

1

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GEAR LUBRICANT COMPRISING A WIDE MINERAL OIL BLEND AND AN OXIDIZED PARAFFINIC RESIDUUM

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This invention relates to improved lubricating compositions of the fluid type, suitable for the lubrication of gears and heavy bearings. More particularly, it relates to a blend of residual and distillate mineral lubricating oils containing an oxidized paraffinic residuum.

The lubricants of this invention consist essentially of a mineral oil component comprising a wide mineral oil blend and a minor but substantial proportion, based on the composition, of an oxidized paraffinic residuum, preferably an oxidized cylinder stock residuum. The mineral oil blend comprises a substantial proportion of a heavy residual oil having a viscosity above the motor lubricating oil range and a substantial proportion of a light naphthenic oil having a viscosity in about the spindle oil range. In addition, it may comprise minor amounts of different lubricating oils of intermediate viscosities, which may be either naphthenic or paraffinic in character. The lubricant preferably comprises about 20-60 per cent by weight of heavy residual oil, having a viscosity above about 600 seconds Saybolt Universal at 210° F., about 20-60 per cent by weight of light lubricating oil having a viscosity below about 200 seconds Saybolt Universal at 100° F. and comprising in major proportion a naphthenic distillate oil having a viscosity of about 50-100 seconds Saybolt Universal at 100° F., and about 5-30 per cent by weight of oxidized paraffinic residuum having a penetration of about 30-100 and generally about 40-90 at 77° F.

Lubricants obtained by employing the above combination of materials have been found to have excellent adhesiveness to metal and other lubricating properties required of a very superior gear lubricant, suitable for use over a wide range of atmospheric temperatures and in the presence of water. They are characterized particularly by a combination of high viscosity index and low pour point, not obtainable with straight mineral oils and mineral oil blends which have been employed heretofore as transmission lubricants. Transmission lubricants are obtained in accordance with this invention having relatively high viscosities at ordinary and elevated atmospheric temperatures, such as are required to prevent gear noises, combined with very satisfactory cold starting characteristics at winter temperatures.

The residual fractions employed in these compositions are highly viscous oils, preferably of low wax content, obtained either from low wax content crudes such as naphthenic base crudes or by substantially dewaxing residual fractions from paraffinic oils. A very satisfactory residuum for this purpose is obtained from Manvel crude, which is a mixed base oil containing only about 2-3 per cent of wax and giving a residuum having a viscosity in excess of about 600 seconds Saybolt Universal at 210° F. A residuum having a viscosity of about 700-800 seconds Saybolt Universal at 210° F. is preferably employed.

The light naphthenic distillate oils employed in the compositions may be obtained by straight distillation of naphthenic type or predominantly naphthenic type crudes or by any of the usual refining methods.

The oxidized residuum is obtained by blowing a par-

2

affinic residual oil or cylinder stock residuum having a viscosity in the upper lubricating oil range, of about 90-750 seconds Saybolt Universal at 210° F., preferably having a viscosity of about 100-300 seconds Saybolt Universal at 210° F. The blowing may be carried out in the conventional manner, by blowing with air at a suitably elevated temperature of about 400-500° F. either in the presence or absence of a catalyst until a product of the desired penetration is obtained, preferably about 55-75 at 77° F. For ease in handling and compounding, the blown residuum is preferably cut back with a light mineral oil. For example, it may be suitably cut back with about 40-60 per cent by weight of a light naphthenic distillate lubricating oil having a viscosity of about 75-125 seconds Saybolt Universal at 100° F. to give a fluid oxidized residuum cut-back having a viscosity of 175-225 Saybolt Furol at 210° F. The cut back thus forms a portion of the light lubricating distillate of the final composition. The oxidized cylinder stock residuum is to be distinguished from blown asphalts prepared from asphalt-base residuums heretofore employed in gear lubricants, since the oxidized cylinder stock residuum has a much higher dropping point and better temperature susceptibility than a blown asphalt because of its high paraffinic content.

As an example of the lubricating compositions of this invention, lubricants were prepared by blending together a heavy Manvel residuum with a lightly refined light naphthenic distillate oil and with a cut-back oxidized residuum, the latter consisting of a 55-75 penetration product obtained by blowing a paraffinic cylinder stock residuum having a viscosity of 120 seconds Saybolt Universal at 210° F., cut back with an equal amount by weight of a second, lightly refined naphthenic distillate oil having an SUS viscosity at 100° F. of 85-115. The oxidized residuum employed in the specific formulation No. 4 of the following Table I had a penetration of 67 and the petroleum fractions employed had the following tests:

	Distillate No. 1	Distillate No. 2 (Employed in cut-back oxidized residuum)	Residuum
Gravity, A. P. I.	26.5	23.3	
Flash, C. O. C.	330	315	615
Fire, C. O. C.	370		700
Viscosity at 70° F., SUS.	104.9		
Viscosity at 100° F., SUS.	61.3	123	85,000 (Calc.)
Viscosity at 122° F., Furol.			1,575
Viscosity at 210° F., SUS.		40	730
Viscosity index	16	48.4	41.2 (Approx.)
Pour, A. S. T. M.	-45	-30	60

The preparation of these lubricants was carried out by heating the cut back oxidized residuum employed in the compositions in a steam heated kettle to a temperature of about 150° F. and then adding the heavy residuum and the distillate oil No. 1 with continuous stirring at temperatures of about 150-175° F. In some of the preparations, a small amount of Paratac was added to the blend while the temperature was about 145° F. This is a high molecular weight linear isobutylene polymer which is employed in lubricating oil compositions to impart stringiness.

The following table shows the properties of a representative lubricant of this series (Lubricant No. 4), as compared with those of straight mineral oil blends of equivalent viscosity and penetration. Lubricant No. 1 of the table was a blend of Manvel residuum and distillate No. 2, having the properties described above. Lubricant No. 2 was a blend of a residuum having a Saybolt Universal viscosity of about 200 at 210° F., from a South Louisiana crude, which is a mixed base paraffin crude of low wax

3

content, with distillate No. 2. Lubricant No. 3 was a blend of the Manvel residuum with a naphthenic distillate oil having a Saybolt Universal viscosity at 100° F. of about 104, a viscosity index of about 40 and a pour point of about 10° F. Lubricant No. 5 was a commercial transmission lubricant of the blended oil type.

4

with the agitator engaged. The power consumption is measured periodically under this set of conditions. Then the test is repeated in the same manner with a 160 watt adjustment at room temperature. The ability of the unit to start and the power consumption are indicative of the suitability of the lubricant for this purpose.

TABLE II

GE cold starting test results

Lubricant No.-----	1		2		3		4		5	
Test Conditions:										
Watt adjustment-----	160	145	160	145	160	145	160	145	160	145
Room temperature, ° F.-----	75	75	80	81	83	83	68	73	83	81
Transmission temperature, ° F.-----	31	33	33	32	33	33	28	26	31	31
Test Results:										
Time on starting windings, seconds-----	30+	30+	30+	30+	30+	30+	<1	9	45+	35+
Power consumption, watts, after-----										
30 seconds-----	(1)	(1)	(1)	(1)	(1)	(1)	230	280	2,150	2,150
1 minute-----							200	200		
2 minutes-----							177	190		
3 minutes-----							165	170		
4 minutes-----							157	160		
5 minutes-----							150	152		

¹ Stalled.² Test discontinued as drive motor was smoking.

TABLE I

Lubricant No.-----	1	2	3	4	5
Composition, Percent by Wt.:					
Heavy residuum-----	58.0	83.3	61.5	34.7	
Light distillate-----	40.0	14.7	36.5	31.5	
Oxidized residuum (out-back)-----	0.0	0.0	0.0	33.3	
Paratac-----	2.0	2.0	2.0	0.5	
Tests:					
Viscosity, Saybolt Universal, seconds-----					
at 100° F.-----	2,995	3,215	2,833	2,210	2,729
at 210° F.-----	145.5	153	148.1	147.5	123.5
Viscosity Index-----	77.1	78.6	84.3	100.1	56.4
Pour-----	5	15	5	0	0
Modified Penetration-----	355	353	354	350	348
A. S. T. M. Bomb Oxidation Test, Pressure Drop, lbs. 100 hours-----				19; 19	17; 18

As shown by the above table, Lubricant No. 4, which was prepared in accordance with this invention, had both a low pour point and a high viscosity index, whereas the straight mineral oil blends having pour points of the same order had much lower viscosity indices. In addition, the lubricant of this invention had excellent oxidation resistance, as shown by the A. S. T. M. Bomb Oxidation test, being equivalent in this respect to the commercial lubricant.

Table II shows the low temperature characteristics of the above lubricants as measured by the so-called GE Cold Starting Test. This test is used to determine the suitability of lubricants for use in the transmissions of washing machines. Since these machines are frequently stored in unheated places and used without warming up, the low temperature characteristics of lubricants employed for this purpose are very important, a great deal of trouble having been experienced with the electric motors burning out due to the excessive drag upon them during cold starting when lubricants of the prior art have been employed in the transmissions.

The equipment employed in the test is the transmission unit from a General Electric washing machine of the conventional agitator-wringer type, Washer Model AW-052, mounted on a test stand. In carrying out the test, the transmission is first thoroughly cleaned and charged with one and one-half pints of the test oil, and adjusted to consume 145 watts unloaded at room temperature with a 110 volt current supply. The test stand is then placed in a cold room maintained at about 29–33° F. for at least 16 hours, after which it is removed and a 90 volt current applied to the motor of the machine

A lubricant of substantially the same composition as lubricant No. 4 of the above tables except that it contained no Paratac and contained 100 parts per million of a kerosene solution containing 10 per cent by weight of a dimethyl silicone polymer (Dow Corning Fluid 200), was tested extensively as a transmission lubricant in washing machines of various makes, with very satisfactory results. Excellent lubrication was maintained in every case, with no development of gear noises or other difficulties, and the lubricant at the end of the tests had not changed appreciably in either chemical or physical characteristics. The lubrication was furthermore substantially unaffected by the presence of water, no lubrication difficulties being encountered in a 1500 hour continuous test carried out under actual service conditions in which the lubricant became contaminated with 28.5 per cent of water, and inspection of the gear parts at the end of the test revealed that they were clean, rustfree and showed no indication of excessive wear, scoring or pitting.

The lubricating compositions of this invention may contain any of the usual lubricant additives, such as extreme pressure agents, oxidation inhibitors, rust inhibitors, and so forth. Very advantageously, a small amount of a foam inhibitor may be employed, those of the silicone type being particularly suitable for this purpose. For example, foaming in the lubricating compositions of this invention was very effectively inhibited by the addition of 50–150 parts per million of a kerosene solution containing 10 per cent of a dimethyl silicone polymer having a viscosity of about 100 centistokes at 77° F.

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.

I claim:

1. A gear lubricant consisting essentially of about 30–35 percent by weight of an unoxidized heavy mixed base residual oil having a viscosity of about 700–750 seconds Saybolt Universal at 210° F., about 30–35 per cent by weight of an unoxidized naphthenic distillate oil having a viscosity of about 50–75 seconds Saybolt Universal at 100° F. and about 30–35 per cent by weight of a fluid cut back oxidized residuum having a Saybolt Furol viscosity of about 175–225 seconds at 210° F. and consisting of about 40–60 per cent by weight of a naphthenic distillate oil having a viscosity of about 75–125 seconds Saybolt Universal at 100° F. and about 40–60 per cent by weight of an oxidized residuum having a penetration at 77° F. of about 55–75, obtained by oxidizing a paraffinic cylinder stock residuum having a viscosity of about 100–150 seconds Saybolt Universal at 210° F.

5

2. A gear lubricant having substantially the following composition in per cent by volume:

Unoxidized mixed-base petroleum residuum, 720-740 SUS viscosity at 210° F.	33- 35
Unoxidized naphthenic distillate, 55-65 SUS viscosity at 100° F.	31- 34
Unoxidized naphthenic distillate, 75-125 SUS viscosity at 100° F.	15- 20
Oxidized cylinder stock residuum, 55-75 penetration at 77° F.	15- 20
Foam inhibitor, 10% kerosine solution of dimethyl silicone polymer, parts per million ..	50-150

3. A gear lubricant consisting essentially of a blend of at least about 25 per cent by weight of an unoxidized residual oil of low wax content having a viscosity of about 600-800 seconds Saybolt Universal at 210° F., at least about 35 per cent by weight of an unoxidized light distillate oil comprising in major proportion a naphthenic distillate oil having a viscosity of about 50-100 seconds Saybolt Universal of 100° F., and about 5-30 per cent by weight of an oxidized residuum having a penetration at 77° F. of about 30-100, obtained by blowing a paraffinic residual oil having a viscosity in the lubricating oil range.

4. A gear lubricant consisting essentially of a blend of about 25-40 per cent by weight of an unoxidized residual oil of low wax content having a viscosity of about 600-800 seconds Saybolt Universal at 210° F., about 35-65 per cent by weight of an unoxidized light distillate oil having a viscosity below about 200 seconds Saybolt Universal at 100° F. and comprising in major proportion a naphthenic distillate oil having a viscosity of about 50-100 seconds Saybolt Universal at 100° F., and about 5-30 per cent by weight of an oxidized residuum having a penetration at 77° F. of about 40-90, obtained by

6

blowing a paraffinic residual oil having a viscosity in the lubricating oil range.

5. A gear lubricant consisting essentially of a blend of about 25-40 per cent by weight of an unoxidized residual oil of low wax content having a viscosity of about 700-800 seconds Saybolt Universal at 210° F., about 35-65 per cent by weight of an unoxidized light distillate oil having a viscosity below about 200 seconds Saybolt Universal at 100° F. and comprising in major proportion a naphthenic distillate oil having a viscosity of about 50-100 seconds Saybolt Universal at 100° F., and about 10-30 per cent by weight of an oxidized residuum having a penetration at 77° F. of about 55-75, obtained by blowing a paraffinic residual oil having a viscosity in the lubricating oil range.

6. A gear lubricant consisting essentially of a blend of about 25-40 per cent by weight of a predominantly paraffinic unoxidized residual oil of low wax content having a viscosity of about 600-800 seconds Saybolt Universal at 210° F., about 35-65 per cent by weight of an unoxidized light distillate oil having a viscosity below about 200 seconds Saybolt Universal at 100° F. and comprising in major proportion a naphthenic distillate oil having a viscosity of about 50-100 seconds Saybolt Universal at 100° F., and about 5-30 per cent by weight of an oxidized residuum having a penetration at 77° F. of about 55-75, obtained by blowing a paraffinic residual oil having a viscosity in the lubricating oil range.

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