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HYDRAULIC FLUID

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This invention relates to compositions of matter and more particularly fluids for use in hydraulically operated apparatus such, for example, as hydraulic brakes, hydraulic clutches, and similar hydraulically operated mechanisms.

Various proposals have been made to use mixtures of alcohol and castor oil, glycerine, and the like, for hydraulic transmission of power such as for actuating the pressure-operated elements of hydraulic brake systems, shock absorber systems, hydraulic clutches and similarly operated apparatus. In a great number of fluids previously proposed, however, there have been numerous disadvantages, such, for example, as wide changes in viscosity, corrosive or decomposing effect of the fluids upon metal and rubber parts of hydraulic apparatus, tendencies toward gasification and/or solidification under higher and lower temperature conditions, respectively; all of these and similar disadvantages being drawbacks to commercial utilization of many previously proposed fluids.

It is an object of the present invention to overcome these and other undesirable characteristics and particularly to produce an improved hydraulic fluid which is characterized by having a wide range of usefulness under extremely variable operation conditions.

Other objects and advantages of this invention will be apparent by reference to the following specification in which its preferred details and embodiments are described.

According to my invention improved hydraulic fluids are produced by mixing a lubricant, such as an animal, vegetable or mineral oil, or derivatives thereof, with varying proportions of one or more normally liquid N-substituted aliphatic acid amides. The new and improved fluids of my invention are characterized by: relatively slight changes in viscosity even at high or low temperatures; little or no corrosive or decomposing effect upon metal and rubber; and no gasification or solidification tendencies under the higher and lower temperature conditions encountered in automobile operation.

Normally liquid substituted amides of normal aliphatic acids generally may be utilized according to this invention, including the normally liquid alkyl-, alkylol-, aryl-, and alicyclic-substituted amides of such acids as acetic, propionic, butyric, isobutyric and acids containing functional groups, such as methoxyacetic acid. These amides possess physical and chemical characteristics which admirably fit them for hydraulic fluid purposes and they may be employed over a wide range of proportions together with the lubricants previously described. Although I prefer to utilize a major portion of substituted amide in my fluids, I have found that as small a quantity as 5% or less will impart desired qualities, and as high as 95% and higher may be employed advantageously. The preferred amounts of substituted amide fall, however, in the range of from about 10 to 90%.

Substituted amides generally may equally as well be utilized as ingredients of my hydraulic fluids whether of the mono- or di-substituted variety. Thus, for example, substituted amides which may be utilized according to the present invention include mono- and diethyl acetamid, dimethyl acetamide, mono- and dimethyl formamide, mono- and diethyl formamide, mono- and dibutyl formamide or mono- and diisobutyl formamide, mono- and dipropyl and isopropyl formamides, ethanol formamide, ethanol glycolamide, dimethyl propionamide, dimethyl isovaleramide, and the like. Any alkyl substituted amide may be utilized according to the present invention, substantially the only requisites being that it be liquid at normal temperatures and have a boiling point not less than 100° C.

The substituted amides of this invention are free from attack upon the rubber and metallic parts of which hydraulically actuated mechanisms are constructed, have a high boiling point, have a sufficient range of viscosity to be operable under a wide range of temperatures and lend their characteristics, in part at least, to the whole hydraulic fluid composition in such a way as to give a desirable hydraulic fluid.

The term animal oil is used in the broad sense to include all terrestrial animal, marine animal and fish oils. In like manner vegetable oils generally may be utilized, and in both cases, i. e., in the case of the animal or the vegetable oil, I have found that the oil itself, or derivatives thereof, may be utilized according to the present invention when combined with normally liquid N-substituted aliphatic acid amides.

Although, according to this invention, I may use any oil whether mineral, vegetable or animal, I prefer particularly to utilize an oil characterized by being a glyceride or other ester of fatty acids, and, more specifically, one which contains hydroxy and/or unsaturated groups. Thus, for example, among the many oils which I may utilize according to this invention there may be mentioned: almond, blackfish, candlenut, castor, China-wood, coconut, cod, corn, cottonseed, croton, eucalyptus, geranium, grape seed, hemp,

juniper, lard, lemon, linseed, maize, menhaden, neat's foot, olive, oiticica, orange, palm, peanut, pine, porpoise, rapeseed, seal, sesame, shark, sperm, tallow, train, sunflower, tung, turpentine, walnut, whale, wool, and the like. Blown oils such as blown castor oil may be utilized alone or in combination with other oils and oil derivatives or both. Derivatives of these oils also may be utilized such for example as those derivatives which may be obtained by alcoholysis of these oils by any simple alcohol or alcohol containing a functional group such as amino, keto, aldo, ether, ethylenic, or other unsaturated groups, and the like. Thus, for example, desirable oil derivatives may be obtained by heating a vegetable or animal oil such as previously disclosed with such monohydric alcohols as methyl, ethyl, normal and isopropyl, butyls, amyls, hexyls, heptyls, octyls, nonyls, decyls, dodecyls; 2 ethyl butyl, and ethyl hexyl; the individual alcohol, or mixture of branched chain alcohols, obtainable by catalytic hydrogenation of oxide of carbon under pressure, such as 2-methyl butanol-1; 3-methyl butanol-2; 2-methyl pentanol-3; 2-methyl pentanol-1; 2,4-dimethyl pentanol-3; 2,4-dimethyl pentanol-1; 2,4-dimethyl hexanol-3; 4-methyl hexanol-1; 2,4-dimethyl hexanol-1; 4-methyl heptanol-1; and the like. Similarly, such dihydric alcohols and glycols may be utilized as ethylene glycol, the 1,2- and 1,3-propylene glycols, the butylene and isobutylene glycols, the amylene and hexalene glycols, and the like, as well as the polyglycols, such as diethylene glycol.

Trihydric alcohols, such as methyl glycerine, glycerine, and other polyhydric alcohols, may be utilized for alcoholysis of the oils disclosed previously as well as those trihydric alcohols which contain functional groups in addition to hydroxyl groups. Further miscellaneous alcohols illustrative of the aromatic and heterocyclic alcohols which may be utilized for alcoholysis of the animal or vegetable oils and which come within the scope of this invention include cyclohexanol, benzyl alcohol, naphthenyl alcohol, sorbitol, lignin, furfuryl alcohol, and the like. Alcohols containing amino, keto, aldol, ether, ethylenic or unsaturated groups which may be utilized, are hydroxy ethylamine, propionyl carbinol, glycolic aldehyde, glycol monoethylether, diethyl acetylene glycol monopropionate, and alpha, gamma butinenediol, which are representative, respectively, of alcohols containing such functional groups. All the specific alcohols hereinbefore set forth are representative and illustrative only of the scope of alcoholysis which may be utilized, according to this invention, for the production of derivatives of animal and vegetable oils and should not be taken as a limitation thereof.

In the alcoholysis of vegetable or animal oils such as previously described, these alcohols or alcoholic bodies may be mixed with varying proportions of vegetable or animal oils, as previously described and heated preferably to a temperature of from 80–250° C. I may use stoichiometric proportions of oil and alcoholic bodies necessary for the alcoholysis reaction, i. e., sufficient alcoholic body to produce monoester, but I prefer to use an excess of alcohol giving as high as 2 to 20 times the quantities of alcohol required for complete reaction. This excess speeds up the reaction and enables its rapid completion under lower temperatures. The excess alcohol or alcoholic body may or may not be removed from the final product, as desired. I prefer to operate the process in the presence of catalysts such, for example, as potassium oleate or ricinoleate, potassium carbonate, potassium hydroxide, zinc oxide, zinc chloride, lead oxide, and the like. I have found that catalyst concentrations of from about 0.01 to 8% (by weight, based upon the mixture of oil and alcohol) are satisfactory altho I prefer to utilize about 4% concentration thereof. If desired, I may also operate the process in the presence of solvents, such as isobutanol, ether, ethanol, pyridine, and the like, which may, if desired, be thereafter utilized as ingredients of the final hydraulic fluid composition. Pressures are utilized which are necessary to allow the use of temperature which in turn will effect a suitably rapid reaction rate, particularly where low boiling reactants are involved.

As a further feature of this invention I have found that the addition of small proportions of graphite, as such or in fluid suspensions, such as those known under the trade-mark names "Castordag," "Aquadag," "Glydag," or the like, is often beneficial and improves the characteristics of my fluid.

I may, for example, use "Castordag" (a suspension of graphite in castor oil) as the source of all or part of the castor oil, and similarly "Glydag" (a suspension of graphite in a polyalcohol) as the source of part or all of the polyalcohol. I prefer to use graphite as such or in the form of suspensions such as previously disclosed so that the graphite concentration will be in a range of from about 0.001 to 0.5% by volume of the total fluid.

Although the lubricant-substituted amide solution previously described is admirably fitted by itself for hydraulic fluid purposes, I have found that improvements upon this fluid can be obtained by adding graphite as previously shown or by utilizing such oil-substituted amide solutions in admixture or combination with one or more organic diluents. Among the organic materials susceptible for admixture as diluents are: alcohols such as the mono- and polyhydric, aliphatic, alicyclic, aromatic and amino alcohols, including specifically methanol, propanol, butanol, isobutanol, octanol, diacetone alcohol, ethylene and propylene glycol, glycerol, sorbitol, cyclohexanol, phenol, benzoyl alcohol, triethanolamine and ethoxy amino butanol; organic esters such as ethyl and butyl acetate; ethers such as diisobutyl, ethyl tertiary butyl, and methyl ricinoleyl ethers; aldehydes such as heptaldehyde and benzaldehyde; ketones such as diisopropyl ketone and cyclohexanone; nitrogen-containing compounds such as triethanolamine, octyl amine, tetrahydrofurfuryl alcohol and furane compounds; hydrocarbons such as isooctane, benzene, and cyclohexane.

Solvents or diluents as above illustrated may be used in ratios to the oil- or oil derivative-substituted amide solutions which vary over a wide range, although, generally speaking, I prefer to have at least about 5% and not more than about 90% of the oil- or oil derivative-substituted amide solution present in my final composition. The range of diluent may be set, therefore, as from about 10 to 95% of the total mixture, altho, preferably 10–60% by volume of diluent and 60–10% of substituted amide should be utilized.

The following examples, altho restricted to substituted formamides, will illustrate proportions of materials which may be utilized according to this invention whether or not substituted formamides or other substituted amides are used.

Example 1

	Per cent
Castor oil	10–50
Dimethyl formamide	50–90

Example 2

	Per cent
Oil consisting of castor oil and/or a glycol ricinoleate made by reacting a glycol with castor oil as set forth above	20–50
Dimethyl formamide	10–40
Isobutanol	10–40

Example 3

	Per cent
Glyceryl mono, di and/or triricinoleates	10–45
Ethyl ether of ethylene glycol	10–50
Monomethyl formamide	10–60

Example 4

	Per cent
Coconut oil	10–50
Dibutyl (iso) formamide	15–50
3-methyl-3-hydroxy butanone-2	10–40

Example 5

	Per cent
Glycol ricinoleates	10–50
Diethyl formamide	10–50
N-butanol	10–50

Example 6

	Per cent
Glycerine (or glycol)	20–50
Dimethyl formamide	50–80

Example 7

	Per cent
Castor oil	10–50
Ethyl alcohol	20–40
Dimethyl formamide	20–50
Glydag (or other suspended graphite)	0.2–5.0

Various changes may be made in the present invention without departing therefrom or sacrificing any of the advantages thereof.

I claim:

1. A hydraulic fluid comprising a normally liquid N-substituted aliphatic acid amide and an organic lubricant.

2. A hydraulic fluid comprising a normally liquid N-substituted aliphatic acid amide, an organic lubricant and an organic diluent.

3. A hydraulic fluid comprising a normally liquid N-substituted aliphatic acid amide, an aliphatic alcohol, and a liquid obtained by alcoholysis of an oil selected from the group consisting of animal and vegetable oils.

4. A hydraulic fluid comprising a normally liquid N-substituted aliphatic acid amide, an aliphatic alcohol, and an organic ricinoleate.

5. A hydraulic fluid comprising an alkyl formamide, an aliphatic alcohol, and an organic ricinoleate.

6. A hydraulic fluid comprising dimethyl formamide, an aliphatic alcohol, and an organic ricinoleate.

7. A hydraulic fluid comprising 10 to 40% by volume of a normally liquid N-substituted aliphatic acid amide, 10 to 40% of an aliphatic alcohol and 20 to 50% of an organic ricinoleate.

8. A hydraulic fluid comprising 10 to 40% of an alkyl formamide, 10 to 40% of an aliphatic alcohol, and 20 to 50% of an organic ricinoleate.

9. A hydraulic fluid comprising 10 to 40% of an alkyl formamide, 10 to 40% of an aliphatic alcohol, and 20 to 50% of a glycol ricinoleate.

10. A hydraulic fluid comprising 10 to 40% of dimethyl formamide, 10 to 40% of an aliphatic alcohol, and 20 to 50% of a glycol ricinoleate.

11. A hydraulic fluid comprising 10 to 40% by volume of dimethyl formamide, 10 to 40% isobutanol, 20 to 50% ethylene glycol ricinoleate, and 0.2 to 5.0% suspended graphite per 100 parts of complete fluid.

12. A hydraulic fluid comprising 10 to 40% by volume of dimethyl formamide, 10 to 40% isobutanol, and 20 to 50% propylene glycol ricinoleate.

13. A hydraulic fluid comprising 30 to 70% by volume dimethyl formamide and 70 to 30% organic ricinoleate.

14. A hydraulic fluid comprising 30 to 70% by volume dimethyl formamide and 70 to 30% of a glycol ricinoleate.

15. A hydraulic fluid comprising 30 to 70% by volume dimethyl formamide and 70 to 30% of a glyceryl ricinoleate.

16. A normally liquid material prepared for use as a hydraulic fluid containing at least 5% by volume of a normally liquid N-substituted aliphatic acid amide and an organic lubricant.

17. A normally liquid material prepared for use as a hydraulic fluid containing at least 5% by volume of a normally liquid N-substituted aliphatic acid amide, an organic lubricant and an organic diluent.

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