

[54] LUBRICANTS

[75] Inventor: **Ralph P. Williams**, Bartlesville,
Okla.
[73] Assignee: **Phillips Petroleum Company**,
Bartlesville, Okla.

2,719,125	9/1955	Roberts.....	252/47
2,812,306	11/1957	Liehe	252/42.1
2,963,433	12/1960	Little et al.	252/47
3,112,270	11/1963	Mitacek et al.	252/41
3,481,871	12/1969	Myers et al.	252/47 X

[22] Filed: **Feb. 15, 1973**

Primary Examiner—H. Sneed

[21] Appl. No.: **332,566**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 123,111, March 10, 1971, abandoned.

[52] U.S. Cl. **252/42.1, 252/47, 252/402**
[51] Int. Cl. **C10m 1/36, C10m 1/38**
[58] Field of Search **252/42.1, 47**

References Cited

UNITED STATES PATENTS

2,371,319 3/1945 Ross et al. 252/47

[57]

ABSTRACT

The addition of a small amount of an alkyl sulfenyl N,N-dialkyl dithiocarbamate to lubricating oils, gear oils, greases, and the like improves the various properties thereof including the higher pressure properties, the stability of the so-treated lubricants against oxidation and rust, as well as antiwear properties, antiscuffing properties, and the like.

10 Claims, No Drawings.

LUBRICANTS

This is a continuation-in-part application of application Ser. No. 123,111, filed Mar. 10, 1971, entitled "Lubricants", now abandoned.

This invention relates to improved lubricants and processes of preparing the same. In accordance with another aspect, this invention relates to addition agents imparting to lubricants increased stability toward oxidation and rust as well as improved high pressure characteristics. In accordance with a further aspect, this invention relates to lubricating oils and greases having improved physical characteristics having incorporated therein a small quantity of an alkyl sulfenyl N,N-dialkyl dithiocarbamate, also referred to as alkyl sulfenyl dialkyl dithiocarbamate in this application. In accordance with a still further aspect, this invention relates to lubricant additives exhibiting antiwear and antiscuffing properties. In accordance with another aspect, this invention relates to improving the physical properties of lubricants by the addition thereto of crude or unrefined alkyl sulfenyl dialkyl dithiocarbamates.

Various efforts have been made with respect to improving the physical characteristics of lubricating oils and greases. One problem often encountered with lubricants is the high pressure characteristics as well as the antiwear and antiscuffing properties. Also, many lubricants do not exhibit a satisfactory stability toward oxidation and rust. In accordance with the invention, it has been found that addition of alkyl sulfenyl dialkyl dithiocarbamates to lubricants substantially improves the lubricants with respect to the high pressure characteristics as well as oxidation, rust, antiwear, antiscuffing, and other properties of the lubricants.

Accordingly, an object of this invention is to provide improved lubricating oils and greases.

A further object of this invention is to provide lubricating oils and greases improved in high pressure or extreme pressure characteristics.

A further object of this invention is to provide lubricating oils and greases having increased stability toward oxidation and rust.

Another object of this invention is to provide effective antiwear and antiscuffing additives for lubricants.

Other objects and aspects, as well as the several advantages of the invention, will be apparent to those skilled in the art upon reading the specification and the appended claims.

In accordance with the invention, lubricating oils and greases are improved in physical properties by the addition of a small effective amount of at least one alkyl sulfenyl dialkyl dithiocarbamate.

It has been found that alkyl sulfenyl dialkyl dithiocarbamates function as rust inhibitors, antioxidants, antiwear additives and antiscuffing additives in lubricating oils and greases. Additionally, it has been found that lubricating oils and greases containing a small quantity of at least one alkyl sulfenyl dialkyl dithiocarbamate exhibit excellent characteristics as extreme pressure lubricants.

In accordance with one specific embodiment of the invention, lubricating oils and grease formulations are improved in the above characteristics by the addition of t-butylsulfenyl N,N-dimethyldithiocarbamate, t-octylsulfenyl N,N-dimethyldithiocarbamate, t-nonylsulfenyl N,N-dimethyldithiocarbamate, and t-dodecylsulfenyl N,N-dimethyldithiocarbamate. The t-

octyl, t-nonyl and t-dodecyl mercaptans from which these sulfenyl compounds are made, are products from the reaction of i-butene dimer, propylene trimer and tetramer, respectively, with hydrogen sulfide and are mixtures of isomers. These isomeric thiols are used to prepare the sulfenyl chloride intermediates for the preparation of the alkyl sulfenyl N,N-dialkyl dithiocarbamates of this invention. Hereinafter, these compounds will be referred to as tertiary or t-compounds, it being understood that they include isomeric species. The names have found acceptance in the chemical industry.

The alkyl sulfenyl dialkyl dithiocarbamates that can be employed according to this invention are represented by the formula $R-S-S-C(S)-N(R')_2$ wherein R is a straight or branched chain alkyl radical having up to 14 carbon atoms and generally from 1 to 10 carbon atoms and R' is a straight or branched chain alkyl radical having from 1 to 5 carbon atoms, and further wherein R and R' can be the same or different.

Examples of compounds which can be used include: t-butylsulfenyl N,N-dimethyldithiocarbamate, methylsulfenyl N,N-dimethyldithiocarbamate, ethylsulfenyl N,N-diisobutyldithiocarbamate, octylsulfenyl N,N-diethyldithiocarbamate, t-octylsulfenyl N,N-dimethyldithiocarbamate, 2,2-(dimethyl)octylsulfenyl N-methyl-N-ethyldithiocarbamate, 2,3-(dimethyl)hexylsulfenyl N,N-diisobutyldithiocarbamate, t-nonylsulfenyl N,N-dimethyldithiocarbamate, t-dodecylsulfenyl N,N-dimethyldithiocarbamate, tetradecylsulfenyl N,N-dimethyldithiocarbamate, t-tetradecylsulfenyl N,N-dipentyldithiocarbamate, and the like. If desired, mixtures of the above compounds can be used. Also, if desired pure as well as crude or unrefined compounds, or mixtures thereof, can be used.

The alkyl sulfenyl dialkyl dithiocarbamates that can be employed according to the invention are well known in the art and can be prepared according to any known procedure.

The amount of alkyl sulfenyl dialkyl dithiocarbamate incorporated into the lubricants according to the invention is a finite amount sufficient to improve the physical properties of the lubricants and is ordinarily at least about 0.05 weight percent and can range from 0.1 to 5 weight percent, preferably from 0.5 to 2 weight percent.

In the preparation of the lubricating compositions, various mineral oils are employed. Generally, these are of petroleum origin and are complex mixtures of many hydrocarbon compounds. Preferably the mineral oils are refined products such as are obtained by well-known refining processes such as by hydrogenation, polymerization, dewaxing, etc. Frequently, the oils have a Saybolt viscosity at 100°F in the range of about 60 to 5,000 and a Saybolt viscosity at 210°F of about 30 to 250. The oils can be of paraffinic, naphthenic or aromatic types, as well as mixtures thereof. The additives of the invention have special advantages when employed with paraffinic types of oil such as are obtained by solvent extraction of a suitable refinery stream. Many suitable compositions are available as commercial products such as those used as motor oils, fuel oils, automatic transmission oils, gear oils, and the like. The invention is applicable to any lubricating oils having a problem with respect to the viscosity when

subjected to high temperature conditions for long periods of time.

Generally, any conventional and commercially available grease is amenable to this invention. The grease employed can have been thickened in any known manner such as by the use of soaps and/or by dissolving polymers in the oil at temperature of at least 245°F and the like.

Suitable greases include substantially any grade of flowable grease as defined by the National Lubricating Grease Institute (NLGI). For example, NLGI grade greases from 000 to 6 can be employed in this invention. Also, greases having an ASTM D 217-68 penetration at 60 strokes in the range of 85 to 475 can be employed.

The lubricating oil bases which can be employed to make greases of this invention can be mineral, vegetable, or animal in nature, preferable lubricant bases having at least a major amount of mineral origin. Such oils include refined oils having a viscosity of from about 35 to about 240 SUS at 210°F. White mineral oil as well as other specialty oils can be used and are among the preferred oils.

Thickeners for the oils can be employed in amounts up to 20 weight percent of the oil. Various soaps normally used to thicken greases can be used and they include metal salts of high molecular weight acids, for example, acids of 10 to 30 and preferably 16 to 24 carbon atoms, either synthetic or of animal or vegetable origin. Other carboxylic acids useful for making soaps of metal salts include those derived from tallows, hydrogenated fish oil, castor oil, wool grease, and rosin. Generally, the alkali metal or alkaline earth metal or aluminum or lead salts of acids such as lauric, palmitic, oleic, stearic, and the like are used. One of the preferred soaps is the lithium soap of 12-hydroxystearic acid. While soaps of a general nature can be used in the greases of this invention, it should be understood that the invention is of use with soapless greases formed essentially from polymers and oil alone, with or without small amounts of known grease additives such as fillers and the like. Thus, polymers such as polyethylene and polypropylene can be employed as thickeners, together, alone or in conjunction with other thickeners such as soap.

Other materials normally used in greases can also be employed in the greases applicable to this invention. For example, additives such as rust inhibitors, antioxidants, fillers, pigments, perfumes, and the like can be employed. Some examples of such materials include propylenediamine, phenyl- α -naphthylamine, phenothiazine, mica, asbestos, powdered lead, powdered zinc, talc, alumina, titanium dioxide, molybdenum disulfide, bentonites, carbon black, nitrobenzene, and the like. Generally, the amount of these modifiers is less than about 10 percent of the total weight of the grease.

Other agents than those which have been mentioned can be present in the lubricant composition such as dyes, pour point depressants, heat thickened fatty oils, sulfurized fatty oils, sludge dispersers, thickeners, viscosity index improvers, oiliness agents, resins, rubber, and the like.

The additives of the invention can also be used in other mineral oil products such as motor fuels, heating oils, hydraulic fluids, torque converter fluids, cutting oils, flushing oils, turbine oils, transformer oils, industrial oils, process oils, and the like, and generally as antioxidants and rust inhibitors in mineral oil products.

They can also be used in gear lubricants, greases and other products containing mineral oils as ingredients.

As indicated above, the addition of alkyl sulfenyl dialkyl dithiocarbamates to lubricating oils and greases in concentrations as indicated above effects a marked increase in the stability of the oils and greases toward oxidation and rust. In addition, the extreme pressure lubricating properties of the alkyl sulfenyl dialkyl dithiocarbamate treated oils and greases are somewhat increased. Other properties of the oils and greases such as wear and scuffing are also improved.

EXAMPLE I

The extreme pressure effectiveness of an additive according to the invention was compared with known additives in a lubricating oil stock. As set forth in Table I below, one percent of t-butylsulfenyl N,N-dimethyldithiocarbamate, an additive of the invention, was incorporated into a lubricating oil stock and compared with three known additives, all of which were present at one percent concentration, and the formulations were subjected to a 4-ball wear test (ASTM D 2956-67-T).

TABLE I

Lubricant Additive ^(a)	Load to Weld, Kg	Wear Scar, M
1% t-butylsulfenyl N,N-dimethyldithiocarbamate	200	2505
1% Anglamol-75 ^(b)	140	2289
1% Lubrizol 1395 ^(c)	120	
1% Vanlube 71 ^(d)	180	
None	110	3750

^(a) Added to Kansas City 10 lube oil stock.

^(b) Zinc dialkyl dithiophosphate: P, 6.8%; S, 14.2%; Zn, 7.2%.

^(c) Zinc dialkyl dithiophosphate: P, 9.5%; S, 20.0%; Zn, 10%.

^(d) Lead diamyl dithiocarbamate.

*Commercial additives supplied in oil carriers, concentration of active ingredients unknown.

As can be seen from above, the additive of the invention exhibited substantial improvement in the extreme pressure effectiveness as compared with the values exhibited by the known additives.

EXAMPLE II

An antioxidant test was carried out comparing an additive of the invention with a known antioxidant. A lubricating oil (a 10W-30 motor oil with detergents, dispersants and viscosity improvers, but containing no antioxidant) was formulated to contain either 1 percent t-butylsulfenyl N,N-dimethyldithiocarbamate, an additive of the invention, or to contain a known additive in 1 percent concentration, and each was evaluated for oxidation inhibition, in accordance with ASTM D 942.

TABLE II

Additive	Pressure Drop, psi		
	24 Hours	48 Hours	72 Hours
1% t-butylsulfenyl N,N-dimethyldithiocarbamate	17	37	57
1% Lubrizol 1395	32	59	72

As can be seen from the above data, the additive of the invention exhibits better oxidation inhibition than with the known antioxidant.

EXAMPLE III

A grease formulation was formulated by milling into the semifinished grease 0.5–3% t-butylsulfenyl N,N-dimethyldithiocarbamate. For comparison, one formulation was prepared to contain 2½% by weight of Vanlube 71.

The basic grease was a lithium soap base grease containing 4 percent by weight high density polyethylene. Results are tabulated below.

	Timken OK Load, lbs.
Grease (control, no additive) specification	<10
Grease plus 2½% Vanlube 71 (lead diamyldithiocarbamate)	70–75
Grease plus 0.5% tert-butylsulfenyl N,N-dimethyldithiocarbamate	30 fail
Grease plus 1.0% do.	50 pass
Grease plus 2.0% do.	50 do.
Grease plus 3.0% do.	50 do.

Due to the desire to eliminate heavy metals, like lead, from the environment, substitution of a non-metallic additive may be required and the present invention provides an alternative non-metallic antioxidant which meets current specification (50 minimum) at 1 weight percent and higher additive levels.

EXAMPLE IV

A number of alkylsulfenyl dialkyldithiocarbamates were prepared and the crude products resulting were evaluated in lubricant compositions. The preparation of these materials are set forth below. Typical Syntheses of t-alkylsulfenyl N,N-dimethyldithiocarbamates

t-Butyl	
Materials	
t-Butylmercaptan	180 g
n-Heptane	1800 ml
Chlorine	136 g
40% aqueous sodium N,N-dimethyldithiocarbamate	715 g

A solution of t-butyl mercaptan in n-heptane and gaseous chlorine were metered in separate streams to a glass mixing tee where they converged in approximately stoichiometric quantities and then passed into a steam jacketed 3-liter, 3-necked flask where the mixture was continually refluxed to remove HCl. The time required for introducing the reactants was 121 minutes. When the mercaptan-chlorine reaction step forming t-butylsulfenyl chloride had been completed, aqueous sodium N,N-dimethyldithiocarbamate solution was added rapidly with brisk stirring to the resulting tert-butylsulfenyl chloride solution in the 3-necked flask, and the mixture was stirred for about 20 minutes. The phases were separated, and the organic phase was washed twice with water. Then the heptane was stripped from the organic phase leaving 381 grams (91.1 percent crude yield) of yellow oil. A portion of the product (50 g) was recrystallized from 200 ml n-heptane, yielding 46.6 g of crystalline product which corresponded to a 93.3 percent purity for the crude product. The remaining 331 grams of crude product was dissolved in sufficient xylene to give 1,103.3 grams of total solution containing 30 weight percent t-butylsulfenyl N,N-dimethyldithiocarbamate.

t-Octyl	
Materials	
t-Octyl mercaptan	146 g
n-Heptane	800 ml
Sulfuryl chloride (SO ₂ Cl ₂)	135 g
40% aqueous sodium N,N-dimethyldithiocarbamate	357.5 g

- 10 Sulfuryl chloride was added to t-octyl mercaptan in n-heptane in a reaction flask over a 10-minute period to form the sulfenyl chloride. The solution was heated to 85°C to drive off SO₂ and HCl, then was washed with water. Aqueous sodium N,N-dimethyldithiocarbamate was then added rapidly to the sulfenyl chloride solution with stirring. After stirring for 15 minutes, the phases were separated and the organic phase was washed with water. Then the heptane was stripped from the organic phase under vacuum in a rotary evaporator on a steam bath. The crude t-octylsulfenyl N,N-dimethyldithiocarbamate weighed 223.0 g (84.2 percent yield).

Analysis	Calculated	Found
C	49.7	49.54
H	8.7	7.65
N	5.3	4.65
S	36.2	37.1

30 t-Nonyl	
Materials	
t-Nonyl mercaptan	
n-Heptane	
Chlorine	
40% Aqueous sodium N,N-dimethyldithiocarbamate	

- 35 371.5 g t-nonyl mercaptan was dissolved in sufficient n-heptane to make 2,000 ml of solution. 1,800 ml of this solution was used to prepare t-nonyl sulfenyl, N,N-dimethyldithiocarbamate, using 130 g chlorine and 715 g of 40% aqueous sodium N,N-dimethyldithiocarbamate. The reaction was conducted in same manner as for t-butyl derivative. The crude liquid t-nonyl sulfenyl N,N-dimethyldithiocarbamate weighed 487.0 g (87.1 percent yield).

Analysis	Calculated	Found
C	51.55	54.8
H	9.03	9.9
N	5.01	4.2
S	34.40	30.4

55 t-Dodecyl	
Materials	
T-Dodecyl mercaptan	
n-Heptane	
Chlorine	
40% Aqueous Sodium N,N-dimethyldithiocarbamate	

- 60 449 g t-dodecyl mercaptan was dissolved in sufficient n-heptane to make 2,000 ml of solution. 1,800 ml of this solution was used to prepare the desired product using 140 g chlorine and 715 g 40% aqueous sodium N,N-dimethyldithiocarbamate.

- 65 Synthesis was carried out in same manner as that for the butyl derivative. The yield of crude t-dodecylsulfenyl N,N-dimethyldithiocarbamate product was 528 g (82.2 percent).

Analysis	Calculated	Found
C	56.01	60.54
H	9.73	10.52
N	4.36	3.27
S	29.90	25.7

EXAMPLE V

The extreme pressure effectiveness (ASTM Method D-2509-68) of the crude products produced in Example IV was compared with a known additive in a grease formulation. The results of these evaluations are set forth below.

Three of the compounds tested at the 1% level meet the current specification value of 50 lbs. minimum and would therefor be acceptable ashless additives to replace ingredients containing heavy metals such as lead and zinc. The other compound, t-dodecylsulfenyl N,N-dimethyldithiocarbamate showed sufficient improvement over the control to be considered an effective additive.

EXAMPLE VI

Wear tests were conducted using high purity and crude products of this invention in a lubricating composition for a sequence I engine test. The results are given below.

TABLE III

Test Conditions: Timken Machine, 10-minutes running time at 800 rpm.
Grease Base Stock: Philube* L-2 (Lithium Base)

Additive	Wt. %	Timken OK Load ^(a) Lb.
None	—	<10
t-Butylsulfenyl N,N-dimethyldithiocarbamate ^(b)	1-3	50
t-Octylsulfenyl N,N-dimethyldithiocarbamate ^(c)	1	50
t-Nonylsulfenyl N,N-dimethyldithiocarbamate ^(d)	1	50
t-Dodecylsulfenyl N,N-dimethyldithiocarbamate ^(e)	1	30
Lead diamyl Dithiocarbamate (Vanlube 71)	2.5	60-70

^(a) Minimum acceptable OK load, 50 lb.

OK load: Test block scar with straight line sides and no metal pickup.

Critical OK Load: Test block scar with straight line sides but with metal pickup.

Failure Load: Test block scar with metal pickup causing boundary lines of scar pattern to be irregular.

^(b) t-C₄ derivative worked equally well over 1-3 weight percent concentration range whether used in high purity or crude form, or as a 30% solution in xylene (solution charged to provide 1-3% t-butylsulfenyl N,N-dimethyldithiocarbamate).

^(c) Crude t-octyl derivative.

^(d) Crude t-nonyl derivative.

^(e) Crude t-dodecyl derivative.

*Phillips Petroleum Company trademark.

40

TABLE IV

SEQUENCE I TEST^(a)—CAMSHAFT AND VALVE LIFTER WEAR
t-Alkylsulfenyl N,N-dimethyldithiocarbamates

Test Conditions:

1967 Ninety-Eight Olds engine.

2500 rpm (65 mph) — Light Load — Road Load.

Coolant temperature, — 94°F.

Oil Temperature, F — 130 (max.)

Engine operates for 10 minutes, then is shut down for 50 minutes of each hour for 30 hours. Running time approximates 325 miles.

Test Oil: Trop-Arctic (Phillips Petroleum Company trademark) all season motor oil, SAE 10W-30 without antiwear agent

Fuel: Kansas City pipeline base with 3 cc TEL/gal.

In. ^(a) Base Oil Plus Antiwear Additive		Camshaft Lobe Wear,			Valve Lifter ^(a) Footcrown Wear, In.		
		Min.	Max.	Avg.	Min.	Max.	Avg.
None		.0006	.1994	.0868	.0000	.0620	.0189
0.19 Wt. %	Lubrizol-1395 ^(b)	.0012	.0005	.0000	.0000	.0000	
0.5 Wt. %	t-Butylsulfenyl DMDTC ^(c)	.0016	.0003	.0000	.0010	.0001	
0.05 Wt. %	do.	.0000	.0012	.0004	.0000	.0020	.0014
0.03 Wt. %	do.	.0000	.0021	.0003	.0000	.0020	.0010
0.05 Wt. %	do.	.0000	.0004	.0002	.0000	.0010	.0003
0.5 Wt. %	t-Octylsulfenyl do.	.0000	.0004	.0001	.0000	.0010	.0003

*N,N-dimethyldithiocarbamate.

^(a) The method sets no wear specs, says only that wear should not be excessive.

^(b) Commercial product: hydrocarbon solution of zinc dialkyl dithiophosphate.

^(c) t-Butylsulfenyl N,N-dimethyldithiocarbamate: High purity crystalline product from plant inventory.

Analysis	Calculated for C ₇ H ₁₅ NS ₂	Found
Carbon	40.15	40.0
Hydrogen	7.22	7.1
Nitrogen	6.69	6.9
Sulfur	45.94	45.5

^(d) used 0.17 weight percent of 30% solution in xylene of crude t-butylsulfenyl N,N-dimethyldithiocarbamate; estimated purity of crude product: 93.3Wt.%.
^(e) crude t-octylsulfenyl N,N-dimethyldithiocarbamate.

^(f) ASTM special technical publication No. 315A, Engine Test Sequences for Evaluating Automotive Lubricants for API Service MS, published by ASTM (1963)

EXAMPLE VII

Additional wear tests were conducted using t-butyl- and t-nonyl-sulfenyl N,N-dimethyldithiocarbamates as oil additives in a Sequence IIIC test. The results are set forth below.

TABLE V

Sequence IIIC Test ^(f)				
Test Conditions:				
98 Olds Engine.				
Turnpike Speed (80 mph) with 55% overload (heavy trailer).				
Coolant temperature, 240°F; Oil Temperature, 300°F.				
Oil: 10W-40 stock with additive package below				
Additive Package:				
0.2 wt. % Vanlube PN* (phenyl-β-naphthylamine)				
1.0 wt. % Ethyl 702* (4,4'-methylene bis(2,6-di-t-butylphenol))				
2.0 wt. % Vanlube SS* (mixture of octylated diphenylamines)				
2.15 wt. % V.I. improver (hydrogenated butadiene-styrene copolymer)				
0.2 wt. % A 152 pour point depressant (a polymethacrylate base acryloid resin)				
6.0 wt. % Lubrizol 934 dispersant (a mixture of 90% by wt. polyisobutenyl succinic ester and 10% by wt. of a mixture of polyisobutenyl succinamide and a succinamide derived from polybutenyl succinic anhydride and alkylene polyamines)				
10.0 ppm DC200 Silicone oil — antifoam agent				
Lifter Wear, Inches		Camshaft Lobe +		
Antiwear Additive		Average	Maximum	
GM Specifications				
0.1 wt. %	t-butylsulfenyl DMDTC	^(a)	0.0010	0.0020
0.2 wt. %	t-nonylsulfenyl DMDTC	^(b)	0.0034	0.0062
1.0 wt. %	do.	^(b)	0.0056	0.0359
			0.0015	0.0025

*Ashless antioxidants

^(a) Used 0.34 wt. % of 30% crude t-butylsulfenyl DMDTC solution in xylene.

^(b) Crude t-nonylsulfenyl DMDTC.

^(f) ASTM special technical publication 315E - Multicylinder Test Sequences for Evaluating Automotive Engine Oils, published by ASTM (1971).

While the samples do not meet the GM specification values it should be pointed out that these specifications were set for a metal containing additive material, such as zinc dialkyldithiophosphate. No standards have been set for an ashless additive. These are now in the development stage. At the 1% level the t-nonylsulfenyl DMDTC is very close to the GM values and would be considered an adequate, ashless, metal-free substitute for the metal containing additive.

I claim:

1. An improved lubricating composition comprising a mineral lubricating oil having incorporated therein a small quantity of an alkyl sulfenyl dialkyl dithiocarbamate having the formula $R-S-S-C(S)-N(R')_2$ wherein R is an alkyl radical having 1-10, inclusive, carbon atoms and R' is an alkyl radical having 1-5, inclusive, carbon atoms and R and R' are the same or different, sufficient to improve the high pressure properties and to increase the stability of the so-treated lubricating oil against oxidation and rust.

2. A composition according to claim 1 wherein the

quantity of alkyl sulfenyl dialkyl dithiocarbamate ranges from 0.1 to 5 weight percent.

3. A composition according to claim 1 wherein said mineral lubricating oil has been thickened with an alkali metal soap to form a grease formulation.

4. A composition according to claim 2 wherein the alkyl sulfenyl dialkyl dithiocarbamate is N,N-dimethyl t-butylsulfenyl dithiocarbamate.

5. A composition according to claim 3 wherein said grease additionally contains polyethylene, said dithiocarbamate is N,N-dimethyl t-butylsulfenyl dithiocarbamate, and the amount of said dithiocarbamate is in the range 1-5 weight percent.

6. An improved lubricating composition comprising a mineral lubricating oil having incorporated therein at least one alkyl sulfenyl N,N-dialkyl dithiocarbamate having the formula $R-S-S-C(S)-N(R')_2$ wherein R is an alkyl radical having 1-14, inclusive, carbon atoms and R' is an alkyl radical having 1-5, inclusive, carbon atoms, and wherein R and R' are the same or

different in a finite amount sufficient to improve at least one of the physical properties of the resulting lubricating composition.

7. A composition according to claim 6 wherein the quantity of alkyl sulfenyl dialkyl dithiocarbamate ranges from 0.05 to 5 weight percent.

8. A composition according to claim 6 wherein said mineral lubricating oil has been thickened with an alkali metal soap to form a grease formulation.

9. A composition according to claim 7 wherein the alkyl sulfenyl dialkyl dithiocarbamate is N,N-dimethyl t-butylsulfenyl dithiocarbamate, t-octylsulfenyl N,N-dimethyldithiocarbamate, t-nonylsulfenyl N,N-dimethyldithiocarbamate, or t-dodecylsulfenyl N,N-dimethyldithiocarbamate.

10. A composition according to claim 8 wherein said dithiocarbamate is N,N-dimethyl t-butylsulfenyl dithiocarbamate, t-octylsulfenyl N,N-dimethyldithiocarbamate, t-nonylsulfenyl N,N-dimethyldithiocarbamate, or t-dodecylsulfenyl N,N-dimethyldithiocarbamate.

* * * * *