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HYDRAULIC PRESSURE TRANSMITTING FLUID

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This invention relates to the manufacture of fluid compositions for the transmission of pressure and more particularly to a fluid that is especially adapted for modern hydraulic brake systems and analogous equipment.

This application is a continuation in part of my co-pending application Serial No. 64,174, filed February 15, 1936.

It is not the purpose of this invention to describe in detail the mechanical construction of hydraulic systems, inasmuch as such systems are known and have heretofore been described. It is sufficient to point out that in order to actuate such systems there is required a fluid for transmitting pressure. It is desired to point out, however, that the modern hydraulic braking system may comprise rubber, aluminum and other sensitive elements in their make-up; hence problems are introduced. My novel fluid is non-injurious to such braking system elements.

Further details respecting hydraulic systems, and fluids, are set forth in my article appearing in Industrial and Engineering Chemistry, vol. 30, page 422. A number of requirements for a high quality fluid are there set forth, as well as further details respecting difficulties such as corrosion, stratification, etc., encountered in the prior art when using conventional fluids.

Inasmuch as prior art fluids comprised such ingredients as aliphatic alcohols, oils, glycerine, water and the like, they were prepared in many instances merely by mixing the various constituents together in the ratio desired, more or less in the cold. In certain prior art disclosures use of mineral oils, very damaging to rubber braking parts, other oils, water and other components have been referred to without suitable limitation.

I have found that greatly improved results, and a superior fluid may be obtained. Preferably I employ my novel manufacturing procedure as set forth in detail herein.

This invention has for one object to provide a novel hydraulic pressure transmitting fluid substantially non-injurious to automotive braking parts, which fluid is capable of miscibility with other fluids. Another object is to provide a method for making fluids for hydraulic apparatus used in the transmitting of power. Still another object is to prepare a base which may be readily converted to fluid. Still another object is to provide a method which is more rapid and produces a superior product than obtained by methods heretofore employed. A still further object is to provide a method conducive to the production of a fluid that will not injure a braking system charged therewith. Other objects will appear hereinafter.

I have found that particularly excellent fluid for use in hydraulic apparatus may be prepared from various vegetable oils, any free oil being substantially comprised of the non-drying and/or semi-drying type, and various solvents provided certain other constituents are incorporated therein, by the proper procedure. While oils are preferred, in some instances fatty acids such as oleic, ricinoleic, and the like, may be employed, being converted to a soap. Or, fatty acids and glycerine may be reacted to produce an oily material. Even though certain oils and solvents have heretofore been considered incompatible, I have found that a large variety of oils and solvents may be coupled into clear, non-viscous fluids satisfactory for use in hydraulic braking systems by my novel procedure set forth in detail hereinafter.

My novel fluids generically comprise a non-drying vegetable oil (if in a free state) such as castor oil, dissolved in or otherwise incorporated with a solvent such as a glycol or other poly-hydric alcohol, and/or glycol ethers such as the mono-ethyl ether of ethylene glycol, and a soap such as a potash soap of a vegetable oil. Ordinarily, certain combinations of oils and solvents have been considered immiscible. However, as will be described in detail hereinafter, the oil and solvent are caused to couple to produce a clear, free-flowing base which can be further diluted with various other organic liquids. While I have mentioned castor oil as the preferred oil, and would employ a good quality castor oil, various other saponifiable oils such as rapeseed, kapokseed, sunflower seed, grapeseed, teaseed, and other such oils may be mixed with the castor oil or otherwise employed, as will be apparent as the description proceeds. Likewise, while I prefer certain mono-hydric alcohols, certain glycols, or other poly-hydric alcohols, and certain glycol ethers as solvents, other solvents such as aliphatic esters, ketones, and the like may be employed.

For a more complete understanding of my invention, reference is made to the following examples which are set forth primarily for the purpose of illustrating my preferred embodiment. Hence, it is to be understood that although these examples represent particularly excellent compositions, my invention embraces other embodiments.

Example I

	Per cent
Teaseed oil	8–15
Castor oil	3–15
Glycerin (or glycol)	10–25
Commercial alcohol	40–68
Potassium hydroxide	1.4–3
(Alkali expressed in soap	8–14)
Water (incidental)	Trace to 14

Example II

	Per cent
Teaseed oil	10–20
Castor oil	5–15
Glycerin	10–30
Denatured alcohol	0–20
Mono-ethyl ether of ethylene glycol	30–60
Potassium hydroxide	1.8–4
(Alkali expressed as soap	9–20)
Water	Traces to 20

Example III

	Per cent
Castor oil	15–25
Ethylene glycol	5–75
Mono-ethyl ether of diethylene glycol	0–60
Ethyl alcohol	0–25
Alkali hydroxide	1½–5
(Expressed as soap	9–24)
Water	Substantially anhydrous

Example IV

	Per cent
Castor oil	10–25
Ethylene glycol	5–20
Denatured ethyl alcohol	45–75
Potassium hydroxide	4–5
(Expressed as soap	5½–24)
Triethanolamine	Traces to 2
Water	Traces to 15

All of the aforementioned brake fluids have viscosities (S. U. V.) at 100° F of less than 100. For example, the viscosities of the preferred compositions falling under Example IV were less than (40) S. U. V. at 100° F. All the fluids also flowed relatively easily at lower temperatures, as for example, 0° F. and did not crystallize, stratify, or otherwise separate at temperatures even below zero.

It will be noted that the alkali hydroxide in the above examples has been expressed as such and also in terms of soap. While it is preferred to employ potassium hydroxide as this is readily available and produces a particularly satisfactory soap with vegetable oils, other alkalis may be employed. In general, the soap content will be greater than 5% and preferably greater than 8%, but less than 35 or 40%. One preferred range of soap is 8%–21% or 22%. In general, the soap is less than sufficient to produce a fluid having a viscosity of greater than 90 S. U. V. at 100° F. For certain fluids for high temperature service the viscosity may be raised to 150–300 (S. U. V.)

Generically, my novel pressure transmitting fluid comprises a non-drying vegetable oil, at least 5% of soap and a solvent. Preferably, the composition would comprise castor oil, between 8% and 25% of an alkali metal soap, and 5–10% of a high boiling point solvent such as ethylene or propylene glycol, polyglycol ethers, or the like. A small amount of an agent such as an amine, pyrogallol, hydroquinones, or the like for acting as an inhibitor might also be included. Any water content present would be small, less than the soap percentage, and preferably the fluids would be substantially anhydrous.

My preferred fluids will have a pH of between 6–9 and preferably between 7.5 and 8.5 as will be described in more detail hereinafter under the method of manufacture.

I have found a method for producing my brake fluids which is particularly efficient and rapid, as well as conducive to the production of a chemically stable and high quality fluid. In considering the methods of manufacturing my fluid, it will, of course be assumed that the acid values of the various oils or other constituents employed, will be known. It will also be assumed that the percentage of purity of the potassium hydroxide or other alkali or other reagent will be at least approximately known.

Referring now to the manufacture of the composition disclosed in detail in Example I, the following procedure was employed: The alkali hydroxide required to saponify the teaseed oil was dissolved with the aid of heat in the high boiling point medium, glycerin. There may be a slight excess of the hydroxide present at this point, if desired; for insuring complete saponification.

After all of the hydroxide was in solution in the glycerin, the fatty oil to be saponified was added with agitation and the temperature of the mixture raised to, for example, 140–190° C. By using such procedure, complete saponification is obtained in relatively few minutes (as contrasted with prior art processes using simple mixing or aqueous, low-temperature conditions.)

Thereafter, the castor oil was incorporated with the resultant glycerin mixture. Further heat may be applied at a suitable time. A sample of the solution was withdrawn and tested, the composition being adjusted (if need be) either by the addition of alkali or acid (as for example in the form of further saponifiable oil, or acid such as oleic, palmitic, and the like), until the pH thereof is within the desired range.

Thereafter the reaction mixture may be cooled to below 100° C. and further diluted with alcohol and/or other solvents already described.

The procedure for manufacturing the compositions described in Examples III and IV are similar to the aforementioned, in that likewise, a high boiling point saponification medium was employed. In Examples III and IV, castor oil, ethylene glycol (and in the instance of Example IV, triethanolamine) were mixed in a reaction kettle. The alkali hydroxide was slowly incorporated with these mixtures with stirring and the temperature raised to above 100° C. but less than 190° C. It is possible to employ these temperatures not hitherto possible in certain prior art processes employing aqueous conditions, inasmuch as ethylene glycol (or other high boiling medium as glycol ethers) was used as the saponification medium. By this procedure a portion of the castor oil underwent reaction. The reaction was completed in a few minutes and the mixture cooled to below 100° C.

The brake fluid "base" produced was thereafter diluted with solvent, in the instance of Example III, mono-ethyl ether of diethylene glycol "Carbitol" and in the instance of Example IV, denatured ethyl alcohol. I term my novel composition at this point "base" inasmuch as it possesses certain properties of miscibility and utility, as discussed more fully hereinafter. The resulting mixtures were tested by titration and suitable addition made, in the event the fluid did not test

as desired, to bring the composition to a pH between approximately 7–8.5.

It will be observed from the preceding examples of suitable methods for preparing my novel compositions, that I am not concerned with merely neutralizing acid in the vegetable oils, but that I actually react a portion of the oil, or other saponifiable component, with the hydroxide. I am able to readily accomplish this in a short time by means of employing a high boiling point saponification medium rather than aqueous conditions. While I prefer a high-grade castor oil or other type non-drying vegetable oil, if the oil should contain any acids or other impurities any reaction thereof would merely be incidental. Therefore, it will be observed that in my novel compositions my soap content is considerably higher than has heretofore been encountered and/or is produced or associated with non-drying oils, low water and the like for obtaining miscibility, homogeneity and other advantages. Although I prefer to obtain the soap content from a portion of the oil to be used as a lubricating or body-forming medium in my brake fluid composition, in some instances it is also possible to independently saponify a vegetable oil with a hydroxide by means of a high boiling point saponification medium as described, and thereafter combine the vegetable soap, with body-giving medium (preferably castor oil) and one or more of the solvents having the structural formula R—OH already described.

Although I have shown the incorporation of triethanolamine in only one example, it is to be understood that this amine or various other amines such as hydroxy ethyl ethylene diamine, and diethylene triamine, and oleic or ricinoleic acid salts of the above amines; rhodamine and esters or other agents and inhibitors, may be incorporated in each of the various compositions disclosed. It is also to be understood that small amounts of various organic dyes may be incorporated in the compositions. In all of the examples disclosed, preferably as already indicated, the pH of the completed solution will be within the range of approximately 7–9.

As indicated above, my composition comprising oil, soap and high boiling solvent may be considered as a hydraulic fluid base. Said base can be prepared as described, stored or otherwise maintained, and subsequent thereto said preparation be diluted with any suitable solvent or solvents such as the aforementioned and then incorporated in the hydraulic apparatus. Inasmuch as both my base and final fluid compositions are miscible with other fluids, they lend themselves to admixture with other fluids, as for example, alcohols and ethers, or commercial brake fluids.

An example of such mixing is as follows: A certain quantity of base as aforementioned was allowed to set for a period. It was then placed in a mixing apparatus and more than an equal quantity of ethyl alcohol added with agitation. Thereafter the resultant mixture was tested and suitable additions of amines, dyes, or the like materials, made to bring the pH to within the range 7–8.5, or otherwise alter the composition.

In place of the alcohol, glycols, glycol-ethers, or other solvents may be incorporated, as apparent from my several examples. Or, two or more of the solvents described herein could be employed in various ratios. For example, the ratio might vary from 1:1 to 1:7. In general, the aggregate addition of further solvents will be at least an amount equal to the weight of the base or one and a half to two or three times said weight.

By my novel procedure described herein, I obtain thorough incorporation and reaction of certain of the components, and otherwise obtain complete and uniform admixture. The process is relatively rapid, requiring only 5–20 minutes at the temperatures above 100° C. even on ½ ton lots, and may be carried out in standard equipment as steam kettles or the like. The resultant products contain no unreacted alkali particles, and consequently the newly prepared fluid may be charged in an automatic braking system without detriment. The fluid is non-injurious to the various parts of the modern hydraulic braking system and is completely homogeneous. By my employment of certain oils and control of the water content, as already described, I obtain a composition that is not only clear and homogeneous as produced but remains so even after the addition of diluents or admixture with other fluids.

From the foregoing, it is apparent that while I prefer the procedure and compositions disclosed because I have found that these are particularly satisfactory, my invention is susceptible of some modification. Hence, I do not wish to be restricted in my invention, excepting insofar as is necessitated by the prior art and the spirit of the appended claims.

I claim:

1. In the manufacture of hydraulic pressure transmitting fluids and bases therefor, the process which comprises mixing a saponifiable vegetable oil with an aliphatic hydroxy liquid, selected from a group consisting of polyhydric alcohols and glycol ethers having boiling points higher than that of water, adding alkali in amount sufficient to produce a soap content, upon reaction with said vegetable oil, of at least approximately 8 per cent by weight in the final fluid, heating the resulting mixture to a temperature above 100° C., the temperature and time of heating being insufficient to cause any substantial reaction between the said hydroxy liquid and the said vegetable oil, any substantial quantity of free oil present being of the non-drying vegetable oil type.

2. The process of claim 1 wherein said saponifiable vegetable oil is castor oil.

3. In the manufacture of hydraulic pressure transmitting fluids, the process which comprises mixing a saponifiable vegetable oil with an aliphatic hydroxy liquid, selected from a group consisting of polyhydric alcohols and glycol ethers having boiling points higher than that of water, in amount sufficient to form a saponification medium, adding a caustic alkali in amount sufficient to produce a soap content, upon reaction with said vegetable oil, of at least approximately 8 per cent by weight in the final fluid, heating the resulting mixture to a temperature above 100° C., the temperature and time of reaction being insufficient to cause any substantial reaction between the said hydroxy liquid and the said vegetable oil, and diluting the resulting product with at least one organic compound selected from the group consisting of the lower aliphatic alcohols, polyhydric alcohols, and glycol ethers in amount sufficient to reduce the viscosity to below about 90 S. U. V. at 100° F.; any substantial quantity of free oil present in the final fluid being of the non-drying vegetable type.

4. A hydraulic pressure transmitting fluid non-

injurious to rubber parts and capable of miscibility with other brake fluids, which comprises a non-alkaline mixture of a non-drying vegetable oil, a vehicle comprising at least one aliphatic hydroxy liquid, selected from a class consisting of polyhydric alcohols and glycol ethers, having boiling points above that of water, at least 8 per cent by weight of an alkali metal soap of a saponifiable vegetable oil, the percentage of incidental water present being less than the percentage of soap, the composition being substantially free from unsaponified oils other than non-drying vegetable oils and having a viscosity not substantially exceeding 90 S. U. V. at 100° F.

5. The brake fluid of claim 4 wherein said non-drying vegetable oil is castor oil.

6. The composition of claim 4 wherein at least one lower aliphatic alcohol is present serving as a diluent.

7. The composition of claim 4 wherein an inhibiting aliphatic amine is present in amount not substantially exceeding 1 per cent.

8. A brake fluid substantially non-injurious toward rubber and capable of miscibility with other brake fluids, which comprises a non-alkaline mixture of a non-drying vegetable oil, at least one liquid from the group consisting of glycerine and monoethyl ether of diethylene glycol and more than 8% of an alkali metal soap of a vegetable oil produced by saponification with said glycerine or monoethyl ether of diethylene glycol as the saponification medium, said glycerine or monoethyl ether of diethylene glycol being present in sufficient amount to produce a fluid having a viscosity of less than 90 S. U. V., the percentage of incidental water being less than the percentage of soap present, said fluid being substantially neutral to phenolphthalein.

9. A clear, free-flowing brake fluid which does not separate into phases upon standing and use, which comprises a non-alkaline mixture of non-drying vegetable oil, sufficient and some excess of at least one liquid from the group consisting of glycerine and monoethyl ether of diethylene glycol to form a saponification medium for an alkali metal soap of a vegetable oil, said soap being present in an amount greater than 8% but insufficient to produce an unclear-viscous fluid at 100° F., a content of ethyl alcohol to produce a viscosity of not greater than 90 S. U. V. at 100° F., any incidental percentage of water being less than said soap percentage present, said fluid being substantially inert towards rubber.

10. A brake fluid substantially inert toward rubber and capable of miscibility with other brake fluids, comprising a non-alkaline mixture of a non-drying vegetable oil, a quantity of an alkali metal soap of a vegetable oil greater than 8% but insufficient to produce a fluid at 100° F. having a viscosity greater than about 90 S. U. V., the percentage of any incidental water being less than the soap percentage, and more than 50% of at least two aliphatic hydroxy liquids having a boiling point not greater than the boiling point of glycerine, one of said liquids having a boiling point above the boiling point of water and being present in at least twice the excess necessary for forming a high boiling saponification medium, said brake fluid being substantially neutral to phenolphthalein.

11. A brake fluid substantially inert toward the braking system parts and capable of miscibility with other brake fluids, comprising a non-alkaline mixture of castor oil with a quantity of an alkali metal soap of a vegetable oil greater than 8% but insufficient to produce a fluid at 100° F. having a viscosity materially greater than about 90 S. U. V., the percentage of any incidental water being less than the soap percentage, more than 50% of at least two aliphatic hydroxy liquids having a boiling point not greater than the boiling point of glycerine, one of said liquids having a boiling point above the boiling point of water and being present in at least twice the excess necessary for forming a high boiling saponification medium, said brake fluid being substantially neutral to phenolphthalein.

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