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FLUSHING OILS

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This invention relates primarily to oils for flushing internal combustion engines by use of the same in the crank case for a period of time in place of the usual lubricating oil.

The object of the invention is to furnish oil having lubricating properties and of such constitution that it will act to remove deposits from the cylinder walls, contiguous piston walls and the piston rings and grooves, as well as from the walls of the crank case, the inside walls of the pistons, the crankshaft and the oil pump screen.

The present invention resides largely in a mineral oil having at least some lubricating properties and containing a large quantity of water held in solution by means of agents possessing water-retaining and common solvent properties.

I have found that large quantities of water can be retained in lubricating oils by means of oil-soluble petroleum sulfonates, and that at the same time freely fluid dispersions or solutions are produced having no emulsion or grease-like properties, which may be entirely clear. The resultant soap and water composition will remove deposits from the walls of the crank case, pistons and cylinders and from piston rings and piston grooves when used in the place of lubricating oil in the crank case of an internal combustion engine for an appreciable length of time, such as one hour. The detergent action possibly is the effect, or is in part the effect, of particular colloidal conditions of hydrated soaps produced with appropriate water contents but I do not wish to be bound in all events by such theory.

According to one preferred form of the invention, I employ in a mineral lubricating oil, preferably a light mineral lubricating oil, a quantity of the sodium or potassium salt or "soap" of oil-soluble sulfonic acids from the treatment of petroleum fractions with sulfuric acid, together with around 20% to 30% water which usually approximates 2 or 3 times the quantity of the sulfonate, and a relatively small proportion of butyl "Cellosolve." Butyl "Cellosolve" is the trade name for the butyl ether of ethylene glycol, or in other words ethylene glycol mono-butyl ether, which has a boiling point of around 170° C. and is produced by Carbide and Carbon Chemicals Corporation of New York city.

Suitable sulfonates, particularly sodium sulfonate, are obtainable on the market, these having been produced in well-known manners from the oil-soluble sulfonic acids obtained in the treatment of various mineral lubricating oils and the like with sulfuric acid. One such is known as "Petronate" produced by Sonneborn and Sons of New York city. Corresponding synthetic com-

pounds are also sometimes available on the market and may be used. Any mineral lubricating oil, especially the light lubricating oils, may be employed as the oil constituent. A desirable oil is a low viscosity acid-treated naphthenic base oil in the SAE 5 range which has a viscosity of around 100 seconds Saybolt Universal at 100° F. Lighter oils having lubricating qualities such as the so-called spray oils can be employed, and also heavier oils such as those of SAE 20 and 30 grades. The oils may be of either paraffinic or naphthenic type. In some instances it might even be appropriate to substitute kerosene. In general, the greater the proportion of sulfonate, the greater the proportion of water which can be retained. Where water contents are much above 35% or 40%, the oils do not appear to be effective until the water has boiled off to reduce it to the 35% to 40% range. The effective water range seems to be between about 5% and about 35%, at least with 10% to 15% sulfonate. Ordinarily 10% sulfonate and 20% to 25% water are used. As specific examples, we have prepared compositions approximately as follows (proportions being in percent by weight):

	Example							
	I	II	III	IV	V	VI	VII	VIII
Sodium sulfonate	6	10	15	6	10	15	15	15
Water	10	20	30	15	25	30	40	45
Oil—S. A. E. acid treated naphthenic base	84	70	55	74	60	54	40	33
Ethylene glycol monobutyl ether				5	5	6	5	7

In the above table, it will be noted that where the proportion of water is small with respect to the sulfonate, that is where the water is about twice that of the sulfonate, no common solvent is used; that is found in Examples I, II and III. However, as shown in the other examples, where a few percent of the common solvent is employed, the water content with respect to any given proportion of sulfonate is subject to considerable increase. The last example also shows that, at least in some cases, the water content may be further increased with an increase in the common solvent. All examples show that as the sulfonate is increased the water content may be increased. Of course, the sulfonate content may be increased without increasing the water content. A typical practical composition for commercial use is that shown in Example V.

Further, with respect to these examples, while

for most practical purposes it is probably preferable to employ the common solvent, nevertheless good results are obtained at normal temperatures or higher without the common solvent so long as the proportion of water does not exceed that which may enter into proper solution. In the case of Examples I, II and III, clear solutions may be readily obtained, although upon standing at temperatures appreciably below room temperature there may be a tendency to cloud, and, especially if the water content is substantially increased without corresponding increase in sulfonate, there may be a tendency toward some water separation in storage. However, this need not be necessarily objectionable for use when the material is stocked in 5 or 6 quart cans whose contents are to be poured directly into the engine being flushed. In such instances cloudiness is no objection and the heat of the engine soon brings about adequate solution. However, this condition may be avoided by employing appropriate amounts of common solvent, which as indicated may vary between about 2% or 3% and 10%. The examples also indicate that there ordinarily is a practical water limit for each percentage of sulfonate or of sulfonate and common solvent. Thus, for about 15% of sulfonate the practical water limit would be about 30% without common solvent, and about 40% with about 4% or 5% of common solvent. The sulfonate could be increased to 20% although without particular additional advantage.

In order to increase the detergency of the composition, aromatic solvents, straight run naphthas and other petroleum thinners and the like may be added to replace a portion of the lubricating oil. For example, 15% or 20% of an aromatic solvent could be used in any of the above examples in place of a corresponding proportion of the mineral oil. Such solvents, or thinners will also have some common solvent effect, and would exert such effect in Examples I, II and III.

In general, proportions are not critical, although, as has been indicated, there are reasonable practical limits, and as water contents increase especially above those given, greater caution is required in compounding. For example, in most cases where the water content is to exceed about 25% such precautionary measures are found in diluting the sulfonate with approximately an equal quantity of oil, mixing the water therewith, employing agitation and ordinarily also warming to 100° F. or up to perhaps 150° F. until a clear solution is obtained, thereupon adding the remainder of the oil, the common solvent when used being added either before or after the addition of the remainder of the oil or with said remainder of the oil. These measures are easily followed and avoid tendencies to maintain a permanent cloud. Of course, in some of these blending operations there is a temporary clouding which disappears upon agitation or warming or standing as the case may be, and when a cloud tends to persist, ordinarily it may be overcome by the addition of further amounts of common solvent, except that too much common solvent after the clear stage has been reached will sometimes cause a cloudy condition which may be difficult to remove without further increase in sulfonate.

Where the compounding procedures indicated are not followed, but a different order of addition is employed, it may be difficult and at times almost impossible to remove completely the cloudy

effect, but this does not appear to detract from the usefulness of the product as a flushing oil.

It will be noted that in the examples given the mineral oil is a naphthenic base oil. Where a paraffinic mineral oil is employed, it may sometimes be desirable to lower somewhat the common solvent in those instances where a common solvent is required to clear the solution, e. g. 1% to 3% less.

As to the common solvent in general, 10% appears to be the maximum that will produce any desirable effect in any commercial composition. Again, since 40% (or possibly 45%) of water seems to be the absolute upper limit of the water content with which the flushing oil is effective, there is no significance in enlarging the proportion of water nor in using the larger proportions of the common solvent in order to clear a solution containing such larger water content. Thus, while it has been found possible by following the preferred procedure above indicated to place 65% of water into solution in the naphthenic base oil with about 7.5% of sulfonate and about 4% of the ethylene glycol monobutyl ether mentioned, there is often a tendency for a cloud to develop, and there appears to be no practical advantage in trying to produce such a product. In general, the avoidance of cloud is more a function of the oil-sulfonate ratio with respect to the water content than of common solvent with respect to water content at ordinary temperature.

With respect to the use of a common solvent of the ether type mentioned, while it has been indicated that it may be omitted in some instances, nevertheless it is preferred to use such a common solvent in all instances because the solvent acts to change the colloidal properties of the sulfonate solution and improve not only the clarity of the product but also the efficiency thereof. This efficiency is improved by reason of the detergent properties possessed by the common solvent itself, and apparently also by reason of the improvement in the colloidal character of the solution. As has been indicated, the required initial colloidal character appears to be due to the existence of the condition of hydration of the soap. It is presumed that the water is necessary to hydrate the soap, and that so long as proper hydration exists the required effectiveness exists. When too much water is present this colloidal state seems to have been affected, and when the water is boiled out the necessary colloidal state again is lost.

In blending, where 15% of sulfonate is used with about 5% or 6% of the ethylene glycol monobutyl ether, when the water is poured into the oil solution the water will disperse without clouding, up to the limit of water which will otherwise be retained; whereas if only 10% of the sulfonate is present in the oil into which the water is being introduced, there will be a slight clouding as the water is commingled but this clouding will clear up on brief standing. The curve representing the transition from a clear product to a substantially milky or cloudy product shows that, with a naphthenic base oil, about 5% or 6% sodium sulfonate is the minimum to retain about 10% water; that about 10% of sodium sulfonate is the approximate minimum to retain 30% to 35% of water, and that the curve then flattens out so that, so far as the question of permanent clear solution is concerned, only 4% or 5% additional sodium sulfonate is essential to retain any larger proportion of water. With a paraffinic oil, the sulfonate should be 2% or 3% higher. Of course,

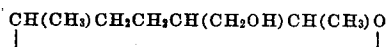
as previously indicated, an appreciable amount of common solvent is usually necessary to insure a clear solution of the oil, water and sulfonate. Under these conditions, about 35% of water is the approximate upper limit when only 10% of the sulfonate is used, but when as much as 15% of the sulfonate is used there is apparently no upper limit to the water content, although more than about 35% to 40% of water (as above indicated) usually produces no desirable effect until the excess water boils off. Similarly, the soap may be increased, for example to 20%, but without any great significance. Apparently, the desideratum is maintaining the soap (sulfonate) in hydrated form. Thus, increase in soap permits increase in water to 50% or more, but an effective composition is limited as indicated to around 35% water. Also, a paraffinic oil ordinarily requires use of more sulfonate, and less common solvent, than is permitted with a naphthenic oil, the tolerance of paraffinic oils for the common solvent apparently being less than that of naphthentic oils.

In employing the present product, the used lubricating oil is drained out of the crank case, the crank case is filled to the usual level with the present flushing oil, and the engine is then run at idling speed for an appreciable length of time, e. g. one hour. For such an operation, it is important that the crankcase temperature become somewhat elevated, as by retarding cooling. Preferably a range of 180° F. to 190° F. is employed because activity is low below 180° F. and the water is driven off too rapidly above 190° F. Under these conditions the soap and water, or perhaps more properly the hydrated soap, becomes very active, and especially in the case of a light oil. The whole solution, especially where common solvent is present, penetrates readily along the piston walls to the rings and ring grooves. Here the solution has apparently a solvent effect upon accumulations containing the usual resinous and varnish-like deposits, and results in the washing away of deposits not dissolved, e. g. carbon particles.

Apparently the oil is effective until all or nearly all of the water has been boiled out, and perhaps for somewhat longer period due to the presence of the sulfonate or the common solvent when used. A sixty-minute flushing period produces very beneficial effects. Since the oil is to be a sufficiently good lubricating oil for whatever period of time the engine is to be cleansed, it may be so operated for longer or shorter periods. However, if the oil from which the product is prepared is a suitable quality lubricating oil an automobile engine may be run while the car is in service for a time adequate to insure thorough flushing. For example, 100 miles at normal crankcase temperatures will suffice. Lighter oils are required where good flushing of the piston rings and grooves is required. Otherwise, heavier oils, e. g. S. A. E. 30, may be used whereby only the crankcase and pan are to be flushed and cleaned. It is also possible to use the old oil already in the crankcase, without draining, by introducing the mentioned additives into the crankcase and forming the solution or blend in situ. During treatment of the engine the flushing oil becomes quite black and dirty, and is removed at the end of the flushing period. To some extent oil filters are also cleaned, solid materials which are not soluble in the flushing oil, e. g. carbon particles, being carried off in suspension.

With respect to substitutes, no thoroughly satisfactory commercial common solvent has yet

been found and tested to replace the ethylene glycol mono-butyl ether mentioned, when naphthenic base oils are used, although the expensive phenyl "Cellosolve" (phenyl ether of ethylene glycol) is good, and doubtless there are known materials of nature somewhat kindred to these which would be suitable equivalents. However, where more paraffinic oils, i. e. oils of higher viscosity index are used, not only is less common solvent usually required, say 1% to 3% less, but the range of common solvents increases; those of the type of "dibutanol," butyl "carbitol" (butyl ether of diethylene glycol) and propylene glycol have been used. Dibutanol is stated by its manufacturers, Carbide and Carbon Chemicals Corporation, in their 1939 booklet entitled "Fine Chemicals," to have the following formula:



This is a glycol type derivative. As a substitute for the sodium or potassium sulfonates, other sulfonates having adequate detergent properties which are adequately oil-soluble and will not themselves tend to leave deposits during the flushing operation, may be used. Examples of these are the triethanolamine sulfonates, and ammonium sulfonates. However, other oil-soluble detergent sulfonates such as the alkaline earth metal sulfonates may be used. Thus, calcium, barium, strontium and magnesium sulfonates are indicated as having at least appreciable value, and also those of metals such as zinc, aluminum, chromium, iron, tin, copper, cadmium and the like.

So far as variations in percentages are concerned, these have been indicated. However, as to butyl "Cellosolve," the percentage variations will be between about 2% and 10%. The common solvent may be entirely omitted as has been indicated where only temperatures of about 75° F. or higher are to be encountered, or where clouding or settling is no objection. Possibly water down to 2% or 3% is beneficial.

This oil product may be used for other appropriate purposes, for example as a cutting oil especially where 30% or larger proportions of water are present, as may be readily attained to almost any limit when about 20% of sulfonate, or possibly a little more in some instances, is used.

I claim:

1. A flushing oil comprising a major proportion of mineral lubricating oil fraction, between about 10% and 35% of water, and between about 5% and 15% of an alkali metal petroleum sulfonate.

2. A flushing oil for internal combustion engines comprising at least about 33% of light lubricating oil, between about 10% and 45% of water, and between about 10% and 15% of oil-soluble petroleum sulfonate.

3. A flushing oil for internal combustion engines comprising at least about 40% of lubricating oil, between about 10% and 35% of water, and between about 10% and 15% of sodium sulfonate derived from petroleum.

4. A flushing oil according to claim 1 containing in the order of 2% to 10% of common solvent.

5. A flushing oil according to claim 2 containing in the order of 2% to 10% of ethylene glycol monobutyl ether.

6. A flushing oil composition comprising mineral lubricating oil a major proportion, between about 10% and 35% of water and in the order

of about 10% of an oil-soluble metal sulfonate derived from petroleum.

7. A flushing oil composition according to claim 6 containing in the order of 2% to 10% of a common solvent.

8. A flushing oil for internal combustion engines containing a major proportion of light mineral lubricating oil in the S. A. E. 5 to 10 range, about 20% to 25% water, and about 10% of oil-soluble sulfonate derived from petroleum.

9. A flushing lubricant comprising in the order of 60% to 65% of light lubricating oil, in the order of 25% to 20% of water, in the order of 5% of a common solvent, and in the order of 10% of oil-soluble sodium sulfonate derived from the treatment of petroleum fractions with sulfuric acid.

10. A flushing oil for internal combustion engines containing at least about 33% lubricating oil, between about 5% and about 20% of oil-soluble petroleum sulfonate, and more than about 10% of water.

11. A flushing oil according to claim 10 containing between about 2% and about 10% of a common solvent.

12. A flushing oil according to claim 10 containing between about 2% and about 10% of a common solvent of the class consisting of ethylene glycol monobutyl ether, phenyl ether of ethylene glycol, dibutanol, and butyl ether of diethylene glycol.

13. A flushing oil according to claim 10 containing in the order of 2% to 10% of ethylene glycol monobutyl ether.

14. A method for operating internal combustion engines comprising operating such an engine with its pistons, cylinder walls, connecting rods, crank shafts and bearings in contact with a composition comprising at least about 33% of lubri-

cating oil, between about 10% and 50% of water and between about 5% and 20% of oil-soluble petroleum sulfonate, whereby deposits in the engine are removed from the mentioned engine parts.

15. A method according to claim 14 wherein the composition contains in the order of 2% to 10% of common solvent.

16. A flushing oil for internal combustion engines containing at least about one-third mineral lubricating oil, between about 5% and 20% of oil-soluble petroleum sulfonate, and in the order of 20% to 40% of water.

17. A flushing oil according to claim 16 containing between about 2% and about 10% of a common solvent.

18. A flushing oil according to claim 10 containing in the order of 2% to 10% of common solvent containing a glycol grouping.

19. A flushing oil according to claim 10 containing in the order of 5% of ethylene glycol monobutyl ether.

20. A flushing oil according to claim 15 containing a small proportion in the order of 5% of a common solvent.

21. A flushing oil comprising a major proportion of mineral lubricating oil fraction containing between about 5% and about 20% of oil-soluble sulfonate and more than 10% water, the composition being relatively free from aromatic petroleum fractions.

22. A flushing oil for internal combustion engines containing at least one-third mineral lubricating oil, between about 5% and about 20% of oil-soluble petroleum sulfonate, and more than 10% water, the composition being relatively free from aromatic petroleum fractions.

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