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LUBRICANT

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This invention relates to improvements in solid lubricants and more particularly to that class of lubricants designed to be used for lubricating and sealing the moving surfaces of valves.

One object of the invention is to maintain the consistency of such lubricants substantially stable over wide temperature ranges.

Another object of the invention is to render the lubricants insoluble in petroleum hydrocarbons and aqueous liquids and unaffected by steam.

Another object of the invention is to insure sufficient stability at elevated temperatures to retain the lubricating and sealing properties of the lubricants substantially intact.

It has been found that the water insoluble metal soaps of thickened fixed oils have the properties desirable for the services in which these lubricants are used. The water insoluble metal soaps may be made by saponifying the oils with sodium hydroxide to form sodium soaps. The water solution of the sodium soap is added to a water solution of metal salt. The insoluble metal soaps thus formed are washed free of any salts and dried. The soaps are then blended or compounded by heating and stirring with a liquid that is insoluble in water and petroleum hydrocarbons to form the lubricant having the desired qualities.

The water insoluble metal soaps which have been found suitable are those of thickened vegetable or animal oils. Such oils include castor, rape seed, fish, linseed, corn, cotton seed, tung and soja bean. This thickening process may consist of blowing, polymerizing, vulcanizing or oxidizing. In the case of blowing, which comprises blowing air through the oils at elevated temperatures, the oils are caused to take up oxygen and form —OH groups and two or more of the molecules of the oil are caused to combine to form larger molecules. The vulcanized oils are formed by heating in contact with sulphur whereby the molecules of oil combine to form larger molecules. Consequently, it will be apparent that all highly blown, vulcanized, oxidized or polymerized animal or vegetable oils can be made into metal soaps that are insoluble in both water and petroleum hydrocarbons.

Typical metal salts to which the sodium soap may be added to form water insoluble metal soaps are aluminum, magnesium or calcium sulphates.

The material with which the water insoluble metal soaps may be blended to form lubricants having the desired properties may be chosen

from those polar non-polar substances or liquids of high molecular weight. Such materials include the compounds belonging to the glyptal resin class, such as "rezyl balsam" and have the properties of being liquid at 40° F. and having a solubility of less than 2% in gasoline at 70° F.; or the thickened fixed oils, such as castor oils, blown rape seed oil, and blown fish oil; or the mono-esters of the acids of thickened fixed oils including the mono-esters of blown castor oil acid, blown rape seed oil acid, blown fish oil acid and polyhydric alcohols such as glycerine or ethylene glycol.

The preferred "rezyl balsam" is that known to those skilled in the art as No. 33. This material is an ester made from glycerol and phthalic acid and is known as a compound belonging to the glyptal resin class. In preparing this material a resin is formed by heating glycerol and phthalic acid and forming a composition in which there are still some free —OH groups left. A non-oxidizing fatty acid such as stearic acid is added which reacts with a part of the remaining —OH groups, tending to make the resin more water resistant and also contributing to the molecular weight, but not increasing resin formation. This class of materials generally has —OH groups that tend to make them insoluble in hydrocarbons and a number of hydrocarbon groups that tend to make them insoluble in water. If the number of —OH groups and hydrocarbon groups is properly balanced it is possible to make resins that are only slightly soluble in water and hydrocarbons. Such a compound is "rezyl balsam" No. 33, and as this particular material has large molecules it has a low vapor pressure at high temperatures and tends to be less soluble in all solvents.

In carrying out this invention, a preferred formula is as follows:

	Percent
Thickened fixed oil.....	26.0
Sodium hydroxide.....	3.2
Metal salt.....	9.8
Water.....	26.0
Rezyl balsam.....	35.0

In making this improved lubricant the thickened fixed oil, such as air blown castor oil, is saponified with the sodium hydroxide in water. To the sodium soap thus formed there is added a solution made from the metal salt and water, such as aluminum sulphate and water. The insoluble soap which results from the mixture is first washed free of all salts on a filter, and,

after being placed in a suitable vessel, the stabilizing agent such as rezyal balsam is added thereto. The mixture is then heated to approximately 400° F. with constant stirring until all the water is evaporated and the aluminum soap is completely suspended.

It will be understood that other polar non-polar material, such as the thickened fixed oils, including those mentioned, may be substituted for the compound of the glyptal resin class given in the foregoing formula. Also the mono-esters of the acids of thickened fixed oils and glycerine or ethylene glycol.

The resulting product after cooling, comprises a heavy, viscous material which is insoluble in water and petroleum hydrocarbons, such as gasoline, kerosene, mineral oil and the like, and has sufficient consistency at 400° F. to seal and lubricate the seating surfaces of valves subjected to high pressures. If desired, a small percentage of a thickened fixed oil, such as blown castor oil, may be added to stabilize the suspension at lower temperatures. In addition, to make the lubricant more solid, a small percentage of a vegetable wax, such as carnauba wax, may be added. As it is usual to form the lubricant into stick form for convenience in use on lubricated valves, the wax imparts certain plastic properties which enables these sticks to retain the desired shape.

An average composition of the lubricant is as follows:

	Percent
Water insoluble metal soap of thickened fixed oil.....	38.2
Rezyal balsam.....	51.8
Thickened fixed oil.....	2.8
Vegetable wax.....	7.2

As stated, the thickened fixed oil and vegetable wax, can be omitted if the properties they impart are not desired. The ratio of water insoluble metal soap to rezyal balsam can vary between limits of 25% water insoluble metal soap and 75% rezyal balsam to 55% water insoluble metal soap and 45% rezyal balsam. Taking these variations into account and including the thickened fixed oil and vegetable wax the composition limits may comprise:

	Percent
Water insoluble metal soap of thickened fixed oil.....	22.2 to 49.0
Rezyal balsam.....	40.0 to 66.8
Thickened fixed oil.....	2.8
Vegetable wax.....	7.2

It will be understood that while the invention is ideally suited for use in lubricating and sealing the moving surfaces of valves it is not limited to such applications, but finds a wide field of usefulness, particularly in devices where solvent action is of importance such as pump and valve packing lubricants.

I claim:

1. The process of manufacturing solid lubricants which comprises mixing a water insoluble metal soap of thickened fixed oil with a polar non-polar material of high molecular weight having sufficient hydrocarbon groups to be substantially insoluble in water and sufficient hydroxyl groups to be substantially insoluble in petroleum hydrocarbons, and heating said mixture until the water insoluble metal soap is completely suspended.

2. The process of manufacturing solid lubricants which comprises mixing a water insoluble metal soap of thickened fixed oil with a polar non-polar material of high molecular weight hav-

ing sufficient hydrocarbon groups to be substantially insoluble in water and sufficient hydroxyl groups to be substantially insoluble in petroleum hydrocarbons, heating said mixture until the water insoluble metal soap is completely suspended, and adding stabilizing and solidifying agents.

3. The process of manufacturing solid lubricants which comprises saponifying a thickened fixed oil with sodium hydroxide in water, processing with a water solution of a metal salt until a water insoluble salt-free metal soap is formed, adding rezyal balsam, and heating the mixture until the water insoluble metal soap is completely suspended.

4. The process of manufacturing solid lubricants which comprises saponifying air blown castor oil with sodium hydroxide in water, processing with a water solution of aluminum sulphate until a water insoluble salt-free aluminum soap is formed, adding rezyal balsam, and heating the mixture until the aluminum soap is completely suspended.

5. A solid lubricant comprising a water insoluble metal soap of thickened fixed oil and a polar non-polar material of high molecular weight having sufficient hydrocarbon groups to be substantially insoluble in water and sufficient hydroxyl groups to be substantially insoluble in petroleum hydrocarbons.

6. A solid lubricant comprising a water insoluble metal soap of thickened fixed oil and a compound of the glyptal resin class which is liquid above 40° Fahrenheit and has a solubility of less than two per cent in gasoline at 70° Fahrenheit.

7. A solid lubricant comprising a water insoluble metal soap of thickened fixed oil, a compound of the glyptal resin class which is liquid above 40° Fahrenheit and has a solubility of less than two per cent in gasoline at 70° Fahrenheit, and a small percentage each of stabilizing and solidifying agents.

8. A solid lubricant comprising about 25% to 55% of a water insoluble metal soap of thickened fixed oil and 75% to 45% of a polar non-polar material of high molecular weight having sufficient hydrocarbon groups to be substantially insoluble in water and sufficient hydroxyl groups to be substantially insoluble in petroleum hydrocarbons.

9. A solid lubricant comprising about 25% to 55% of a water insoluble metal soap of thickened fixed oil and 75% to 45% of a compound of the glyptal resin class which is liquid above 40° Fahrenheit and has a solubility of less than two per cent in gasoline at 70° Fahrenheit.

10. A solid lubricant comprising about 25% to 55% of a water insoluble metal soap of thickened fixed oil and 75% to 45% of thickened fixed oil.

11. A solid lubricant comprising about 25% to 55% of a water insoluble metal soap of thickened fixed oil and 75% to 45% of the mono-ester of the acid of thickened fixed oil and a polyhydric alcohol.

12. A solid lubricant comprising about the following formula:

	Percent
Water insoluble metal soap of thickened fixed oil.....	22.2 to 49.0
A compound of the glyptal resin class (liquid above 40° Fahrenheit and less than two per cent soluble in gasoline at 70° Fahrenheit).....	40.0 to 66.8
and a small percentage each of stabilizing and solidifying agents.	

13. A solid lubricant comprising about the following formula:

	Percent
5 Water insoluble metal soap of fixed oil.....	22.2 to 49.0
A compound of the glyptal resin class (liquid above 40° Fahrenheit and less than two per cent soluble in gasoline at 70° Fahrenheit).....	40.0 to 66.8
10 Thickened fixed oil.....	2.8
Vegetable wax.....	7.2

14. A solid lubricant comprising about the following formula:

	Percent
Water insoluble metal soap of fixed oil.....	22.2 to 49.0
20 Rezyl balsam.....	40.0 to 66.8
Thickened fixed oil.....	2.8
Vegetable wax.....	7.2

15. A solid lubricant comprising about the following formula:

	Percent
Water insoluble metal soap of thickened fixed oil.....	38.2
30 A compound of the glyptal resin class (liquid above 40° Fahrenheit and less than two per cent soluble in gasoline at 70° Fahrenheit).....	51.8
Thickened fixed oil.....	2.8
Vegetable wax.....	7.2

16. A solid lubricant comprising about the following formula:

	Percent
40 Aluminum soap of blown castor oil.....	22.2 to 49.0
Rezyl balsam.....	40.0 to 66.8
Blown castor oil.....	2.8
Carnauba wax.....	7.2

17. A solid lubricant comprising about the following formula:

	Percent
Aluminum soap of blown castor oil.....	38.2
Rezyl balsam.....	51.8
Blown castor oil.....	2.8
Carnauba wax.....	7.2

18. A solid lubricant comprising a water insoluble metal soap of thickened fixed oil and a polar non-polar material of high molecular weight having sufficient hydrocarbon groups to be substantially insoluble in water and sufficient hydroxyl groups to be substantially insoluble in petroleum hydrocarbons, said material being liquid above 40° F. and having a solubility of less than 2% in gasoline at 70° F.

19. A solid lubricant comprising a water insoluble metal soap of thickened fixed oil and a polar non-polar material of high molecular weight having sufficient hydrocarbon groups to be substantially insoluble in water and sufficient hydroxyl groups to be substantially insoluble in petroleum hydrocarbons, said lubricant having sufficient consistency at 400° F. to seal and lubricate the seating surfaces of valves subjected to high pressures.

20. A solid lubricant comprising a water insoluble metal soap of thickened fixed oil and a polar non-polar material of high molecular weight having sufficient hydrocarbon groups to be substantially insoluble in water and sufficient hydroxyl groups to be substantially insoluble in petroleum hydrocarbons, said material being liquid above 40° F. and having a solubility of less than 2% in gasoline at 70° F., said lubricant having sufficient consistency at 400° F. to seal and lubricate the seating surfaces of valves subjected to high pressures.

21. A solid lubricant comprising a water insoluble metal soap of thickened fixed oil and "rezyl balsam".

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