

UNITED STATES PATENT OFFICE

2,475,409

LUBRICANTS

Herschel G. Smith, Wallingford, and Troy L. Cantrell, Lansdowne, Pa., and John G. Peters, Audubon, N. J., assignors to Gulf Oil Corporation, Pittsburgh, Pa., a corporation of Pennsylvania

No Drawing. Application January 15, 1948,
Serial No. 2,556

7 Claims. (Cl. 252—34)

1

This invention relates to an improved lubricant and particularly to a mineral oil lubricating base blended with an additive which will improve the lubricating properties.

The development of new automotive and other types of power developing machines of increased power output has led to the introduction of bearing surfaces which are corroded by oxidation products formed in the lubricant. Also the other parts of such power developing machines are corroded and rusted by products formed during use such as water and oxidation products of the lubricant. These difficulties have been overcome to a certain extent by adding substances to the lubricant which reduce the corrosion, rusting and other tendencies.

This invention has for its object to provide an improved lubricant comprising a mineral oil lubricating base uniformly blended with an additive which will retard rust and corrosion when the lubricant is used for the lubrication of power developing machines such as automotive, marine, etc. engines. Another object is to provide an improved mineral oil lubricating base containing an additive which will markedly reduce the corrosion of bearings of a power developing machine. Another object is to provide a mineral oil lubricating base having improved oiliness and reduced foaming characteristics. Other objects will appear hereinafter.

These and other objects are accomplished by our invention which includes a compounded lubricant comprising a mineral oil lubricating base uniformly blended with a product obtained by reacting a mixture of a high molecular weight unsaturated fatty acid and a high molecular weight aliphatic alcohol with maleic acid or maleic anhydride and an olefin oxide or corresponding glycol followed by substantial neutralization with a primary aliphatic amine containing from 8 to 26 carbon atoms. It has been found that such a compounded lubricant has reduced tendency to rust or corrode the machine parts and at the same time has reduced tendency to foam. It has also been found that the oiliness of the mineral oil base is improved. It is well known that a good lubricant should be capable of adhering to the metal bearing surface under high bearing pressures and such property is commonly referred to as oiliness.

In the following description we have set forth

2

several of the preferred embodiments of our invention but it is to be understood that they are given for the purpose of illustration and not in limitation thereof.

5 The mixture of high molecular weight unsaturated fatty acid and high molecular weight alcohol can be obtained from any desired source. A convenient method of preparation is to hydrolize an ester of the desired acid and alcohol such as sperm oil, which is primarily composed of an ester of oleic acid and cetyl alcohol. On the other hand, the individual components of the mixture may be obtained from different sources such as by synthesis or by preparation from natural materials and the two components mixed in the desired proportions. By the term high molecular weight we intend to designate an unsaturated acid or an alcohol having 8 or more carbon atoms in the molecule. Examples of suitable unsaturated high molecular weight fatty acids are oleic, geranic, linoleic and erucic, etc. acids; examples of suitable alcohols are dodecanol, dodecenol, and oleyl alcohols, etc. In the event an ester such as sperm oil is hydrolyzed to yield a mixture composed mainly of unsaturated carboxylic acids and fatty alcohols of the sperm oil, the hydrolysis may be accomplished in known manner, such as by saponification with an alkali followed by removal of the alkali metal from the soaps by treatment with an acid, or by heating the sperm oil in the presence of water and a fat splitting agent such as sulfuric acid.

10 The proportion of high molecular weight alcohol to high molecular weight fatty acid may vary considerably. In general we prefer to use from about one-half mol to about 5 mols of alcohol per mol of acid. However, larger or smaller amounts may be used. Sperm oils usually contain from about 45 to about 55 mol per cent of alcohol based on the total amount of high molecular weight unsaturated fatty acid and alcohol present. Proportions in this range are very satisfactory.

15 The mixture of unsaturated acid and alcohol is reacted with the maleic acid or maleic anhydride, preferably after dissolving the mixture in a solvent such as light lubricating oil. The rate of reaction may be increased by heating. The maleic anhydride or maleic acid is advantageously used in approximately equimolecular amounts based on the unsaturated fatty acid.

This product is then reacted with an olefin oxide or corresponding glycol such as ethylene, propylene or butylene oxides or ethylene, propylene or butylene glycols. It is necessary that the olefin oxide or corresponding glycol be of low molecular weight, i. e., less than about eight carbon atoms. The olefin oxide or corresponding glycol is preferably added in amounts of about 0.25 to 1 mol of oxide or glycol per mol of alcohol contained in the original high molecular weight alcohol-unsaturated fatty acid mixture. Larger or smaller amounts may be used. The reaction with the olefin oxide or glycol is likewise assisted by heating and is also advantageously carried out in the presence of a solvent. The glycol or oxide is advantageously directly added to the reaction mixture containing the maleic acid or anhydride reaction product.

The product thus prepared contains free carboxylic acid and is therefore substantially neutralized with an aliphatic primary amine containing between about 8 and 26 carbon atoms. Normal straight chain primary amines such as decyl amine and octadecyl amine are advantageously used but it is satisfactory to use unsaturated primary aliphatic amines such as undecylene amine. Mixtures of straight chain primary alkyl amines such as cocoamine are advantageously because of their relative cheapness. Cocoamine is a commercial mixture of higher alkyl amines prepared from coconut oil fatty acids. It contains a major amount of primary dodecyl amine and typical samples thereof have been found to have an average molecular weight ranging from 200 to 210. The amine is used in an amount such that the reaction products will be substantially neutralized.

The final product can be directly incorporated in the mineral oil lubricating base preferably in amounts of about 0.1 to 5 per cent on a solvent free basis. However, larger or smaller amounts may be used to obtain reduction in corrosion, rusting and foaming properties. It is advantageous to prepare a concentrate of this product in a mineral oil or fraction thereof and use this concentrate as a convenient vehicle for incorporating in the lubricating base.

Example 1.—Into a closed iron reaction vessel there was charged 500 pounds of refined sperm oil, 700 pounds of a light lubricating oil, and 80 pounds of 50 per cent caustic soda. The temperature was raised to 320° F. for 5 hours, while maintaining 30 pounds of pressure per square inch within the reaction vessel. The mixture was then cooled to 120° F. and 328 pounds at 15 per cent sulfuric acid was added after which the temperature was raised to 175° F. where it was maintained for 2 hours. The mixture was allowed to settle and the aqueous layer drawn off. This was followed by 3 water washes using 30 gallons of water per wash. The washed material was then dried at 240° F. under 15 inch mercury pressure. Then the material was cooled to 200° F. after which 50 pounds of maleic anhydride and 38 pounds of propylene glycol were added. The temperature was maintained at 200° F. for 6 hours, following which 291 pounds of cocoamine were added to neutralize the resulting acidity. The product had the following properties:

Gravity: °API	28.2
Viscosity, SUV: 210° F	50.1
Pour: °F	+50
pH value	7.8
Neutralization number	18.0

Example 2.—A highly refined lubricating oil was treated with 0.5 per cent by volume of an additive prepared according to Example 1. Comparative tests indicating the properties of the base and inhibited lubricating oil are:

	Base Oil	Inhibited Oil
Gravity: °API	28.0	25.9
Viscosity, SUV: 100° F	1,175	1,171
Flash, OC: °F	420	420
Pour: °F	+10	+10
Corrosion Test:		
ASTM D665-46T—		
Steel Rod: Appearance	rust	bright
Area Rusted: Percent	100	0
Air Bubbling Foam Test:		
Method 435, Gulf—		
Vol. Oil & Foam: Vol. Oil 77° F	4.5	1.02

Example 3.—Into an iron reaction vessel were charged 282 pounds of oleic acid, 242 pounds of cetyl alcohol, 750 pounds of a light lubricating oil, and 55 pounds of maleic anhydride. The mixture was heated to 200° F. at which temperature it was held for 5 hours. Then 20 pounds of ethylene glycol were added. The mixture was then reacted for 3 hours at the temperature 200° F. Following this the product was neutralized with 270 pounds of cocoamine. The product had the following properties:

Gravity: °API	26.0
Viscosity, SUV: 210° F	47.1
Pour: °F	+55
pH value	7.9
Neutralization number	21.0

Example 4.—A highly refined turbine oil was treated with 0.3 per cent by weight of an additive prepared according to Example 1. Comparative tests indicating the properties of the base oil and the inhibited turbine oil are:

	Base Oil	Inhibited Oil
Gravity: °API	29.4	29.3
Viscosity, SUV:		
100° F	305	301
210° F	53.0	51.0
Viscosity Index	100	100
Flash, OC: °F	450	450
Fire, OC: °F	510	510
Pour: °F	+5	+5
Color, NPA	2.0	2.0
Corrosion Test:		
ASTM D665-46T—		
Steel Rod: Appearance	rust	bright
Area Rusted: Per Cent	100	0
Air Bubbling Foam Test:		
Method 435, Gulf—		
Vol. Oil & Foam: Vol. Oil 77° F	4.5	1.02

The compounded lubricant of the present invention has many advantages. It will be noted that the corrosion and rusting of metal surfaces is greatly reduced so that the moving parts of power generating equipment would remain in good condition for a longer period and would continue to deliver approximately the original power output after many hours of use. The compounded lubricants of the present invention also have increased oiliness so that they can be used to effectively lubricate bearings which are operating under high pressures. These products also have greatly reduced foaming characteristics. This is, of course, important since a lubricant which foams to a large extent cannot be used to lubricate engines operating under extreme conditions. These advantages are not obtained if an acid or anhydride other than maleic is used.

What we claim is:

1. As an improved compound lubricant, a uni-

form blend of a mineral oil lubricating base with a small amount, sufficient to retard rust and corrosion, of a product obtained by reacting at a temperature between about room temperature and about 200° F., a mixture of an unsaturated fatty acid containing 8 or more carbon atoms and an aliphatic alcohol containing 8 or more carbon atoms with (one) a member of the group consisting of maleic acid and maleic anhydride and (two) a member of the group consisting of olefin oxides containing less than about 8 carbon atoms and glycols corresponding thereto and then neutralizing the reaction product with an aliphatic primary amine containing from 8 to 26 carbon atoms.

2. As an improved compound lubricant, a uniform blend of a mineral oil lubricating base with between about 0.1 and 5 per cent of a product obtained by reacting at a temperature between about room temperature and about 200° F., a mixture of an unsaturated fatty acid containing 8 or more carbon atoms and an aliphatic alcohol containing 8 or more carbon atoms with (one) a member of the group consisting of maleic acid and maleic anhydride and (two) a member of the group consisting of olefin oxides containing less than about 8 carbon atoms and glycols corresponding thereto and then neutralizing the reaction product with an aliphatic primary amine containing from 8 to 26 carbon atoms.

3. As an improved compound lubricant, a uniform blend of a mineral oil lubricating base with a small amount, sufficient to retard rust and corrosion, of a product obtained by reacting at a temperature between about room temperature and about 200° F., a mixture of an unsaturated fatty acid containing 8 or more carbon atoms and an aliphatic alcohol containing 8 or more carbon atoms with (one) a member of the group consisting of maleic acid and maleic anhydride and (two) a glycol containing less than about 8 carbon atoms and then neutralizing the reaction product with an aliphatic primary amine containing from 8 to 26 carbon atoms.

4. As an improved compound lubricant, a uniform blend of a mineral oil lubricating base with a small amount, sufficient to retard rust and corrosion, of a product obtained by reacting at a temperature between about room temperature and about 200° F., a mixture of an unsaturated fatty acid containing 8 or more carbon atoms and an aliphatic alcohol containing 8 or more carbon atoms with (one) a member of the group con-

sisting of maleic acid and maleic anhydride and (two) an olefin oxide containing less than about 8 carbon atoms and then neutralizing the reaction product with an aliphatic primary amine containing from 8 to 26 carbon atoms.

5. As an improved compound lubricant, a uniform blend of a mineral oil lubricating base with a small amount, sufficient to retard rust and corrosion, of a product obtained by reacting, at a temperature between about room temperature and about 200° F., the hydrolysis products of sperm oil with (one) a member of the group consisting of maleic acid and maleic anhydride, and (two) a member of the group consisting of olefin oxides containing less than about 8 carbon atoms and glycols corresponding thereto and then neutralizing the reaction product with an aliphatic primary amine containing from 8 to 26 carbon atoms.

6. As an improved compound lubricant, a uniform blend of a mineral oil lubricating base with a small amount, sufficient to retard rust and corrosion, of a product obtained by reacting, at a temperature between about room temperature and about 200° F., the hydrolysis products of sperm oil with (one) maleic anhydride, and (two) propylene glycol and then neutralizing the reaction product with an aliphatic primary amine containing from 8 to 26 carbon atoms.

7. As an improved compound lubricant, a uniform blend of a mineral oil lubricating base with a small amount, sufficient to retard rust and corrosion, of a product obtained by reacting, at a temperature between about room temperature and about 200° F., a mixture of oleic acid and cetyl alcohol with (one) maleic anhydride and (two) ethylene glycol and then neutralizing the reaction product with an aliphatic primary amine containing from 8 to 26 carbon atoms.

HERSCHEL G. SMITH.
TROY L. CANTRELL.
JOHN G. PETERS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,342,113	Blair	Feb. 22, 1944
2,342,114	Blair	Feb. 22, 1944
2,422,881	Blair	June 24, 1947