acid, cottonseed fatty acid, coconut fatty acid, rape-seed fatty acid, naphthenic acid and other carboxylic acids of low melting point, below about 35° C. usually having about 12 to 20 carbon atoms.

The petroleum sulfonate employed in our composition is the preferentially oil soluble type or "mahogany" sulfonate obtained by the action of fuming sulfuric acid on petroleum lubricating oils or aromatic alkylates usually within the range of about 100 to 550 SSU viscosity at 100° F. The resulting sulfonic acid after purification to remove inorganic salts, is usually concentrated in the oil phase and converted to calcium or barium sulfonate or other polyvalent metal sulfonate. The resulting product in the case of calcium sulfonate having about 8% neutral ash, corresponds to about 40% calcium sulfonate in oil. If barium sulfonate is used, the equivalent amount based on the sulfonic acid present is employed and more or less concentrated polyvalent metal sulfonates can be used in equivalent amounts. We may also employ the basic alkaline earth metal sulfonates in the same manner, having, for example, alkali values of 10 to 60 mg. KOH per gram.

When used to clean the crankcase of the engine, we may add to our composition a small amount, about 0.1 to 2 percent of an agent to increase film strength, such as tricresyl phosphate, tributyl phosphite, and zinc dimethyl cyclohexyl dithiophosphate.

The foregoing composition can be packaged in convenient containers for distribution and should be maintained sealed at all times to avoid loss of water by evaporation. When using this combination for cleaning fouled-up carburetors and engines, the following procedure is employed:

The engine should be warm, for example, about 160° to 190° F. The air cleaner leading to the carburetor should be removed. With the motor running at a fast idle, about 300 cc. of the cleaning composition is slowly introduced into the air intake of the carburetor. The speed of the engine is then increased and about 150 cc. more of the cleaning fluid is poured rapidly into the carburetor, stalling the engine. The ignition is then turned off and the engine allowed to stand for 15 to 30 minutes or longer. The air cleaner is replaced and the engine idled until smoke ceases to be emitted from the exhaust. It is usually desirable to readjust the carburetor after cleaning to compensate for the removal of gums which have interfered with its action. Tests on engines cleaned in this manner have shown an increase in maximum horsepower upward of 5 to 10 H.P.

Under some conditions, it has been found that ethylene glycol antifreeze in the cooling system has gained access to the crankcase through a leaking gasket and, being insoluble in lubricating oil, it remained in the crankcase when the oil was drained. Our cleaner has the power to remove such glycol deposits, thus eliminating a cause of corrosion and interference with proper engine lubrication.

This application is a continuation in part of our application, Serial No. 445,915, filed July 26, 1954, now abandoned.

Having thus described our invention, what we claim is:

1. A clear carburetor and engine cleaning composition for removing deposits of gummy materials, carbonaceous matter and inorganic substances from the carburetor and combustion chambers of internal combustion engines when introduced through the carburetor of said engines while idling, said composition consisting essentially of the following ingredients:

	Parts by weight
Alkoxy alcohol containing 2–5 carbon atoms in the alkyl group	5–10
Aliphatic alcohol having 4–6 carbon atoms	5–10
Aromatic naphtha boiling above 300° F.	30–40
Liquid fatty acid of 12 to 20 carbon atoms	6–12
Volatile nitrogen base selected from the class consisting of ammonia, butylamine, morpholine, and trimethylamine	1– 3
Water	15–35

2. The carburetor and engine cleaning composition of claim 1 to which is added 10–20 parts by weight of a hydrocarbon distillate lubricating oil having a viscosity above 60 seconds Saybolt at 100° F.

3. The carburetor and engine cleaning composition of claim 1 containing, in addition, about 1 to 3% of an oil solution of an alkaline earth metal mahogany sulfonate in 40% concentration.

4. A clear carburetor and engine cleaning composition for removing deposits of gummy materials, carbonaceous matter, and inorganic materials from the carburetor and combustion chambers of internal combustion engines when introduced through the carburetor of said engines,

said composition consisting essentially of the following ingredients:

	Parts by weight
Alkoxy alcohol containing 2–5 carbons in the alkyl group	5 to 10
Aliphatic alcohol having 4 to 6 carbon atoms	5 to 10
Water	15 to 35
Aromatic naphtha boiling above about 320° F. comprising at least 50% aromatic hydrocarbons	30 to 40
Oleic acid	6 to 12
Light mineral lubricating oil of 60–150 SSU @ 100° F.	10 to 20
Petroleum mahogany sulfonate of an alkaline earth metal	1 to 3
Aqua ammonia (28% NH_3)	1 to 3

5. A carburetor and engine cleaner comprising a substantially transparent emulsion consisting essentially of the following ingredients in parts by weight:

Butyl hydroxy ethyl ether	6.34
Isobutyl carbinol	6.34
Water	26.4
Petroleum naphtha having an initial boiling point above about 320° F. and containing at least 50 percent of aromatic hydrocarbons	36.96
Aqua ammonia (28% NH_3)	1.58
Oleic acid	8.13
100 SSU Viscosity at 100° F. Pale Oil	12.67
Calcium mahogany sulfonate having 8% neutral ash	1.58

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