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MINERAL OIL COMPOSITION

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This invention has to do with lubricants and, more specifically, has to do with improvingg mineral lubricating oils by incorporating therein a small amount of a mineral oil characterizing ingredient.

As is well known to those familiar with the art, mineral lubricating oils are characterized by certain undesirable features or shortcomings under various conditions of use. For example, in present day engine operation, the less stable constituents of such oils tend to oxidize and form acidic and gummy, or sludge-like, materials which corrode and scuff or wear metal engine parts. In this way, the efficiency of the lubricating action of the oil is substantially reduced and the useful life of the oil is correspondingly reduced. Mineral lubricating oils also possess the undesirable property of forming emulsions when in contact with water. This latter property is particularly detrimental in an environment such as is in a steam turbine inasmuch as emulsions interfere with the separation of the lubricant from water, both in the lubricating system and in the centrifugal washing operation. Oils of such caliber do not come up to the standards approved by the United States Government in certain tests which are described hereinafter.

Various additive materials have been proposed for use in mineral lubricating oils to counteract the aforesaid shortcomings of such oils. Numerous antioxidants or oxidation inhibitors have been used for such purposes, but while they have been found to reduce the formation of sludge-like materials in the oil and retard the emulsion-forming tendencies of the oil, they have not appreciably reduced corrosion of said metal parts. Also certain esters of fatty acids, as well as many fatty acids typical of which is stearic acid, have been incorporated in small amounts in lubricating oils to reduce the corrosion problem. In general, however, although oils containing fatty acids or alcohol esters do substantially prevent rusting of metal parts such as those used in turbines, they have the undesirable feature of producing emulsions when in contact with water.

It is one object of the present invention to impart anti-rusting and demulsifying properties to mineral lubricating oils by the incorporation therein of a small amount of a new and novel mineral oil characterizing ingredient. It is another object of the present invention to impart demulsifying properties to mineral lubricating oils containing an oxidation or corrosion inhibitor. Still another object is to impart demulsifying properties to said oils containing both an oxidation and a corrosion inhibitor. It is a further object of this invention to fortify said oils in these respects such that they conform to the standards established by the U. S. Government test methods and other test methods of the art. Still other objects will be apparent to those familiar with the art from the illustrative examples and test results provided hereinafter.

The present invention is predicated upon the discovery that the aforesaid objects are accomplished by the use of a small amount of an oil-soluble alcohol extract of blown lard oil in a mineral lubricating oil such as one used in turbine operation.

The oil-soluble alcohol extract of blown lard oil contemplated herein is prepared by contacting a blown lard oil with an alcohol, removing the alcohol from the alcohol extract containing that portion of the blown lard oil which is soluble in the alcohol, and thereby obtaining said oil-soluble alcohol extract.

A preferred procedure for obtaining the mineral oil characterizing ingredient of the present invention is the following: Lard oil was heated and blown with air in a jacketed steam kettle until the Saybolt viscosity, at 210° F., of the oil was 158 seconds. The blown lard oil was heated in an open kettle with stirring at 135° F. to 145° F. with 2 to 2½ times its volume of 95% ethyl alcohol until the mixture thus formed was thoroughly agitated. Then, heating and agitation were discontinued and the mixture was allowed to settle. Two layers were thus obtained; the upper being the alcohol solution of blown lard oil extract and the lower layer being the extracted blown lard oil, that is, the portion insoluble in the alcohol. The two layers were separated and the alcohol solution of blown lard oil extract (upper layer) was placed in a still suitable for removing the alcohol from the desired extract. The alcohol was distilled off and the residue or extract in the still was finally heated to 240° F. to 250° F. with a gentle stream of carbon dioxide bubbling therethrough in order to remove the final traces of alcohol. The residue, blown lard oil extract, was withdrawn from the still and tested as described hereinafter. By means of the foregoing preferred procedure, four samples of blown lard oil extract were prepared by using oil:alcohol ratios of from 1:1 to 1:2.5. The yields of extract ranged from 9.5% to 20.0% and the

neutralization numbers (N. M.; mgms. KOH/gram of extract) varied from 53 to 62. In each case, the extracts were substantially of the same degree of effectiveness in fortifying mineral lubricating oils. In Table 1 given hereinafter, sample 1 represents that blown lard oil extract obtained from 50 grams of blown lard oil and an oil:alcohol ratio of 1:2. Sample 2 describes that extract obtained from 1 kilogram of blown lard oil and an oil:alcohol ratio of 1:2, and sample 3 is that extract obtained from 28 pounds of blown lard oil and an oil:alcohol ratio of 1:2.5. Sample 4 is a trial extraction with oil:alcohol ratio of 1:1. The yield obtained was 9.5%.

That the oil-soluble blown lard oil extract contemplated herein is extremely effective in improving the corrosion and emulsion characteristics of mineral oil fractions is demonstrated by the results obtained by subjecting several blank oils and oil blends containing said extract to the following corrosion (or rust) and emulsion test methods.

One test method is designated as the proposed A. S. T. M. Rust Test Method and involves suspending a polished steel specimen in 300 cc. of the oil under test at 140° F. for 30 minutes, then adding 30 cc. of distilled water and stirring the mixture at 750 R. P. M. for 48 hours. The steel specimen is removed from the water and oil mixture and examined for evidence of corrosion. The oil passes this test when there is no evidence of rust.

Another test method used herein was the Static Rust Test which involves placing a slightly concave, polished steel specimen in a beaker of oil under test at 90° F. for ½ hour. A drop of distilled water is then placed below the surface of the oil and on the surface of the steel specimen. After 24 hours, the steel specimen is withdrawn from the beaker and is examined for rust. To pass this test, the oil should not allow any rust to form on the specimen.

The emulsion tests used herein are designated as Emulsion tests 1, 2 and 3 and are the following:

Emulsion test 1 represents Emulsion Test for Lubricating Oils (Method 320.13) described in the Federal Standard Stock Catalog, Section IV, part 5, Federal Specifications VV-L-791b, Feb. 19, 1942. In this test, 40 cc. of oil and 40 cc. of emulsant (water) in a 100 cc. cylinder are stirred with a paddle at 1500 R. P. M. for 5 minutes at the prescribed temperature. The separation of the emulsion is observed while the cylinder is kept at the prescribed temperature for the specified time. The figures given on the chart, provided in the reference identified above, are the actual times at which there is no continuous layer of emulsion remaining between the oil and watr. Other figures shown are the cc. of emulsion remaining after the specified time interval. In order to pass this test, specifications for mineral lubricating oils of viscosities shown on the chart usually call for a continuous layer to be absent at the interface after 30 minutes.

Emulsion test 2 is the Emulsifying Constituents With Steam Test described in the Bureau of Ships pamphlet N. B. S. 431, Lubricating Oil, General Information, Requirements and Methods of Test. The emulsifying constituents with steam factor is determined by steaming 100 cc. of the oil and 20 cc. of distilled water in a 250 cc. cylinder for 10 minutes, after which the temperature of the cylinder and contents is maintained at 130° F. for 1 hour. If at the end of 1 hour there is no emulsion, the test is reported as none, and if there is an appreciable amount of emulsion present, the test is reported as present.

Emulsion test 3 is the Steam Emulsion Test for lubricating oils described in the Federal Standard Stock Catalog, Section IV, part 5, Federal Specifications VV-L-791b, Feb. 19, 1942, F. S. No. 320.61 or the A. S. T. M. Method D-157-36. The Steam Emulsion Number (S. E. No.) obtained in this test is the number of seconds required for an oil to separate when emulsified and separated under the specifically prescribed conditions of steaming and separation outlined in this method. This test is common to practically all turbine oil specifications.

The data provided in Table 1 below represent results of the foregoing tests in which several typical blank oils, designated as oils A, B and C, were used. It will be apparent to those skilled in the art that these oils have good emulsion and poor rusting properties when subjected to the tests described hereinabove.

Table 1

	Emulsion test 1			Emulsion test 2		Emul. test 3, S. E. No., secs.	Proposed A. S. T. M. rust test	Static rust test
	Time of separation (mins.) with—			Emulsifying constituents with steam	Time of sep., mins.			
	Dist. water	1% salt	1 N NaOH					
Oil A						43	Not passing	Not passing.
Oil B	5	11	20	None	21	83	do	Do.
Oil C	8	8	16	do	8	110	do	Do.

The data set forth in Table 2 below represent results of the aforesaid tests in which oil blends of blank oils and various oil addition agents were used. Oil blends are shown of said blank oils and of a typical oxidation inhibitor, a condensation product obtained by reacting ethylaniline and formaldehyde as described in Patent 2,223,411, issued December 3, 1940; other oil blends are shown of the blank oils, the aforesaid typical oxidation inhibitor, and typical corrosion inhibitors, dioleyl malate and degras fatty acids.

Also shown are oil blends of said blank oils containing both the oil-soluble alcohol extract of blown lard oil, the aforesaid typical oxidation inhibitor, and a typical corrosion inhibitor.

In Table 2, oil A' is a so-called "Light oil," identified by a Saybolt Universal viscosity at 100° F. of 148–155 seconds; oil B' is designated a "Heavy medium oil" and is identified by the characteristics Saybolt Universal viscosity at 100° F. of 315–325 seconds; and oil C' is a "Heavy oil" identified by Saybolt Universal viscosity at 130° F. of 185–205 seconds. Oils A', B' and C' are similar to those shown in Table 1 above.

Table 2

	Emulsion test 1, time of separation (mins.) with—			Emulsion test 2		Emuls. test 3, steam em. No., secs.	Proposed A. S. T. M. rust test	Static rust test
	Distilled water	1 per cent salt solution	1 N NaOH	Emulsifying constituents with steam	Time of separation, mins.			
Oil A'+0.2% ethyl-aniline-formaldehyde+:						75	Not passing	Not passing.
0.04% alc. extract blown lard oil (sample 1).						75	Pass	
0.05% dioleyl malate						133	do	Pass.
0.05% dioleyl malate+0.04% alc. extract blown lard oil (sample 3).						45	do	Do.
Oil B'+0.2% ethyl-aniline-formaldehyde+:	8	8	13	None	3	92	Not passing	Not passing.
0.04+ alc. extract blown lard oil (sample 2).	13	15	30	do	8	75	Pass	
0.2% dioleyl malate	60-<1 cc. emul.	60-<1 cc. emul.		Present	60-38 cc. emul.	300	do	Pass.
0.1% dioleyl malate+0.04% alc. extract blown lard oil (sample 3).	6	15	26	None	5	71	do	Do.
Oil C'+0.2% ethyl-aniline-formaldehyde+:	17	13	15	do	3	160	Not passing	Not passing.
0.03% alc. extract blown lard oil (sample 1).	13	16	25	do	7	105	Pass	
0.05% alc. ext. blown lard oil (sample 1).	15	8	45	do	4	75	do	
0.05% degras fatty acids	60	60-1 cc. emul.	60-4 cc. emul.	Present	60-35 cc. emul.	300+	do	Pass.
0.2% dioleyl malate	53	50	36	do	90-2 cc. emul.	215	do	Do.
0.05% degras fatty acids+0.05% alc. extract blown lard oil (sample 3).	21	17	35	None	30	110	do	Do.
0.1% dioleyl malate+0.05% alc. extract blown lard oil (sample 3).	23	15	37	do	7	75	do	Do.
0.2% dioleyl malate+ 0.075% alc. ext. blown lard oil (sample 3).	27	35	33	do	4	70	do	Do.

The results shown under the heading oil A' indicate the relative effectiveness of various oil blends of oil A' in the aforesaid emulsion and rust tests. An oil blend of oil A' and a typical antioxidant, ethylaniline-formaldehyde reaction product, reveals that the blend possesses good emulsion properties as shown by the S. E. number, but poor anti-rusting properties. On the other hand, an oil blend of oil A', the ethylaniline-formaldehyde reaction product and a representative corrosion inhibitor, dioleyl malate, possesses good anti-rusting properties but poor emulsion properties. The oil blends or compositions contemplated herein and represented by the oil blends shown thereafter in Table 2 are superior to those already discussed in that they possess both good emulsion characteristics and anti-rusting characteristics. It will be observed that the addition of only 0.04% of the oil-soluble alcohol extract of blown lard oil greatly improves the emulsion characteristics of the oil blend containing dioleyl malate and the ethylaniline-formaldehyde reaction product.

The more extensive data given for oil blends of oil B' point in the same direction as do those for oil A' discussed above. For example, while the emulsion characteristics of the oil blend containing the typical antioxidant, ethylaniline-formaldehyde condensation product, are good, its anti-rusting properties are undesirable. Also, the oil blend of oil B', the ethylaniline-formaldehyde reaction product and dioleyl malate has good anti-rusting properties but poor emulsion characteristics. When, however, the oil-soluble alcohol extract of blown lard oil is used with the ethyl-aniline-formaldehyde reaction product in oil B', the oil is then desirable both from the standpoint of emulsion and anti-rusting properties. Similarly, a superior oil is obtained when dioleyl malate, the ethylaniline-formaldehyde reaction product and said extract are used in the oil.

Similar comparison of the oil blends for oil C' bear out the conclusions mentioned above in connection with oils A' and B'. That is, that an oil blend containing an antioxidant alone is undesirable in view of its rust-forming property; that oil blends containing the same antioxidant (ethylaniline-formaldehyde reaction product) and typical corrosion inhibitors, illustrated by dioleyl malate and degras fatty acids, are undesirable because of their undesirable emulsion characteristics; and that oil blends containing both the demulsifying and anti-rusting agent of this invention, oil-soluble alcohol extract of blown lard oil, an oxidation inhibitor and a corrosion inhibitor possess both excellent anti-rusting and emulsion characteristics.

Similarly, a comparison of the results shown in Tables 1 and 2 will clearly indicate that the alcohol extract of blown lard oil, contemplated herein, is a rust inhibitor and also imparts good emulsion characteristics to an oil. It will again be observed that typical corrosion inhibitors and typical oxidation inhibitors are not so characterized for they do not improve, and in general impair, the emulsion properties of the oil to which they have been added.

It is to be understood that the aforesaid oil blends are illustrative only and that the invention is not limited thereto. For example, all viscous mineral oil fractions are contemplated herein; the preferred fractions, however, are mineral lubricating oils typified by oils A, B, and C, above, which are suitable for use in turbines. Also the oil-soluble alcohol extract of blown lard oil may be used alone in a minor proportion or amounts of from about 0.03% to about 0.1%, and in oils containing either an oxidation inhibitor or a corrosion inhibitor, or both, in amounts of from about 0.02% to about 0.30%.

It is also to be understood that the procedure given hereinabove for the preparation of the oil-soluble alcohol extract of blown lard oil of this invention is merely illustrative of one means by which the extract may be obtained. While this procedure is preferred, desirable extracts are ob-

tained by varying the several factors involved in the preparation. That is, ethyl alcohol of different concentrations, other than 95%, may be used, as may also other alcohols. The ratio of alcohol to blown lard oil, temperatures, inert gas used in the preparation, etc., may be modified. Similarly, the blown lard oil shown hereinabove is representative only of the type of blown lard oil which may be used. For example, the blown lard oil may be blown with air to a greater or lesser degree than the one shown, may be of different viscosity, and the N. N. thereof may vary over a wide range.

The corrosion inhibitors and oxidation inhibitor shown above in Table 1 are typical of the broad classes of such oil addition agents, and it will be apparent to those familiar with the art that others of these classes are contemplated herein for use in oil blends of a viscous mineral fraction oil and the aforesaid oil-soluble alcohol extract of blown lard oil. For example, this invention contemplates the use of the alcohol extract of blown lard oil in combination with materials such as alkyl aniline-formaldehyde condensation products, aromatic amines, phenolic derivatives, sulfur derivatives, etc., and with rust inhibitors such as fatty acids, alcohol esters of fatty acids, esters of poly basic acids, etc., or with combinations of anti-oxidants and rust inhibitors of the type conventionally used in lubricant compositions which are typified in the foregoing example. The alcohol extract of blown lard oil may also be used in combination with oils containing other additives instead of, or in addition to, the anti-oxidants and rust inhibitors above referred to. Detergents, such as oil soluble metal soaps, pour point depressants, viscosity index improvers, etc., are typical additives used in lubricating oils which may be improved in their emulsion characteristics by the blown lard oil extracts contemplated herein. Our experience indicates that the extract contemplated herein may be used in combination with these other additives without detracting from the function of the other additives and that the other additives do not interfere with the effectiveness of the blown lard oil extract in improving the emulsion characteristics of the oil blend.

I claim:

1. An improved mineral oil composition comprising a viscous mineral oil fraction having in admixture therewith a minor proportion, sufficient to retard the rust- and emulsion-forming characteristics of said oil fraction, of an oil-soluble alcohol extract of blown lard oil and a minor proportion, sufficient to retard the deleterious effects of oxidation upon said oil fraction, of the condensation product of ethylaniline and formaldehyde.

2. An improved mineral oil composition comprising a viscous mineral oil fraction having in admixture therewith a minor proportion, sufficient to retard the rust- and emulsion-forming characteristics of said oil fraction, of an oil-soluble alcohol extract of blown lard oil and a minor proportion, sufficient to retard the corrosivity attending said oil fraction, of dioleyl malate.

3. An improved mineral oil composition comprising a viscous mineral oil fraction having in admixture therewith a minor proportion, sufficient to retard the rust- and emulsion-forming characteristics of said oil fraction, of an oil-soluble alcohol extract of blown lard oil; a minor proportion, sufficient to retard the corrosivity attending said oil fraction, of dioleyl malate; and a minor proportion, sufficient to retard the deleterious effects of oxidation upon said oil fraction, of the condensation product of ethylaniline and formaldehyde.

4. An improved mineral oil composition comprising a viscous mineral oil fraction having in admixture therewith a minor proportion, sufficient to retard the rust- and emulsion-forming characteristics of said oil fraction, of an oil-soluble alcohol extract of blown lard oil obtained by blowing a lard oil with air, contacting the blown lard oil from the preceding operation, with alcohol, separating the alcohol extract layer and the extracted blown lard oil layer thus obtained, and removing the alcohol from the alcohol extract layer to obtain said oil-soluble alcohol extract of blown lard oil.

5. An improved mineral oil composition comprising a viscous mineral oil fraction having in admixture therewith a minor proportion of an oil-soluble alcohol extract obtained by blowing a lard oil with air until said lard oil was characterized by a Saybolt Universal viscosity of about 158 seconds at 210° F., heating and agitating said blown lard oil with alcohol, separating the alcohol extract layer and the extracted blown lard oil layer obtained in the preceding operation and distilling off the alcohol from the alcohol extract layer to obtain said oil-soluble alcohol extract of blown lard oil.

6. An improved mineral oil composition comprising a viscous mineral oil fraction having in admixture therewith a minor proportion of an oil-soluble alcohol extract obtained by blowing a lard oil with air until said lard oil was characterized by a Saybolt Universal viscosity of 158 seconds at 210° F., heating and agitating said blown lard oil with 95% ethyl alcohol, separating the ethyl alcohol extract layer and the extracted blown lard oil layer obtained in the preceding operation, and distilling off the ethyl alcohol from the ethyl alcohol extract layer to obtain said oil-soluble alcohol extract of blown lard oil.

7. An oil composition adapted for the lubrication of ferrous metal surfaces in an environment containing water, comprising a viscous mineral oil fraction having in admixture therewith a minor proportion of an oil-soluble alcohol extract of blown lard oil, which is present in an amount sufficient to retard the rust- and emulsion-forming characteristics of said oil fraction.

8. A turbine oil composition comprising a viscous mineral oil fraction having in admixture therewith a minor proportion, sufficient to retard the rust- and emulsion-forming characteristics of said oil fraction, of an oil-soluble alcohol extract of blown lard oil.

9. A turbine oil composition comprising a viscous mineral oil fraction having in admixture therewith from about 0.03 per cent to about 0.1 per cent of an oil-soluble alcohol extract of blown lard oil.

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