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LUBRICATING OIL CONTAINING AN ALKALINE EARTH METAL SULFONATE, A CO-NEUTRALIZED NONYL PHENATE, AND A METAL DIAMYLDITHIOCARBAMATE

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The present invention is directed to an improved heavy duty lubricating oil. More specifically, the invention is concerned with an improved lubricating composition having outstanding cleanliness and stability characteristics. In its more specific aspects, the invention is concerned with an improved motor lubricant for automobile and gas engines, and the like.

The present invention may be briefly described as a lubricating oil composition of high stability which comprises an alkaline earth metal sulfonate in an amount within the range from about 1 percent to about 5 percent by weight, a co-neutralized sulfurized alkyl phenate in a ratio of about 2 parts of said alkaline earth metal sulfonate to about 1 part of said co-neutralized sulfurized alkyl phenate, an amount of zinc diamyldithiocarbamate within the range from about 0.5 percent to about 2.0 percent by weight and the remainder a lubricating oil fraction.

The lubricating oil fraction making up part of the composition is suitably a paraffinic, naphthenic or mixture of the two types of lubricating oils. Such lubricating oil fractions may be obtained from crude petroleum from the Pennsylvania, California, and the Gulf Coastal fields. Crude oils, such as those from the Panhandle, Texas, fields produce lubricating oil fractions which are also suitable for use in the present invention.

While petroleum lubricating oil fractions are preferred components of the composition, it is within the purview of this invention to use synthetic lubricating oil fractions, such as those formed by polymerizing olefins to high molecular weight fractions having lubricating oil characteristics. The lubricating oil base stock employed in the present invention may have a viscosity within the range from about 35 to about 160 Saybolt seconds Universal at 210° F.

The alkaline earth metal sulfonate forming a component of the present invention may be calcium, barium or strontium sulfonate, although calcium and barium will be preferred. These alkaline earth sulfonates may be suitably formed by alkylating benzene with tetrapropylene to form a long chain alkylated aromatic hydrocarbon, followed by sulfonation of the alkylated aromatic hydrocarbon and then neutralizing the sulfonated alkylated aromatic hydrocarbon with barium or calcium hydroxide or oxide. Other means for preparing the sulfonate may be employed, for example, by photosulfochlorination of saturated hydrocarbons with corresponding treatment of the sulfonyl chloride with barium or calcium oxide or hydroxide.

The amount of the alkaline earth sulfonate may suitably be in the range from about 1 percent to about 5 percent by weight of the composition. Very satisfactory results are obtained employing about 2.5 percent by weight of the alkaline earth metal sulfonate.

The co-neutralized sulfurized alkyl phenate is employed with the alkaline earth metal sulfonate in a ratio of about two parts of the sulfonate to about one part of the phenate. The alkyl phenate may be sulfurized nonyl barium phenate, but other alkyl phenates such as nonyl barium phenate, sulfurized nonyl calcium-barium phenate, nonyl calcium-barium phenate, and nonyl calcium phenate are suitably used in the practice of the present invention.

In the practice of the present invention, by virtue of using the sulfonate and phenate in a ratio of about two parts of the sulfonate to about one part of the phenate in conjunction with zinc, cadmium, silver, or other metal diamyldithiocarbamates, it is possible to obtain a synergistic effect wherein a composition of improved stability is obtained having substantially less increase in viscosity after subjecting to rather rigorous conditions.

In order to illustrate the present invention further, a number of blends were made up employing an extracted Coastal lubricating oil having a viscosity index in the range from about 60 to about 63. To this base lubricating oil was added varying amounts of alkaline earth metal sulfonates in conjunction with a co-neutralized sulfurized alkyl phenate and an amount of zinc diamyldithiocarbamate. These several blends were submitted to a modified Indiana life oxidation test to determine the viscosity increase after 32 hours. The results of these tests, along with the identity of the several blends are given in the following table:

Table I

Blend No.	1	2	3	4	5	6	6a	7	8
	Extracted Coastal (60–63 V.I.)								
Base stock additive	4% calcium sulfonate		2.5% barium sulfonate		2.5% barium sulfonate and co-neutralized sulfurized nonyl phenate			2.5% (2 parts Ca. Sul., 1 part co-neutralized sulfurized nonyl phenate)	
Ratio of sulfonate [1] to co-neutralized sulfurized nonyl phenate	1:0		1:0		2:1			2:1	
1% zinc diamyldithiocarbamate added.	No	Yes	No	Yes	No	Yes	[2] Yes	No	Yes
Percent Visc. Incr. after 32 hrs.	35	25	50	24	34	10	11	30	12

Table I.—Continued

Blend No.	9	10	11	12	13	14	15	16	17
	Extracted Coastal (60–63 V.I.)								
Base stock additive	2.5% (2 parts Ba. Sul., 1 part co-neutralized sulfurized nonyl phenate		5% calcium sulfonate and co-neutralized sulfurized nonyl phenate		2.5% co-neutralized sulfurized nonyl phenate		2.5% co-neutralized sulfurized nonyl phenate		None
Ratio of sulfonate [1] to co-neutralized sulfurized monyl phenate	2:1		1:2		0:1		0:1		-------
1% zinc diamyldithiocarbamate added	No	Yes	No	Yes	No	Yes	No	Yes	Yes
Percent Visc. Incr. after 32 hrs.	34	12	23	23	29	31	30	29	16

[1] Either barium or calcium sulfonate.
[2] Cadmium diamyldithiocarbamate employed rather than the zinc compound.

From the data in the preceding table, it may be seen that where a ratio of sulfonate to phenate of 2:1 was employed with the zinc or cadmium diamyldithiocarbamate, substantially improved and synergistic results were obtained.

Referring to compositions 17, 5, 7, and 9, as compared with 6, 8 and 10, where the zinc diamyldithiocarbamate was present and 6*a* where cadmium diamyldithiocarbamate was present, it will be clear that by employing the ratio of the sulfonate to phenate of 2:1 substantially improved and synergistic results were obtained.

Referring to compositions 13, 14, 15 and 16, it will be clear that the zinc diamyldithiocarbamate used in conjunction with the alkyl phenate did not give results that compare favorably with the results from the composition of the present invention.

Comparing compositions 1 to 4, inclusive with 5 to 10, it will be seen that with the composition of the present invention, where the zinc diamyldithiocarbamate was used with the sulfonate and phenate in the critical ratio, substantially improved results were obtained.

The Indiana life test employed to show the beneficial effects of the present invention is described in the Journal of Industrial and Engineering Chemistry, Analytical Edition, vol. 6, page 419, by Rogers and Shoemaker. The modified Indiana life test consists in suspending a rod having strips of copper, iron and zinc wrapped thereon in the oil during the oxidation period and the withdrawal of samples of sufficient amount at specified intervals for determination of viscosity from which the viscosity increase is calculated.

In order to illustrate the present invention further, a run was made on a CRC L–4 Chevrolet engine on a 36-hour test. The composition 6 was compared with the composition 12, as shown in the following table:

Table II

	Blend 6	Blend 12
Varnish Demerit	0.0	0.5
Bearing Weight Loss, Grms	0.132	0.133
Sludge Merit Rating	48.5	48.0
Percent Visc. Incr. After 36 Hours	7.4	21.2

It will be clear from comparing blend 6 with blend 12 that blend 6 showed no varnish demerit, and viscosity increase after 36 hours' operation in the engine was only about one-third of that for blend 12, blend 6 being the present invention. In other words, blend 6 is superior in both stability and cleanliness to that of blend 12.

The composition of the present invention has particular application as a lubricant in automobile and industrial gas engines in which it is particularly useful.

The nature and objects of the present invention having been completely described and illustrated, what I wish to claim as new and useful and to secure by Letters Patent is:

1. A lubricating oil composition of high stability which comprises an alkaline earth metal sulfonate selected from the group consisting of calcium and barium sulfonates in an amount within the range from about 1.0% to about 5.0% by weight, a co-neutralized sulfurized nonyl phenate in a ratio of about 2 parts of said alkaline earth metal sulfonate to about 1 part of said co-neutralized phenate, an amount of metal diamyldithiocarbamate selected from the group consisting of zinc and cadmium diamyldithiocarbamate within the range from about 0.5% to about 2.0% by weight, and the remainder a petroleum lubricating oil fraction.

2. A composition in accordance with claim 1 in which the alkaline earth metal sulfonate is calcium sulfonate.

3. A composition in accordance with claim 1 in which the alkaline earth metal sulfonate is barium sulfonate.

4. A composition in accordance with claim 1 in which the metal in the carbamate is cadmium.

5. A composition in accordance with claim 1 in which the metal in the carbamate is zinc.

6. A lubricating oil composition of high stability which comprises about 2.5% by weight of a mixture of an alkaline earth metal sulfonate selected from the group consisting of calcium and barium sulfonates and co-neutralized sulfurized nonyl phenate, in a ratio of about 2:1, about 1% by weight of metal diamyldithiocarbamate selected from the group consisting of zinc and cadmium diamyldithiocarbamate, and the remainder a petroleum lubricating oil fraction.

7. A composition in accordance with claim 6 in which the alkaline earth metal sulfonate is calcium sulfonate.

8. A composition in accordance with claim 6 in which the alkaline earth metal sulfonate is barium sulfonate.

9. A composition in accordance with claim 6 in which the metal in the carbamate is cadmium.

10. A composition in accordance with claim 6 in which the metal in the carbamate is zinc.

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