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SOLVENT COMPOSITION AND METHOD OF CLEANING LUBRICATED APPARATUS

John D. Morgan, South Orange, N. J., assignor to Cities Service Oil Company, New York, N. Y., a corporation of Pennsylvania

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This invention relates to improvements in solvent compositions and in methods of cleaning lubricated apparatus. More particularly the invention relates to solvent compositions for and method for cleaning internal combustion motors.

This application is a continuation-in-part of the applicant's pending application Serial No. 307,585, filed December 5, 1939 (now Patent No. 2,301,918, granted November 17, 1942), for "Flushing oil," and covers an improvement in the composition disclosed therein.

This pending application covers a flushing oil composition and the method of cleaning bearing surfaces which are commonly lubricated by oil or grease, the cleaning operation to be carried out while the moving parts of the apparatus are in motion. The preferred composition disclosed in this pending application is as follows:

	Present by volume
Commercial xylol	10
No. 2 fuel oil	88.9
Octyl alcohol	0.1
Sulfurized cresyl phosphite	0.5
Sulfurized cresyl phosphate	0.5

To over fifty gallons of this mixture, two grams of a red organic dye are added in order to give a distinctive color to the mixture.

According to the further disclosure of the pending application, the commercial xylol is a good solvent for varnishes, gums and resins which are often formed in the crank case and around the piston rings of an automobile engine. The xylol has good penetrating properties and a desirable surface tension to assist in dissolving gums, resins and the like in a crank case, and should contain a relatively low percentage of benzol and have a minimum flash point of 115° F.

The fuel oil referred to above is described as preferably comprising a mineral oil which is a good solvent for asphalts, mineral residues and reaction products of mineral oils which are deposited in the crank case from lubricating oils, and gasoline which may dilute the lubricating oil in the operation of the engine. The preferred properties for this fuel oil are:

	° F.
Minimum flash point	110
Maximum flash point	190
On Engler distillation:	
10% over at	440
90% over at maximum	600
Pour point	15

A fuel oil of this type in addition to being a good solvent is an excellent carrier for emulsions, carbon and dirt which accumulates in an engine, and therefore assists in effectively flushing out foreign material in the crank case.

The small proportion of the octyl alcohol is used to prevent frothing in washing the engine, and the sulfurized phosphite and phosphate are employed as extreme pressure lubricants to lubricate the moving parts while they are being cleaned. The phosphite-phosphate mixture furthermore has the property to clean and displace undesired residues which are deposited in bearings.

The primary object of the present invention is to provide an improved solvent composition which may be used in accordance with the disclosure of the above-mentioned pending application, but which is especially useful for the removal of gums, residues and carbonaceous deposits which form on the valves and piston rings of internal combustion motors.

Another object of the invention is to provide improved methods for cleaning the valves, cylinders and pistons of internal combustion engines by the use of an improved solvent composition.

A further object of this invention is to provide an improved cleaning solvent for internal combustion motors which can be used for cleaning the valves and piston rings of the motor while in operation.

The improved solvent composition in accordance with the present invention preferably includes the following constituents in approximately the percentages given:

	Percentage by volume
Kerosene	16
Xylene	16
Secondary butyl alcohol	16
Light lubricating oil	50
Extreme pressure lubricant base (consisting of equal parts of #2 furnace oil and a cresyl phosphite condensation product containing one half equivalent of combined sulfur)	2

This composition is particularly useful for loosening the gums and resins and similar varnish-like materials which collect on the valves, pistons and piston rings of internal combustion motors.

One method of utilizing the solvent composition is to remove the spark plugs from the motor and pour approximately two ounces of the solvent into each spark plug hole and let the motor stand in this condition from two to twelve hours, after which the spark plugs are replaced and the motor run for ten minutes until the color of the exhaust becomes normal. The loosened gum and car-

bonaceous material will be blown from the motor with the exhaust. Such accumulations may include carbon and fine metal particles which have been cemented to the valves and piston parts with the gums, varnishes or resins referred to above.

Another method of utilizing the improved solvent composition is to pour several ounces of the solvent directly into the air intake of the motor carbureter while the motor is idling. In this case, the air cleaner of the motor should be removed and the solvent poured in slowly.

The foregoing methods of utilizing the improved solvent composition usually apply to motors which are not operating satisfactorily or which are known to have deposits of resinous or gummy materials or in which the valves are known to stick and not function properly. The solvent may be utilized to prevent deposits in a motor or to remove slight deposits, by adding four ounces of the solvent to each ten gallons of gasoline, as for example in the gasoline tank of the motor car. This treatment will prevent valve sticking and keep the piston rings in their normal condition so that maximum compression and normal motor performance will be obtained.

The improved solvent composition of the present invention as will be noted above preferably contains considerable proportions of kerosene, xylene and secondary butyl alcohol, which, along with the small proportion of the phosphite condensation product which seems to act as a plasticizing agent, quickly assimilates or cuts the gum and resinous deposits. The solvent seems to cut directly into such materials, possibly because of the softening or plasticizing action of the phosphite condensation product. Instead of using secondary butyl alcohol, other equivalent higher alcohols of this type may be employed such as iso- and tertiary butyl alcohols, and isoamyl alcohol. The proportion of the alcohol in the composition should not be less than about 15%, but may comprise as high as 32% of the composition. Lower alcohols such as methyl and ethyl alcohols are unsatisfactory in the mixture because they tend to annul the solvent influence and solvent-carrying power of the kerosene, light lubricating oil and xylene. On the other hand the alcohols referred to above, and particularly secondary butyl alcohol, seem to accelerate the solvent power of the kerosene and xylene and increases the carrying power of the light lubricating oil. The proportions of xylene and kerosene may be from 8 to 16%, but are preferably near the upper limit, for example 15%. The solvent composition may be comprised of approximately 15% of kerosene, 15% of xylene, 15% of secondary butyl alcohol, 50% of a light mineral lubricating oil and from 1% to 5% of a condensation product of organic phosphite molecules with sulfur.

The phosphite condensation product comprising a relatively small proportion of the preferred solvent composition may be prepared by reacting a quantity of tricresyl phosphite with one half its atomic equivalent of flowers of sulfur. The phosphite and sulfur are mixed together and heated while stirring in a reaction chamber to a temperature of from 370° to 425° F. (preferably at approximately the higher temperature). During this heating operation an exothermic reaction takes place so that care must be taken to prevent excessive temperature rise. Tests on this product show that a sulfurized condensation product is formed in which sulfur is directly attached to phosphorus, and in which at least two phosphite groups are attached to a single sulfur atom. Other more complex condensation products may be present.

While the preferred phosphite condensation product contains only one-half equivalent of sulfur, very satisfactory extreme pressure bases have been prepared by using somewhat larger proportions of sulfur. Condensation products containing one, and one and one-half equivalents of sulfur have been found to possess very good plasticizing and extreme pressure properties. The condensation product in accordance with the present invention may contain up to three atomic equivalents of sulfur to two molecules of the phosphite. While the preferred solvent composition as described above includes the use of a tricresyl phosphite condensation product with sulfur, it is to be understood that the phosphite may be either a primary, secondary or tertiary organic phosphite in which the organic groups or radicals, represented by (R) or (RO), may be aliphatic, aromatic, mixed aromatic and aliphatic, heterocyclic or hydro aromatic groups. The "R" or "RO" groups in any phosphite may be alike or different, but in general the "RO" tertiary phosphites are preferred. One or more of the "R" or "RO" groups may be halogenated. The halogenated phenolic phosphite condensation products with sulfur are very effective plasticizing and extreme pressure agents when used with the xylene, secondary alcohol and kerosene of the improved solvent composition of the present invention. The solvent may contain from 1 to 5% by volume of the phosphite condensation product, although 1% is usually sufficient.

The improved solvent composition of the present invention is particularly adapted for use in internal combustion motors for the purposes described above, but may be employed for a number of other uses, such as in the cleaning of various types of bearings and interacting surfaces where used lubricants and foreign particles may accumulate and adversely effect the functioning of the apparatus on question. In certain types of apparatus which are not normally lubricated with oil or grease, the improved solvent composition will penetrate between such surfaces and leave a lubricant film which will be composed particularly of the phosphite condensation product after the other materials have evaporated. For example, the product will penetrate and suitably lubricate leaf springs and similar equipment. In this case some of the light lubricating oil may be left between the leaves along with the extreme pressure lubricating agent. Where the composition is used primarily as a cleaning material, the light lubricating oil, which may be an SAE 10 or lighter oil, functions as a carrier medium mutually soluble with the other constituents of the composition, and is adapted to carry considerable proportions of dissolved resinous type material.

While the improved solvent composition has been described in substantial detail, as well as the improved method of cleaning lubricated apparatus, it is to be understood that various modifications may be made without departing from the spirit and scope of the present invention, as defined by the claims.

Having thus described the invention in its preferred form what is claimed as new is:

1. A solvent composition for loosening gums, resins and carbonaceous matter from the pistons and valves of an internal combustion motor, comprising approximately 16% of kerosene, 16% of xylene, 16% of secondary butyl alcohol, 50% of

a light mineral lubricating oil, and approximately 1% of a condensation product of tricresyl phosphite molecules with about one-half atomic equivalent of sulfur, said percentages being by volume.

2. A solvent composition for loosening and removing gums, resins and carbonaceous matter from the valves, pistons and other lubricated parts of internal combustion motors, comprising approximately 15% of kerosene, 15% of xylene, 15% of secondary butyl alcohol, 50% of a light mineral lubricating oil and from 1 to 5% of a condensation product of organic phosphite molecules with from one-half to three atomic equivalents of sulfur, said percentages being by volume.

3. A solvent composition as defined by claim 2 in which said organic phosphite is a phenolic phosphite.

4. A solvent composition as defined by claim 2 in which said phosphite is an aryl phosphite.

5. A solvent composition as defined by claim 2 in which said organic phosphite is a halogenated organic phosphite.

6. The method of loosening and removing resins and carbonaceous residues from the valves and pistons of an internal combustion motor, which comprises introducing into the cylinders of the motor a solvent mixture comprising approximately 15% of kerosene, 15% of xylene, 15% of secondary butyl alcohol, 50% of light mineral lubricating oil and from 1 to 5% of a condensation reaction product of tricresyl phosphite and sulfur, the percentages being by volume.

7. An improved solvent composition for loosening and removing gums, resins and carbonaceous materials from the relatively moving parts of apparatus comprised essentially of from 8 to 16% kerosene, from 8 to 16% xylene, from 16 to 32% secondary butyl alcohol, approximately 50% light mineral lubricating oil, and from 1 to 5% of sulfurized tricresyl phosphite, said percentages being by volume.

8. A solvent composition for loosening and removing gums, resins and carbonaceous materials from the relatively moving parts of apparatus and for lubricating such parts while they are being cleaned, comprising from 15 to 32% by volume of secondary butyl alcohol, approximately 15% each of xylene and kerosene by volume, most of the remainder of the composition being a light mineral lubricating oil, and from 1% to 5% of an extreme pressure lubricating agent consisting essentially of a condensation product of organic phosphite molecules chemically linked to sulfur.

9. A solvent composition for cleaning gums, resins and carbonaceous matter from the surfaces of lubricated apparatus such as the pistons and valves of internal combustion engines, comprising from 8% to 16% each by volume of kerosene and xylene, from 16% to 32% by volume of secondary butyl alcohol, from about 1% to 5% by volume of a sulfurized organic phosphite as a plasticizing agent, the remainder of the composition being a light mineral lubricating oil.

10. The method of loosening and removing resins and carbonaceous residues from the valves and pistons of an internal combustion motor, which comprises introducing into the cylinders of the motor a solvent mixture comprising from 8% to 16% each by volume of kerosene and xylene, from 16% to 32% by volume of secondary, butyl alcohol, from 1 to 5% by volume of a sulfurized organic phosphite as a plasticizing agent, the remaining portion of the mixture being a light mineral lubricating oil.

JOHN D. MORGAN.