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LIQUID FOR TRANSFERRING ENERGY AND LUBRICATING

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The present invention relates to liquids for transferring energy and lubricating.

It is well known that castor oil and other vegetal, i. e. animal or mineral, oils and fats are efficient lubricants. If however such lubricants are used in hydraulic machinery, such as fluid brakes, as means for transferring energy a disadvantage occurs which consists in the considerable increase of viscosity of the said materials at low temperatures. It has been already suggested to diminish the viscosity by adding ethyl alcohol to castor oil but these mixtures corrode metals. In order to obviate this deleterious effect alkali metal hydroxide or alkali metal salts, in particular arsenites or phosphates, have been added but with insufficient results and the substitution of butyl alcohol for ethyl alcohol has not proved satisfactory as regards corrosion.

We have now found that liquids for transferring energy and lubricating can be prepared by mixing liquid ethers, especially ethers of the glycols or polyglycols, or mixtures thereof, with oily lubricating agents such as vegetable, animal or mineral oils, especially with castor oil, and if desired with further additions of diluents, alkaline agents or agents retarding oxidation or several of such agents. The components of the said mixtures must of course be so chosen that they are miscible with each other at the temperatures concerned in the application of the mixtures for the said purposes. The ratio between the ethers and oily lubricating agents varies in rather wide limits depending on the purpose intended for the preparations; thus the quantity of ether may be from 5 to 200 per cent of the oily lubricating agents, provided these quantities dissolve in each other, which is the case with most ethers and especially with vegetal, i. e. vegetable and animal oils. Certain mineral lubricating oils such as those of Pennsylvanian origin are less compatible in many cases with ethers of low molecular weight in which the ratio of oxygen to carbon is rather high, and in these cases quantities of ether of from about 5 to about 30 per cent are preferred. The ethers employed may be chosen from any ethers containing aliphatic radicles and we wish the term "ethers" to be understood as not including purely aromatic compounds such as diphenyl oxide and the like. The ethers can be chosen from all those ethers which have a melting point below zero centigrade and are therefore liquid under normal conditions. Suitable ethers are the symmetrical and unsymmetrical aliphatic ethers as for example methyl, ethyl, propyl, butyl, heptyl and decyl ethers, methyl dodecyl ether, dibenzyl ether, the alkyl and aryl ethers of glycols, of polyglycols and of other higher polyhydric alcohols and similar ethers provided they fulfil the requirements as regards their melting point. The low aliphatic ethers such as di-methyl ether, methyl ethyl ether or di-ethyl ether may be employed for use at low temperatures but should not be employed in preparations for use at temperatures above the boiling point of the said ethers.

Since by the addition of the ethers, the setting point of the oils contained in the mixture is lowered with the simultaneous reduction of the viscosity of these oils at the temperatures concerned, such mixtures have a viscosity especially suitable for the aforesaid purpose and may be accommodated to the requirements by appropriate choice of the proportions or components of the mixture in a manner in which no other mixtures can. This is especially important because, in the apparatus and machines necessary for the various purposes, the openings for the flow of the pressure transferring liquids, as for example nozzles, valves and the like, are frequently of very different sizes. Moreover, the said mixtures have a good lubricating action and may therefore be used as lubricants in machines as well as for hydraulic purposes, though the lubricating power of the ethers is below that of the oily lubricating agents.

For example a mixture of equal parts by weight of neutral castor oil which has a viscosity of 20° Engler at 50° C. and of 140° Engler at 20° C., and of ethylene glycol mono-ethyl ether has the following viscosities:

Temperature (in degrees centigrade)	−20°	0°	20°	50°
Viscosity (in degrees Engler)	19°	6.2°	3.3°	1.8°

With ethylene glycol mono butyl ether the corresponding viscosities are:

Temperature (in degrees centigrade)	−20°	0°	20°	50°
Viscosity (in degrees Engler)	49°	13°	5.2°	2.3°

A mixture of 1 part of castor oil with 2 parts of polyethylene-glycol mono-ethyl ether has the following viscosities:

Temperature (in degrees centigrade)	−20°	0°	20°	50°
Viscosity (in degrees Engler)	32°	8°	3°	2°

A mixture of 2 parts of castor oil and 1 part of commercial poly-ethylene glycol mono-butyl

ether has a viscosity of about 4.5° Engler at 50° C.

On an average the alteration in the viscosity with the temperature is thus much smaller than with oils, as can be seen from the following table in which the ratio of the times of outflow from a capillary glass pipe are given:

Mixture in parts by weight	Ratio of times of outflow at—			
	50° C.	20° C.	0° C.	−29° C.
1 part of castor oil and 2 parts of poly ethylene glycol monobutyl ether	1	2.4	5.7	21
1 part of castor oil and 2 parts of poly ethylene glycol mono-ethyl ether	1	2.4	5.1	20
1 part of castor oil and 2 parts of ethylene glycol mono-butyl ether	1	2.0	4.2	13
1 part of castor oil and 2 parts of ethylene glycol mono-ethyl ether	1	1.7	2.8	6.9

The values given vary somewhat by reason of slight differences in the initial materials. By employing other mixtures especially those of mixtures of the mixtures specified with other ethers of ethylene glycol or of polyethyleneglycol, as for example ethyleneglycol mono-cresyl ether, ethylene glycol diethyl ether, and the like, the viscosities at the different temperatures may be still more adapted to the purpose in view.

In the place of, or together with, the ethers of glycols or of polyglycols other ethers may be employed, for example symmetrical or mixed ethers of monohydric aliphatic, cycloaliphatic or aliphatic aromatic alcohols, provided that the ethers possess a boiling point above the temperature which may arise in the particular application desired. Thus, for example a mixture of equal part by weight of castor oil and of di-n-butyl ether has the following viscosities: at −20° C. 7.9° Engler, at 0° C. 3.4° Engler, at 20° C. 1.9° Engler and at 50° C. 1.4° Engler, whereas a similar mixture with ethyl alcohol in the place of the ether has a viscosity at −20° of 25° Engler. A mixture of 2 parts of mineral oil, 1 part of ice-machine oil and 1 part of di-butyl ether shows the following viscosity values at the aforesaid temperatures: 3.1, 1.7, 1.3 and 1.1. The viscosity of "Gargoyle Mobile Oil BB" which corresponds to a period for effluing from the Engler viscosimeter at 20° C. of 406 seconds is reduced to 235 seconds by an addition of 5 per cent of dibenzyl ether and to 82 seconds by an addition of 10 per cent of di-butyl ether. Of the oils, castor oil has been found to be especially suitable by reason of its good lubricating power and its small attack on caulking materials especially on rubber. A great variety of kinds of castor oil may be employed, including those which have been rendered miscible with mineral oils, and also mixtures of these oils with other oils, such as mineral oils or vegetable oils other than castor oil. For example a mixture of 30 parts by volume of a castor oil miscible with mineral oil, 30 parts by volume of ethylene glycol mono-cresyl ether and 10 parts by volume of mineral oil, which remains completely clear at 10° below zero centigrade may be mentioned. Moreover, mixtures of 20 parts of an oil having a low setting point such as the oils known in the trade for lubricating ice-machines and 20 parts of poly-ethylene glycol mono-butyl ether, or of 20 parts of a mineral lubricating oil and from 20 to 40 parts of ethylene glycol mono-butyl ether are very useful, and likewise mixtures of 10 parts of mineral lubricating oil, 10 parts of ice-machine oil and from 4 to 10 parts of ethylene glycol mono-butyl ether or of di-n-butyl ether.

In order to prevent any corrosion of metals such as iron, steel, copper and the like, by a content of free acids in the oils it is preferable to employ neutral oils, such as are obtained for example by heating the acid oils with ethylene oxide or a homologue thereof or to add to the mixtures small amounts of basic compounds such as alkali metal hydroxides, alkaline reacting salts of the oxygen acids of phosphorus, carbonates and the like, which, if necessary, may be previously dissolved in suitable solvents, as for example ethyl alcohol, in order to produce clear mixtures.

When employing commercial ethers, it is frequently preferable to purify them for this purpose by a treatment with alkalies and subsequent distillation. With oils which undergo change by the oxygen of the air such as vegetable or animal oils it is sometimes preferable to add agents for preventing oxidation as for example those used in the rubber industry such as aldol-alpha-naphthylamine, or other agents such as urea and the like.

The said mixtures may be used as power-transferring and lubricating liquids for a great variety of hydraulic apparatus and machines, as for example for brakes, shock-absorbers, presses, lifting apparatus and the like.

What we claim is:—

1. As a composition of matter suitable for transferring energy and lubricating, a practically anhydrous, limpid, homogeneous mixture consisting of a liquid polyglycol ether and a lubricating oil.

2. As a composition of matter suitable for transferring energy and lubricating, a practically anhydrous, limpid, homogeneous mixture consisting of a liquid glycol ether, a liquid polyglycol ether and a lubricating oil.

3. As a composition of matter suitable for transferring energy and lubricating, a practically anhydrous, limpid, homogeneous mixture consisting of a liquid polyglycol ether and a vegetable lubricating oil.

4. As a composition of matter suitable for transferring energy and lubricating, a practically anhydrous, limpid, homogeneous mixture consisting of a liquid polyglycol ether and castor oil.

5. As a composition of matter suitable for transferring energy and lubricating, a practically anhydrous, limpid, homogeneous mixture consisting of about equal parts by weight of neutral castor oil and of polyethylene glycol mono-ethyl ether.

6. As a composition of matter suitable for transferring energy and lubricating, a practically anhydrous, limpid, homogeneous mixture consisting of a liquid polyglycol ether and a mineral lubricating oil.

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