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MARINE ENGINE OIL CONTAINING A PETROLEUM OXIDATE

John K. McKinley and Melvin R. Hefty, Port Arthur, Tex., and Alton J. Deutser, Northville, Mich., assignors to The Texas Company, New York, N. Y., a corporation of Delaware

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The present invention relates to a lubricating composition capable of forming water in oil emulsions in the presence of water, and particularly to such a composition suitable for use as a marine engine oil.

Lubricating oils employed in the lubrication of exposed bearings and other engine parts under wet conditions must have the property of emulsifying readily with water to form emulsions of the water-in-oil type of good lubricating characteristics in order to provide satisfactory lubrication without excessive oil consumption. They must also have good oiliness and adherence to metal and suitable viscosity characteristics, including the property of feeding freely from wick-feed or drip lubricator systems which are commonly employed in the lubrication of such external engine parts. The emulsification properties are particularly important in the case of lubricants employed in the lubrication of reciprocating steam engines such as are employed in marine vessels, since these oils ordinarily become contaminated with considerable amounts of water which drips from the steam cylinders over the moving parts of the engines, and since it is common practice to use water as an extender and to lubricate the crosshead guides and eccentrics with emulsions. In addition to good lubricating properties, the formed emulsions must be stable at both atmospheric temperatures and at elevated temperatures of the order encountered in the lubrication of steam engines.

The most satisfactory marine engine lubricants employed up to the present time have been compounded oils comprising mineral oils with about 10 to 20 per cent or more of blown rapeseed oil. Such compositions have the required emulsification and other characteristics and have been very satisfactory in this type of service. However, rapeseed oil is an expensive and increasingly scarce material, so that it has become commercially important to find a cheap and readily available material which will impart equivalent emulsification properties to mineral lubricating oils.

In accordance with our invention a lubricating composition suitable for use as a marine engine oil comprises a mineral lubricating oil containing about 1 to 10 per cent by weight of a special type of wax oxidate characterized by a ratio of neutralization number to saponification number below about 0.25 and a viscosity (Saybolt Universal) at 210° F. of at least about 1500 seconds, suitably in the range from about 1500 seconds to about 20,000 seconds, and preferably in the range of about 4000–12,000 seconds. Suitable oxidates of this character are petrolatum or lubricating oil oxidation products having a maximum neutralization number of about 35, saponification numbers between about 90 and 145 and containing not more than about 50 per cent of unsaponifiables. The mineral lubricating oil is preferably a naphthenic or predominantly naphthenic oil having a Saybolt Universal viscosity at 100° F. in the range of from about 400 to 1500 seconds. A naphthene base lubricating oil which has been prepared by light acid treating, neutralizing, steaming and brightening, and which has a Saybolt Universal viscosity at 100° F. of about 500–1200 seconds is particularly suitable.

We have found that compositions of the above type meet all the requirements for a very superior marine engine oil, including emulsification characteristics which are fully equivalent to those of compositions comprising 20 per cent of blown rapeseed oil which have been used heretofore for this purpose. In addition they have the advantage of being compounded from inexpensive and readily available materials.

The wax oxidates employed in these compositions may be obtained by oxidizing with air petrolatum and lubricating oil fractions in the presence of a catalyst at an air feed rate of 10 to 35 standard cubic feet of air per pound of hydrocarbon per hour, at a temperature between 270 and 400° F. and at atmospheric pressure. The preferred feed stocks employed for obtaining the oxidates for use according to our invention are heavy petrolatums containing from about 1 to 25 per cent of oil and most suitably from about 1 to 15 per cent of oil, obtained from naphthenic, paraffinic or mixed base crude oils. Under the above conditions the viscosity of the oxidate increases rapidly during the oxidation and if the oxidation period is extended sufficiently it becomes a plastic mass at 210° F. With the type of feed stock described, the neutralization number also increases under these conditions to a maximum value of about 35 and the saponification number to a maximum value of about 145. According to our invention the oxidation is carried out until a product is obtained having a viscosity of at least about 1500 seconds Saybolt Universal at 210° F., and preferably between 4000 and 12,000 seconds, although more viscous products may be employed if desired.

The above oxidates are readily soluble in naphthenic lubricating oils, and blends of suitable homogeneity may be obtained comprising 20 per cent or more of these oxidates. According to the preferred method for preparing our lubricating compositions, a concentrate of the oxidate in a naphthenic lubricating oil is first prepared and permitted to stand for a period of at least about two days, and preferably for at least two weeks. It is then filtered to remove the small amount of insoluble material which separates out, and the filtered concentrate is diluted with additional mineral lubricating oil of suitable viscosity to obtain a blend of the desired oxidate concentration. Most advantageously, our lubricating compositions are prepared by dissolving a suitable wax oxidate of the character described above in a light naphthenic lubricating oil having a Saybolt Universal viscosity at 100° F. below about 300 to form a concentrate containing at least 20 per cent by weight of said oxidate, settling the concentrate for a minimum period of about two weeks at a temperature in the range of about 80–100° F., separating the insoluble material and then diluting with additional naphthenic lubricating oil of higher viscosity to form a blend of the desired viscosity containing about 1–10 per cent of the oxidate.

We are aware that oxidized waxes have been employed heretofore in other types of lubricating compositions for various purposes. However the oxidized waxes which are employed according to this invention are of very different character from those which have been employed in other types of lubricating compositions heretofore, chiefly in their high voscosity and low ratio of neutralization to saponification number. We have found that these oxidates are of greatly improved solubility in mineral lubricating oils and, in addition, they have very superior emulsification characteristics and other properties which make them suitable for use in marine engine oils or other similar oils. It was not to be anticipated that this different type of wax oxidate, when employed in the proportions stated in the particular naphthene base oil, would be critical in providing the required emulsification prop-

erty of the water in oil type, as well as other properties enumerated above, to produce an excellent marine engine oil fully equivalent to the blown rapeseed oil product.

Table I below shows how the character of a wax oxidate depends upon the type of material oxidized and upon the conditions of oxidation employed. Wax oxidate No. 1 of the table was obtained by oxidizing a crude scale wax (A) having a Saybolt Universal viscosity at 210° F. of 38.4 and an oil content of 3.4 per cent, obtained from a paraffinic type crude oil. Wax oxidates 2–7, inclusive, were obtained by oxidizing a 20.5° API gravity petrolatum (B) having a Saybolt Universal viscosity at 210° F. of 86.6 and an oil content of 13.39 per cent, obtained by centrifuge dewaxing of a filtered heavy residuum from a mixed base paraffinic and naphthenic crude oil. Oxidate No. 8 was obtained by oxidizing a 33.5° API gravity petrolatum (C) having a Saybolt Universal viscosity at 210° F. of 77.5 and an oil content of 6.58 per cent, obtained by solvent dewaxing a refined residuum from a paraffin base crude oil.

TABLE I

Influence of operating variables upon wax oxidate properties

Wax Oxidate No.	1	2	3	4	5	6	7	8
Original Material	A	B	B	B	B	B	B	C
Oxidation Conditions:								
Temperature, ° F	270	250	250	330	330	360	360	330
Pressure, p. s. i. a	Atm.	Atm.	80	Atm.	Atm.	Atm.	Atm.	Atm.
Air rate, S. C. F. H./Lb	20	30	30	6	20	16	30	30
Catalyst, Percent $KMnO_4$	0.4	0.4	0.4	0.4	0.4	None	0.4	0.4
Time, hours	5.0	12.5	2.75	17.5	6.25	4.5	5.5	5.0
Tests on Oxidate:								
Neutralization No	181	27	48	9.9	26	15.6	2.7	24
Saponification No	293	79	101	82	126	83	66	121
Nonsaponifiable, Percent	33.2	35.9	50.6	57.8	37.7	56.9	32	39.9
Viscosity, SUS, at 210° F	51.5	162.7	177.1	684	6,211	214	11,038	1,503

Of the above oxidates only those numbered 5, 7 and 8 were of sufficient solubility to form a stable 5 per cent solution in a 750 Pale Oil (naphthene base distillate lubricating oil having SUS viscosity at 100° F. of around 750). Oxidate number 1 was only very slightly soluble, while oxidates numbered 2, 3 and 6 formed clear solutions upon heating with the mineral oil but separated out in large amounts upon cooling to room temperature or upon standing for a short time. Oxidate No. 4 was much superior in this respect to oxidates Nos. 2, 3 and 6 but decidedly inferior to oxidates Nos. 5, 7 and 8. Table II below shows the difference in emulsifying characteristics of the lubricating oil blends obtained with these different oxidates. The data given in the table were obtained upon 5 per cent solutions in a 750 Pale Oil of wax oxidate No. 2, representative of the type of oxidates which have been employed heretofore in lubricating compositions, and oxidates Nos. 7 and 8, representative of the type of oxidates employed according to our invention.

TABLE II

Emulsification properties of different type oxidates

Oxidate No.	2	7	8
Eccentric Emulsification test, Minutes:			
Distilled water	22, 22	6, 7	7, 7
1% Salt solution	13	5	5
Emulsion Stability Test: 180° F., 2 hours	5-4-91	2-0-98	0-Tr-80

Tr stands for trace.

The eccentric emulsification test of the foregoing table is a test which was developed to duplicate in miniature the motion of the engine eccentrics encountered on ships. For this purpose, a motor driven horizontal shaft equipped with a 4" diameter eccentric (eccentricity of 1 in.) was maintained with the eccentric dipping within a semi-circular pan (3½" radius x 2½" wide) so that the eccentric at the extreme limit of its movement was about ½" from the semi-circular side of the pan. 250 milliliters of water and 250 milliliters of the oil compositions under test were added to the pan, thereby bringing the level of the oil-water mixture to about 1" below the shaft axis. With this oil-water mixture maintained at 95–100° F., the shaft and eccentric were rotated at 125 R. P. M.; and the time in minutes for effecting complete emulsification of the mixture, as determined visually, was recorded. The test was performed on each sample both with distilled water and with a 1% salt (NaCl) solution. The lower the emulsification time in this test, the better is the product; and emulsification times less than about 10 minutes are considered excellent. The results obtained with this test have been found to correlate well with those obtained in actual service in marine engines.

The emulsion stability test of the table was carried out by pouring either 100 ml. or 80 ml. of the emulsion obtained in the eccentric emulsification test into a graduate and letting it stand for 2 hours at a temperature of 180° F. The readings given for each sample signify from left to right the ml. of oil separated, the ml. of water separated and the ml. of emulsion remaining. Substantially no oil or water separation is obtained in this test on conventional marine engine oils.

The following examples illustrate the preparation and properties of lubricants of the marine engine oil type which were prepared, employing high ester-high viscosity type wax oxidates in naphthenic base oils according to our invention:

EXAMPLE 1

A series of lubricants was prepared comprising 5 per cent blends of a wax oxidate of our high ester-high viscosity type of varying degrees of oxidation in a 750 Pale Oil, which was a moderately refined naphthene base distillate oil.

Inspection data upon the stocks employed are as follows:

	Petrolatum	Lubricating oil
Flash, COC, ° F	540	395
Fire, COC, ° F	615	
Viscosity, SUS, at 100° F		801
Viscosity, SUS, at 210° F	94.1	59.6
Petrolatum M. P., ° F	161.8	
Ash, Percent	0.012	0.002
S, Percent	0.17	
Oil, Percent	12.23	

In preparing the oxidates, 150 lbs. of the petrolatum and 0.6 lb. of potassium permanganate in 10 lbs. of water were charged to an aluminum reactor and the mixture heated by heat exchange to 360° F., and maintained at this temperature for 10 minutes to initiate the reaction. The temperature was then lowered to 330° F. and air was passed through at a rate of 20 standard cubic feet of air per pound of hydrocarbon charge per hour for 3.74 hours under atmospheric pressure. The air rate was then cut to 10 cubic feet per pound of charge per hour and the reaction continued for a total time of

11.24 hours. Oxidate cuts of varying degrees of oxidation were taken during the reaction and blended with the 750 Pale Oil in amounts to give 5 per cent solutions of the oxidate. The blending was accomplished by mechanical mixing at a temperature between about 160° F. and 200° F. Clear red oils were obtained which remained clear upon cooling to room temperature but which became hazy upon standing at room temperature or below for several hours. In order to obtain a stable product, samples of these oils were allowed to stand for one month at winter temperatures and then filtered.

Table III below shows the emulsification characteristics of these compounded oils, and also the storage stability of the filtered and the original blends. The emulsion test of the table was carried out as prescribed by Federal Specification VV-L-791d Method 320.1.5 with the exception that a temperature of 130° F. rather than 180° F. was employed; and the figures reading from left to right stand for the ml. of oil separated, the ml. of water separated, the ml. of emulsion remaining, and the time in minutes of the test. The storage stability test was carried out by letting quart samples of the oxidate solutions stand for one year at atmospheric temperature and measuring the depth of sediment at the bottom of the container.

TABLE III

Duration of Oxidation, hours	5.24	8.24	11.24
Tests on Oxidate:			
Neutralization No.	29	20	12.
Saponification No.	123	118	114.
Viscosity, SUS, at 210° F.	1,604	6,722	Above 100,000 Cp.
Emulsion Test, Fed. Spec. VV-L-791d Method320. 1.5, Modified:			
Distilled water	0-0-80-60	0-0-80-60	
1% Salt Solution	0-0-80-60	0-0-80-60	
Eccentric Emulsification Test, Minutes:			
Distilled water	5, 5	4, 4	4, 4.
1% Salt Solution	5	4	4.
Emulsion Stability Test:			
Room Temp., 16 hours	Tr-0-80	Tr-0-80	Tr-0-80.
130° F. 16 hours	Tr-0-80	Tr-0-80	Tr-0-80.
Emulsion Viscosity: Cp. at 100° F.	1,360	1,520	1,680.
Storage Stability Test, 1 Year, Atmospheric Temp.:			
Unfiltered Sample Sediment, mm./qt.	8	7	1.
Filtered Sample Sediment, mm./qt.	None	None	None.

The above table shows that oxidates of varying degrees of oxidation having Saybolt Universal viscosities at 210° F. above about 1500 seconds form stable 5 per cent blends in naphthenic lubricating oils which have excellent emulsification characteristics, including emulsion viscosities approximately the same as those of commercial marine engine oils comprising 20 per cent of blown rapeseed oil in lubricating oils, or within the range of about 1300 to about 1800 centipoises at 100° F.

EXAMPLE 2

Another series of lubricating compositions was prepared comprising varying amounts of a high ester-high viscosity type oxidate with a 750 Pale Oil of the same type as that employed in Example 1. The oxidate was obtained by oxidizing a petrolatum stock from a mixed paraffinic and naphthenic base crude residuum in an aluminum reactor at atmospheric pressure and 330° F. employing an air rate of 20 standard cubic feet per hour per pound of hydrocarbon charge and in the presence of 0.4 per cent of potassium permanganate as a catalyst. Inspection data upon the petrolatum and upon the oxidate are as follows:

	Petrolatum	Oxidate
Flash, COC, ° F.	520	455
Fire, COC, ° F.	590	530
Viscosity, SUS, at 210° F.	86.6	4,012
Petrolatum M. P., ° F.	151.8	149.1
Ash, Percent	0.008	0.41
S, Percent	0.19	
Oil, Percent	13.39	
Saponification No.		121
Neutralization No.		21
Unsaponifiable, Percent		36.0

The above oxidate was blended with the 750 Pale Oil as described in Example 1 in amounts to give blends comprising 1, 3, 5, 10 and 20 per cent of oxidate. Clear red solutions were obtained which remained clear upon cooling to room temperature but which became hazy upon standing. The emulsification properties of these solutions are shown in the following table.

TABLE IV

Oxidate Concentration, Percent	1	3	5	10	20
Emulsion Test, Fed. Spec. VV-L-791d Method 320.1.5, Modified:					
Distilled water	0-0-80-60	0-0-80-60	0-0-80-60	0-0-80-60	0-0-80-60
1% Salt Solution	0-0-80-60	0-0-80-60	0-0-80-60	0-0-80-60	0-0-80-60
Eccentric Emulsification Test, Distilled water: Minutes	8, 8	7, 7	6, 6	13, 13	16, 17
Emulsion Stability Test:					
Room Temp., 16 hours	Tr-0-80	Tr-0-80	0-Tr-80	0-Tr-80	0-Tr-80
130° F., 16 hours	16-0-64	6-0-74	Tr-0-80	0-Tr-80	0-Tr-80
Emulsion Viscosity, Cp. at 100° F.	1,280	1,440	1,440	1,840	2,950

The above table shows that lubricating oils having the emulsification charactersitics required for marine engine oils are produced by employing our oxidates in amounts ranging from about 1 to about 10 per cent by weight in naphthenic lubricating oils, about 3 to 10 per cent being the preferred range of oxidate concentration and about 5 per cent being optimum.

EXAMPLE 3

Lubricating compositions comprising 5 per cent oxidate blends were prepared from the 10 and 20 per cent oxidate concentrates of Example 2 by allowing the concentrates to settle for two weeks at room temperature (70–80° F.), filtering and cutting back to 5 per cent oxidate concentration with additional 750 Pale Oil. Table V below gives storage stability tests obtained upon the concentrates and upon the 5 per cent solutions obtained from them.

Table V

STORAGE STABILITY TEST

	9 Months, 70–80° F. Sediment, mm./quart	9 Months, 25–35° F. Sediment, mm./4 oz.
10% Oxidate Blend:		
Original	20	10.
Filtered	Clear	Turbid.
Cut back to 5%	do	Light suspension.
20% Oxidate Blend:		
Original	Heavy sediment	
Filtered	Clear	10.
Cut back to 5%	do	Light suspension.

The above table shows that oxidate blends according to our invention possessing excellent stability for long periods at both ordinary and low temperatures such as are encountered in the storage and handling of lubricating oils are obtained by removing the insoluble material separating out during a period of about two weeks after the oxidates are dissolved in a concentration of at least about 10 per cent in a naphthenic lubricating oil.

EXAMPLE 4

A lubricating composition was prepared comprising 5 per cent of a high ester-high viscosity oxidate in a blend of Pale Oils combined to approximate the viscosity at 100° F. of a commercial marine engine oil comprising 20 per cent of blown rapeseed oil in a naphthenic lubricating oil. The test lubricant was prepared from the following materials in the indicated proportions by weight:

	Percent
Wax oxidate	5.0
70 Pale Oil	9.3
750 Pale Oil	38.5
75/80 Pale Oil	47.2

The Pale Oils were all moderately refined naphthene base distillate oils. The wax oxidate was obtained by oxidizing a heavy petrolatum of the same type as that employed in Example 1 by passing air through it in an aluminum reactor at a rate of 20 standard cubic feet of air per hour per pound of hydrocarbon charge at atmospheric pressure and at 330° F. in the presence of 0.4 per cent of potassium permanganate until a viscosity of approximately 7400 seconds Saybolt Universal at 210° F. was reached.

Inspection data on the stocks employed are as follows:

	Oxidate	70 Pale Oil	750 Pale Oil	75/80 Pale Oil
Gravity, ° API	13.6	23.7	19.3	18.6
Flash, COC, ° F	480	315		450
Fire, COC, ° F		350		
Viscosity, SUS, at 100° F		70.3	781	1,634
Viscosity, SUS, at 210° F	7,364		59.6	76.4
Petrolatum M. P., ° F	141			
Ash, Percent	0.48			
S, Percent				
Saponification No	120			
Neutralization No	24.3			
Unsaponifiable, Percent	34.7			

In preparing the lubricant, 105 lbs. of the oxidate was blended with 195 lbs. of the 70 Pale Oil at 160° F. with stirring in a steam heated kettle, forming a 35 per cent concentrate of the oxidate in the oil. The concentrate was allowed to stand for two weeks at a temperature of 100° F. and then filtered through a plate and frame filter press, employing 45 p. s. i. g. pressure and a small amount of the commercial diatomaceous earth filter aid "Speedflow." Inspection data on the original concentrate and upon the settled and filtered concentrate are as follows:

	Oxidate Concentrate Original	Oxidate Concentrate Settled and Filtered
Gravity, ° API	20.5	
Flash, COC, ° F	325	325
Viscosity, SUS, at 100° F	1,344	1,110
Viscosity, SUS, at 130° F	556	489
Viscosity, SUS, at 210° F	125.7	109.8
Neutralization No	10.6	7.9
Saponification No	44.5	44

The settled and filtered oxidate concentrate was employed in the lubricant preparation by blending 132 pounds of the concentrate with 354.5 pounds of the 750 Pale Oil and 434.5 pounds of the 75/80 Pale Oil with stirring in a steam heated kettle at 160° F. A clear dark red oil was obtained which remained clear upon cooling to room temperature and upon standing. Test data obtained upon this oil are given in the following table comparatively with those obtained upon a commercial marine oil comprising 20 per cent of blown rapeseed oil in a naphthenic lubricating oil.

TABLE VI

	Marine Engine Oil	Lubricant, Example 4
Gravity, ° API	19.9	19.1.
Flash, COC, ° F	375	390.
Fire, COC, ° F	420	430.
Viscosity, SUS, at 70° F	2,790	3,670.
Viscosity, SUS, at 100° F	929	934.
Viscosity, SUS, at 130° F	392	333.
Viscosity, SUS, at 210° F	92.1	67.0.
Viscosity Index	108.3	25.8.
Pour, ° F	—20	—10.
Corrosion, Cu strip, 3 hrs. at 212° F	Negative	Negative.
Ash, Percent	0.10	0.015.
Neutralization No	1.00	1.4.
Saponification No	41.0	8.0.
Emulsion Test, Fed. Spec. VV-L-791d Method 320.1.5, Modified:		
Distilled water	0-0-80-60	0-0-80-60.
1% Salt solution	0-0-80-60	0-0-80-60.
Eccentric Emulsification Test, Distilled water: Minutes	18, 14	11, 11.
Emulsion Stability Test:		
Room temp., 16 hours	Tr-Tr-80	Tr-Tr-100.
130° F., 16 hours	Tr-2-78	1-Tr-99.
180° F., 2 hours	0-0-100	Tr-0-100.
Emulsion Viscosity, Cp. at 100° F	1,600	1,440.
SAE Value, 500 R. P. M.	85, 110, 95	145, 109, 110.
Storage Stability Test, 6 months:		
Atmospheric Temp.—		
Appearance		Clear.
Sediment		None.
25-35° F.—		
Appearance		Slightly hazy.
Sediment		None.

The above table shows that the lubricating composition of our invention was fully equivalent in all significant properties to the commercial lubricant containing 20 per cent of blown rapeseed oil, which is rated as a very superior marine engine oil. As shown by the table, our lubricant met the viscosity specifications which have been set up for marine engine oils which require a Saybolt Universal viscosity at 100° F. in the range of 900–1000 seconds, a viscosity at 70° F. not above 3800 seconds and a 10° F. maximum pour point, and in addition it possessed excellent storage stability and was equal or slightly superior to the commercial product in emulsification and load-bearing properties.

The above lubricating composition of our invention was also tested as a marine engine oil under actual service conditions in a field test wherein it was employed to lubricate the reciprocating steam engines of two Great Lakes ore carriers while they traveled a total distance of 2103 miles. The test lubricant gave excellent performance in this test, and was judged to be equivalent to the conventional blown rapeseed oil product in emulsifiability, and superior in emulsifiability to another commercial product of good grade containing a different type of emulsifying agent. It was also superior to the latter product in that it was free from objectionable tackiness and flowed readily in the drip lubrication system which was used to lubricate the crossheads, cranks and main bearings.

Obviously many modifications and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof and, therefore, only such limitations should be imposed as are indicated in the appended claims.

We claim:

1. A lubricating composition adapted to form emulsions of the water in oil type in the presence of water, consisting essentially of a mineral lubricating oil of predominantly naphthenic character having a Saybolt Universal viscosity at 100° F. in the range from about 400 to 1500 seconds, and about 1–10 per cent by weight of a petroleum oxidate characterized by a maximum neutralization number of about 35, a saponification number of about 90–145, a ratio of neutralization number to saponification number below about 0.25 and a Saybolt Universal viscosity at 210° F. above about 1500 seconds.

2. A marine engine lubricant capable of forming emulsions of the water in oil type in the presence of water consisting essentially of a mineral lubricating oil of pre-

dominantly naphthenic character having a Saybolt Universal viscosity at 100° F. in the range of from about 500 to about 1200 seconds, and about 3–10 per cent by weight of a petroleum oxidate characterized by a maximum neutralization number of about 35, a saponification number of about 90–145, a ratio of neutralization number to saponification number of not more than 0.25 and a Saybolt Universal viscosity at 210° F. in the range of from about 4,000 to about 20,000 seconds.

3. A marine engine lubricant capable of forming emulsions of the water in oil type in the presence of water consisting essentially of a mineral lubricating oil of predominantly naphthenic character having a Saybolt Universal viscosity at 100° F. in the range of from about 600 to about 800 seconds and about 4–6 per cent by weight of a petrolatum oxidate having a neutralization number of about 10–35, a saponification number of about 90–145, a ratio of neutralization number to saponification number below about 0.25, a Saybolt Universal viscosity at 210° F. of about 5000 to about 10,000 seconds, and containing not more than about 50 per cent of unsaponifiables.

4. A lubricating composition adapted to form emulsions of the water-in-oil type in the presence of water, consisting essentially of a mineral lubricating oil of predominantly naphthenic character having a Saybolt Universal viscosity at 100° F. in the range from about 400 to 1500 seconds, and about 1–10 per cent by weight of a wax oxidate characterized by a maximum neutralization number of about 35, a saponification number between about 90 and 145, a ratio of neutralization number to saponification number below about 0.25, and a Saybolt Universal viscosity at 210° F. above about 1500 seconds.

5. A lubricating composition adapted to form emulsions of the water-in-oil type in the presence of water, consisting essentially of a mineral lubricating oil of predominantly naphthenic character having a Saybolt Universal viscosity at 100° F. in the range from about 400 to 1500 seconds, and about 1–10 per cent by weight of an oxidized heavy petrolatum characterized by a maximum neutralization number of about 35, a saponification number between about 90 and 145, a ratio of neutralization number to saponification number below about 0.25, and a Saybolt Universal viscosity at 210° F. above about 1500 seconds.

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