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COMPOUNDED LUBRICATING OIL

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This invention relates to mineral lubricating oils containing an additive which serves to inhibit rusting of metal surfaces and to increase the load carrying characteristics of the lubricant.

A primary object of the present invention is the preparation of compositions which may be employed as internal combustion engine lubricants and which will also serve for the protection of exposed surfaces of such engines when the same are not in use. When operating such engines in climates having a high humidity, rusting begins within a very short period of time after the engine is shut down. The compositions of the present invention are particularly valuable in preventing such rusting and they are valuable not only in internal combustion engines, but with oil bases of suitable viscosity they may be employed as cutting oils or as penetrating oils, lubricants for fire arms, ordnance equipment, industrial machinery, etc., and in fact for any lubricating purposes where metal surfaces are exposed to moisture.

The new class of additives of the present invention serve not only to inhibit rusting but also for the purpose of increasing the load bearing properties of the oil to which they are added. These additives may be defined as aliphatic or cycloaliphatic amine salts of pentachlorophenol. They may be formed by contacting pentachlorophenol with an aliphatic amine in equimolecular proportions at ordinary temperatures, but it is usually desirable to heat the mixture to a temperature of the order of 100–120° C. to insure completion of the reaction. No catalyst is required.

The aliphatic or cycloaliphatic amines which may be advantageously reacted with pentachlorophenol to form the additives of this invention should contain a total of at least eight carbon atoms to provide sufficient oil solubility in the resulting salt. The amines may be primary, secondary, or tertiary amines, and they may contain straight or branched chain, saturated or unsaturated hydrocarbon groups. There may be present various substituent atoms or groups, such as halogen atoms, nitro groups, hydroxyl groups, alkoxy groups, ester groups, phosphate and thiophosphate groups, and the like, provided only that the amine molecule does not contain a free acid group. Among the large number of amines suitable for the purpose may be mentioned n-octylamine, 1-amino-3,5,5-trimethylhexane, n-dodecylamine, tert.-dodecylamine, n-hexadecylamine, n-octadecylamine, di-n-butylamine, tri-n-butylamine, dicyclohexylamine, high molecular weight aliphatic acid esters of triethanolamine such as the tall oil monoester of triethanolamine, and the like, as well as commercial mixtures of primary amines derived from fatty acids, such as "Lorol" amine, which is a mixture of C_{10} to C_{18} primary amines derived from coconut oil acids.

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The additives of the present invention may be advantageously employed with petroleum fractions of a wide variety, although their preferred use is in lubricating oil bases to form lubricant compositions which also act as corrosion preventives. The base stocks may be derived from various types of crude petroleum and may consist of distillates or blends of various kinds which have been refined by any of the conventional methods. Synthetic oils may also be used such as those obtained by the polymerization of olefins or by the hydrogenation of coal or its products. An ester type base oil, such as 2-ethylhexyl sebacate, may also be used. In the case of lubricants the base stock chosen will normally be that oil which without the new additives gives the optimum performance in the service contemplated. The base oils may vary considerably in viscosity and other properties depending upon the particular use for which they are desired. For crankcase use they usually range from about 40 to 130 seconds viscosity Saybolt at 210° F. The viscosity index may range from less than 0 to 130 or even higher. Turbine oils usually have a viscosity of 40 to 60 seconds Saybolt at 210° F. Corrosion preventing compositions other than lubricating oils may comprise base stocks of a wide variety with respect to viscosity and may consist of mixtures of base stocks, as in slushing oils, which may consist of a mixture of naphtha and lubricating oil and may contain small amounts of petrolatum or a fatty compound such as degras.

For the purpose of the present invention the additives described herein are incorporated in the base stock in proportions generally ranging from 0.01% to 10% by weight. In some cases larger proportions than those specified may be employed to advantage.

The following examples illustrate the application of the present invention to a lubricant suitable for use in an airplane engine, but these examples are not to be construed as limiting the invention in any way.

Example 1

60 g. (0.225 mol) of pentachlorophenol was mixed with 60 g. (0.225 mol) of a commercial

mixture of primary amines consisting of approximately the following composition:

	Per cent
Octadecylamine containing 2 double bonds	45
Octadecylamine containing 1 double bond	35
Octadecylamine	10
Hexadecylamine	10

A mildly exothermic reaction took place. To insure completion of the reaction, the mixture was heated with stirring at a temperature of 120° C. for 30 minutes. The reaction product, obtained in quantitative yield, was a dark viscous liquid.

Example 2

60 g. (0.225 mol) of pentachlorophenol and 95.5 g. (0.224 mol) of triethanolamine tall oil monoester were mixed together, whereupon a homogeneous solution resulted accompanied by a rise in temperature. The mixture was heated to 100° C. for 30 minutes with stirring to complete the reaction. A quantitative yield of a dark viscous liquid was obtained.

Example 3

The materials obtained in the foregoing examples were evaluated for their rust inhibiting properties by employing them in 1% by weight concentration in a phenol-treated Mid-Continent lubricating oil of 120 seconds viscosity (Saybolt) at 210° F., which was used as the crankcase oil in a single cylinder air cooled aviation type engine of 5.7 H. P. at 2400 R. P. M. speed, manufactured by the Wisconsin Motor Corporation. The engine was operated on 91 grade aviation gasoline containing 4 cc. tetraethyl lead per gallon. After running the engine for eight hours with the test oil, the steel cylinder which had the same composition as the cylinders of a full scale airplane engine, such as a Pratt and Whitney R1340 engine, was removed from the engine and stored in a Tenney humidity cabinet in which the temperature was caused to vary between 72° and 90° F. and the relative humidity between 94% and 53% during each 24 hour period. Typical conditions in a tropical climate were thus simulated. After five days' storage the amount of rust developed was determined and recorded as the percent of the total cylinder barrel area rusted. For comparison, oils containing the constituents of the amine salts separately were similarly tested as well as a sample of the base oil containing no additive and a sample containing pentaerythritol monooleate, a well known rust inhibitor. The results of the foregoing engine rust tests are given in the following table:

Oil or Oil Blend Tested	Percent Cylinder Barrel Area Rusted After 5 Days' Storage
Base oil	35
Base oil+1% pentaerythritol monooleate	10
Base oil+1% pentachlorophenol	9
Base oil+1% C_{18} amine mixture of Example 1	12.5
Base oil+triethanolamine tall oil monoester	8
Base oil+1% salt of Example 1	3.5
Base oil+1% salt of Example 2	4

It will be noted from the above that the salts formed by the reaction of pentachlorophenol with the amines are considerably more effective than either the pentachlorophenol or the amines when used separately in similar amounts.

Example 4

The product of Example 1 was tested as to effectiveness in increasing the load bearing capacity of a base stock, by blending the same in 2% proportion by weight in a phenol extracted coastal oil of 45 second Saybolt at 210° F. and testing the resulting blend in a Shell Four-ball E. P. Tester, made by Precision Scientific Company, and in the Almen machine. For comparison, samples of the base stock alone and of the base stock containing a commercial ester type oiliness agent were similarly tested. The results are shown in the following table:

Oil or Oil Blend Tested	Four-ball E. P. Tester, 20 kg. Load, 30 Min. Operation. Wear Spot Diameter (mm.)	Almen Machine Weights Carried (Gradual Loading)
Base oil	0.60–0.65	2.3
Base oil +2% commercial ester type oiliness agent.	0.52	4
Base oil +2% product of Example 1	0.50	6

In addition to the materials to be added according to the present invention, other agents may also be used such as dyes, pour depressors, heat thickened fatty oils, sulfurized fatty oils, organo-metallic compounds, metallic or other soaps, sludge dispersers, antioxidants, thickeners, viscosity index improvers, oiliness agents, resins, rubber, olefin polymers, voltolized fats, voltolized mineral oils, and/or voltolized waxes, and colloidal solids such as graphite, etc. Solvents and assisting agents, such as esters, ketones, alcohols, aldehydes, halogenated or nitrated compounds, and the like may also be employed.

In addition to being employed in crankcase lubricants the additives of the present invention may also be used in extreme pressure lubricants, engine flushing oils, industrial oils, general machinery oils, process oils, rust preventive compositions, and greases.

What is claimed is:

1. A composition consisting essentially of a mineral lubricating oil containing dissolved therein 0.01 to 10% of an amine salt of pentachlorophenol, the amine portion of said salt containing a total of not less than eight carbon atoms and is a member of the class consisting of aliphatic and cycloaliphatic amines.

2. A composition according to claim 1 in which the amine salt is derived from an aliphatic amine.

3. A composition according to claim 2 in which the amine is essentially of C_{18} chain length.

4. A composition according to claim 3 in which the amine contains at least one double bond.

5. A composition according to claim 1 in which the amine salt is derived from a high molecular weight aliphatic acid ester of triethanol amine.

6. A composition consisting essentially of a mineral lubricating oil containing dissolved therein 0.01–10% of an amine salt of pentachlorophenol, the amine portion of said salt being derived from the tall oil monoester of triethanol amine.

7. A composition consisting essentially of a mineral lubricating oil containing dissolved therein 0.01–10% of an amine salt of pentachlorophenol, the amine portion of said salt being derived from a primary aliphatic amine of not less than 8 carbon atoms.

8. A composition consisting essentially of a mineral lubricating oil containing dissolved therein 0.01–10% of an amine salt of pentachlorophenol, the amine portion of said salt being derived from a primary aliphatic amine of about C_{16}–C_{18} chain length.

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