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HALOGENATED ALIPHATIC LUBRICANT ADDITIVE

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This invention relates to lubricants and is more particularly concerned with lubricants having high extreme pressure characteristics.

It is well known that the load carrying ability of mineral lubricating oils can be improved by adding thereto various halogenated hydrocarbons. It is also well known that a somewhat similar improvement in the load carrying ability of mineral lubricating oils can be effected by adding thereto lead soaps, sulfurized hydrocarbons, sulfurized fatty oils and phosphorus compounds.

The extent of the improvement accomplished by the various extreme pressure additives varies considerably depending upon a number of factors, some of the more important of which are the particular extreme pressure agent used, the quantity added and the testing method used to measure the load carrying capacity. Of these variables, perhaps the most difficult to correlate is the load carrying ability as indicated by different testing apparatus. There are a number of devices commercially available for determining the extreme pressure characteristics of lubricants, such as the Floyd, Almen, Faville-Levalley, Timken, S. A. E. and a number of others which test E. P. lubricants for more specific applications. Two of these machines appear to be much more widely accepted than any of the others. These are "The Timken wear and lubricant tester" made by the Timken Roller Bearing Company of Canton, Ohio, and a machine offered as a tentative standard by the Society of Automotive Engineers and known as the "S. A. E. extreme pressure testing machine." This machine is made by the Highway Trailer Company of Edgerton, Wisconsin. Unfortunately there is considerable difference in the results obtained in the two machines and in the application of the results to practical lubricating problems. For example, mineral oil to which has been added lead soap and active sulfur will withstand the full load on the S. A. E. machine, 500 pounds at 1000 R. P. M., whereas on the Timken machine the results are quite low, being of the order of 18 to 25 pounds beam arm load and a pressure of 10,000–13,000 lbs. per square inch.

Lubricating engineers are not entirely in agreement as to just what these tests mean in actual performance, although there has been a great deal of work done to correlate such test results with actual service. At the present time it appears that the only entirely satisfactory test for E. P. lubricants is actual service, though the Timken and S. A. E. machines serve a useful purpose by indicating those lubricants that are worthy of the time and expense required for actual service tests. It is significant to note that commercially successful E. P. lubricants on the market at the present time give good results on one or the other of these machines. It is equally significant that commercially successful E. P. lubricants will not withstand high loads on both the S. A. E. and Timken machines, that is, a load of the order of 300 pounds at 1000 R. P. M. on the S. A. E. machine and 68 pounds beam arm load and 25,000 pounds per square inch on the Timken machine.

It is an object of this invention to provide an improved E. P. lubricant.

Another object of this invention is to provide an E. P. lubricant which will give superior results in actual service and will give satisfactorily high results on both the Timken and S. A. E. extreme pressure testing machines.

A further object of this invention is to provide a stable non-corrosive E. P. base and lubricant which when added to mineral lubricating oils will be entirely soluble and will impart unusual E. P. characteristics to the resulting blend without attacking the metal parts with which it comes in contact.

Still further objects of this invention will be apparent from the following description.

Halogenated aliphatic hydrocarbons have been added in the past to mineral oil to impart E. P. properties. In general, however, they have not been considered satisfactory due either to failure to carry satisfactory loads on both the S. A. E. and Timken testing machines or to lack of stability as shown particularly by the tendency to hydrolyze.

Certain chlorinated open chain aliphatic hydrocarbons such as hexachlorethane although not satisfactory alone as an E. P. additive, when added to lubricants containing phosphorized or sulfurized and phosphorized organic lubricant additives of the non-corrosive type, for example such as those disclosed in Chittick Patent No. 2,142,998 or in Whittier et al. application Serial No. 55,200 now Patent No. 2,211,306, wherein mineral and fatty oils are phosphorized or sulfurized and phosphorized, produce lubricants which are highly stable as measured by their tendency to hydrolyze, are completely soluble in mineral oil and show unexpectedly high results on both the Timken and S. A. E. testing machines.

It has now been found, however, that certain highly halogenated open chain hydrocarbons when added to mineral lubricating oil alone will carry high loads on both the S. A. E. and Timken testing machines and show a high degree of stability to hydrolysis since they do not substantially

hydrolyze even at temperatures materially above those incurred in service. These halogenated hydrocarbons are also effective when used in small amounts in conjunction with lubricants containing phosphorized or sulfurized and phosphorized oils.

Halogenated, particularly chlorinated, open chain hydrocarbons containing 3 carbon atoms and which contain at least approximately 90% by weight of chlorine, have been found to be effective lubricant additives either when added to mineral oil alone or to lubricants containing phosphorized or sulfurized and phosphorized oils. Examples of chlorinated hydrocarbons which have been found suitable as E. P. agents according to this invention are three carbon atom compounds in which all the hydrogen has been replaced by chlorine, such as octachlor propane and hexachlor propene—sometimes called hexachlor propylene—or three carbon atom compounds in which all but one of the hydrogen atoms have been replaced by chlorine, specifically, unsymmetrical heptachlor propane. These compounds are of comparatively high boiling point, that is, they do not boil substantially below 180° C., which is an important feature in considering the practical application of lubricants. Lower boiling compounds may be volatilized and lost at temperatures encountered in actual service. As examples of lubricants within the scope of this invention, and in order to provide a comparison with existing lubricants, the following table has been compiled. All of the lubricants tested were of approximately the same viscosity and were within the viscosity range of S. A. E. 90:

Table I

Material	S. A. E. test, 1,000 R. P. M. lbs.	Timken test	
		Beam wt. lbs.	Pressure lbs./sq. in.
Mineral oil (Gulf Coast), S. A. E. 90	15	8	8,000
95% mineral oil and 5% octachlorpropane	550	86	20,000
95% mineral oil and 5% hexachlorpropane	550	77	18,000
95% mineral oil, 5% unsymmetrical heptachlorpropane	540	77	19,500
18% sulfurized and phosphorized base, 82% mineral oil	110	86	35,250
18% sulfurized and phosphorized base, 80% mineral oil, 2% octachlorpropane	550	86	36,500
18% sulfurized and phosphorized base, 80% mineral oil, 2% hexachlorpropene	550	86	35,250
10% sulfurized and phosphorized base, 85% mineral oil, 5% unsymmetrical heptachlorpropane	550	77	32,750

It will be noted from the results in Table I that mineral oil alone, as might be expected, shows very low results on both the Timken and S. A. E. machines. When 5% octachlorpropane, unsymmetrical heptachlorpropane or hexachlorpropene is added to the mineral oil, the Timken test is appreciably increased, particularly as to beam arm load and the S. A. E. test is sufficiently high to withstand the maximum loading of this machine.

The addition of 18% of a sulfurized and phosphorized base to mineral oil shows an excellent Timken test and only a relatively small improvement on the S. A. E. test. When only 2% octachlorpropane or hexachlorpropene is added to the mineral oil-sulfurized and phosphorized oil blend, the Timken test is substantially the same as that of the mineral oil-sulfurized and phosphorized blend, while the S. A. E. test is markedly improved, the material being held up under the maximum loading of the machine.

It is obvious that the quantity of halogenated compound used may vary within rather wide limits, although approximately 0.5% to 5% is generally preferred where E. P. characteristics are important. The upper limit of 5% has been mentioned only because with the methods of testing now available it has been found that no advantage appears from adding larger quantities. There does not appear to be any reason, however, why quantities in excess of 5% may not be used. The quantity of phosphorized or sulfurized and phosphorized base preferably varies from approximately 5% to 25%, although these proportions are not critical and the invention contemplates the use of these materials in proportions outside the preferable limits.

While the foregoing data and discussion relate to the addition of relatively stable halogenated open chain hydrocarbons to mineral oil or to lubricants containing a phosphorized or sulfurized and phosphorized lubricant base, it is within the scope of this invention to add halogenated hydrocarbons directly to a phosphorized or a sulfurized and phosphorized base and to use this base as the lubricant or to add it to mineral oil and use the resulting mixture as a lubricant, or to bring about any mixture of the aforementioned components at the surfaces to be lubricated. The aforementioned halogenated compounds are excellent additives for lubricants used in tool cutting, grinding and drawing operations. They may be used either straight or emulsified with water. The most noticeable characteristics of the performance of these lubricants as cutting fluids are the increased life of the cutting edge of the tool used and the improved, bright, clean-looking finish on the machined surface.

We claim:

1. A lubricant comprising a major portion of mineral lubricating oil and a minor portion of halogenated open chain hydrocarbon selected from the group consisting of octa halogenated propane, hexa, halogenated propene, unsymmetrical hepta halogenated propane.

2. A lubricant comprising a major portion of mineral lubricating oil and a minor portion of chlorinated three carbon atom hydrocarbon containing at least approximately 90% by weight of chlorine.

3. A lubricant comprising a major portion of mineral lubricating oil and a minor portion of chlorinated open chain hydrocarbon selected from the group consisting of octachlorpropane, hexachlorpropene, and unsymmetrical heptachlorpropane.

4. A lubricant in accordance with claim 2 in which chlorinated hydrocarbon is present in proportions of approximately 0.5% to 5.0%.

5. A lubricant in accordance with claim 2 in which the chlorinated hydrocarbon is octachlorpropane.

6. A lubricant in accordance with claim 2 in which the chlorinated hydrocarbon is hexachlorpropene.

7. A lubricant in accordance with claim 2 in which the chlorinated hydrocarbon is unsymmetrical heptachlorpropane.

8. A lubricant in accordance with claim 1 containing a minor portion of sulfurized and phosphorized organic lubricant additive.

9. A lubricant in accordance with claim 2 containing a minor portion of sulfurized and phosphorized organic lubricant additive.

10. A lubricant comprising a major portion of mineral lubricating oil and a minor portion of halogenated three carbon atom hydrocarbon selected from the group consisting of hydrocarbons in which all of the hydrogen has been replaced by halogen and hydrocarbons in which all but one hydrogen has been replaced with halogen.

11. A lubricant in accordance with claim 10 and containing a minor portion of sulfurized and phosphorized organic compound having the ability to increase the extreme pressure characteristics of mineral lubricating oil.

12. A lubricant in accordance with claim 13 and containing a minor portion of sulfurized and phosphorized fatty oil.

13. A non-corrosive composition for lubricating relatively moving, frictionally engaged metallic surfaces subjected to extreme pressure conditions, comprising a major portion of mineral lubricating oil and a minor portion of a halogenated open chain hydrocarbon selected from the group consisting of octachlor propane, hexachlor propene and unsymmetrical heptachlor propane.

14. A composition in accordance with claim 13 in which the halogenated hydrocarbon contains at least 90 per cent by weight of chlorine.

15. A composition in accordance with claim 13 which contains a minor portion of sulfurized and phosphorized organic lubricant additive.

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