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3,049,494
POWER TRANSMITTING FLUIDS

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11 Claims. (Cl. 252—75)

This invention relates to power transmitting fluids and more particularly to a combination of additives designed to improve lubricants which are useful in automatic power transmission mechanisms.

The introduction of automatic hydraulic transmissions in automobiles has created a demand for a specific type of hydraulic fluid which will insure dependable operation of this type unit. Fluids of this type are required to function as a power transmission medium, heat transfer medium, control fluid, clutch fluid, and as a gear and bearing lubricant. In addition to these requirements hydraulic fluids of this type should also provide maximum resistance to oxidation, operation over a broad temperature range, minimum volatility, minimum foaming characteristics, maximum protection against corrosion and rusting of component parts and minimum effect on rubber seals.

In establishing the composition of a fluid that meets these requirements, particular emphasis is placed on its "anti-squawk" property, as it is most critical to fluid composition. Squawk is a chattering or metallic clunking noise that occurs in hydraulic transmission mechanisms, such as the General Motors Hydramatic transmission, when the unit up-shifts from the second to the third position when certain transmission fluids are used. It appears that at this point in the up-shifting cycle a more critical requirement is placed on the fluid than at any other point. Although this phenomenon is restricted to new units and usually disappears after from 5 to 500 miles of usage, it cannot be tolerated by the car manufacturer. We are aware that certain compositions have been proposed as automatic transmission oils in U.S. Patents 2,662,055 and 2,710,842.

In accordance with this invention, we have found that valuable power transmitting fluids can be obtained by blending in a hydrocarbon oil defined amounts of a combination of additives comprising a barium dialkyl dithiophosphate and a detergent material selected from the group consisting of basic barium petroleum mahogany sulfonate and carbonate basic barium petroleum mahogany sulfonate. This combination of additive agents has been found to eliminate objectionable "squawking" properties in power transmitting fluids, and when used with other additives such as extreme pressure agents, pour depressants, anti-foaming agents and the like a lubricant is provided which meets the vigorous requirements set up to qualify hydraulic fluids for automatic transmission units. As fully formulated, the fluid compositions of this invention are resistant to oxidation and temperature extremes, produce a minimum of foam, are not harmful to rubber seals, provide good corrosion inhibiting properties and do not afford squawking during shifting. Aside from providing lubricant properties for the moving metal parts of the transmission unit, the power transmitting fluids are characterized by a low pour point, good low

temperature-fluidity properties and a high viscosity index.

The fluid compositions of our invention which prevent squawking in the automatic transmission comprise essentially a major proportion of a hydrocarbon oil, about 0.5 to 2 weight percent on a dry soap basis of barium dialkyl dithiophosphate in which the alkyl groups contain at least 12 carbon atoms, and about 0.5 to 1 percent, on the same weight basis, of basic barium mahogany sulfonate or carbonated basic barium mahogany sulfonate. In addition to the above ingredients, other materials may be employed to supplement the oil in one or more respects. Thus where the dithiophosphate and basic sulfonate are used in the base oil to provide good antioxidant and sludge-dispersant properties, other materials such as anti-foaming agents, pour depressants, viscosity improvers, extreme pressure agents and the like are preferably incorporated in the lubricant. In order to impart extreme pressure properties a material such as sulfurized sperm oil can be employed in amounts ranging from about 2 to 3 weight percent. Other additives such as silicones are used to impart anti-foaming characteristics to the oil. These additives are used in very small amounts, for example, about 0.001 to 0.003 weight percent. Methacrylate polymer type additives are desirable as viscosity index improvers and are advantageously used in a proportion of about 1 to 2 weight percent on a dry basis. Waxy additives such as lanolin and slack wax, or any soluble wax component, are desirable for providing low temperature-fluidity properties and eliminating squawk. For this purpose any soluble amount of the waxy compound can be used although preferably at least about 0.3 weight percent and not more than 0.7 weight percent is employed.

A particularly advantageous formulation of our composition is a hydrocarbon oil which contains, on a dry soap basis, about 0.8 weight percent of barium dialkyl dithiophosphate in which the alkyl group contains from 12 to 18 carbon atoms, about 0.8 weight percent of basic barium mahogany sulfonate or carbonated basic barium mahogany sulfonate, about 0.002 weight percent of a silicone anti-foam agent, about 2.5 weight percent of sulfurized sperm oil and about 1.5 weight percent of a methacrylate polymer, such as "Acryloid 710." These ingredients are conveniently added to the hydrocarbon oil in the form of oil solutions and if desired lanolin or slack wax can be included in an amount of about 0.5 weight percent.

The barium salts of dialkyl dithiophosphates useful in our invention must contain at least 12 carbon atoms in the alkyl chain in order to provide an oil which does not have squawking properties. If the number of carbon atoms in the dialkyl dithiophosphate is less than 12, or when higher proportions than specified of sulfonate are used, effective anti-squawk properties have not been obtained. Similarly, while the barium salts of the dialkyl dithiophosphate have been found to provide good anti-squawk characteristics, such results are not obtained with the corresponding zinc salts. Preferably the alkyl chain contains from 12 to 14 carbon atoms and can contain as high as 18 carbon atoms. The dithiophosphates are prepared by reacting at elevated temperature an alcohol containing at least 12 carbon atoms and a phosphorus sulfide to form an acid ester, $(RO)_2P(S)SH$. Barium

oxide is added to the ester and the mixture is then heated to an elevated temperature to obtain the barium salt. The resulting compounds have the formula

$$[(RO)_2P(S)S]_2Ba$$

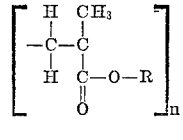
in which R is an alkyl radical containing at least 12 carbon atoms. Useful alcohols are, for example, dodecyl alcohol, tetradodecyl alcohol, cetyl alcohol and octadecyl alcohol.

As previously mentioned, the useful detergent material employed in our composition is basic barium mahogany sulfonate or carbonated basic barium mahogany sulfonate. The latter materials have been found particularly valuable in hydrocarbon oils containing phosphorus and sulfur type oxidation inhibitors since the carbonated sulfonates have the ability to improve the base oil with respect to water tolerance and the formation of objectionable precipitates. In combination with the barium dithiophosphate, both the carbonated and non-carbonated basic barium sulfonates have been found effective as squawk suppressors. Other sulfonate materials, however, such as neutral barium petroleum sulfonate or carbonated synthetic sulfonates have not been found effective in providing anti-squawk properties.

The basic barium sulfonates used for the purpose of this invention are the basic salts or soaps of the oil-soluble petroleum sulfonic acids, generally designated as mahogany acids, which are obtained by the sulfuric acid, oleum or sulfur trioxide treatment of petroleum oils boiling in the range of about 600 to 1000° F. Advantageously, the sulfonic acids are prepared by a two-stage sulfonation reaction in which the charge oil is contacted in a first stage with a small proportion of oleum at low temperatures. After sludge removal the partially sulfonated oil is diluted with kerosene and is contacted with SO_3 in admixture with SO_2 in a second stage. This preparation has been found particularly valuable inasmuch as high yields of acids are obtained without increased formation of objectionable color bodies. The basic sulfonates can be prepared by neutralizing the mahogany acids with a theoretical excess of a barium neutralizing agent, such as barium hydroxide, so as to obtain a product which contains an amount of barium in excess of that theoretically required to replace the acidic hydrogens of the sulfonic acids. Generally, the amount of barium hydroxide employed in treating the acids is at least 1.5 times that required for neutralization to obtain the normal salt. The basic sulfonates are conveniently employed as a concentrate in the oil from which they are derived and may vary in concentration from 10 to 50% by weight.

The carbonated basic barium sulfonate which can be employed is obtained by contacting the basic barium mahogany sulfonate with carbon dioxide until the strong basicity of the sulfonate to phenolphthalein is reduced and a final pH of about 7 to 8.5 is obtained. This can be carried out, for example, by introducing the basic barium sulfonate to the top of a packed column and then feeding carbon dioxide to the bottom of the tower. The carbonated basic barium mahogany sulfonate is recovered and vacuum dried to obtain the final product. As an example, a typical carbonated basic barium sulfonate prepared from an oleum-treated West Texas gas oil fraction analyzed 2.86% barium and had a base No. to pH 4 of 11.3.

The methacrylate polymers used in our fluids are acrylic ester polymers which have molecular weights ranging from about 5000 to 20,000 and which are well known as viscosity index improvers and pour depressants. Commercially available materials which are particularly suitable are the "Acryloids," a series of polymers which may be represented as follows:



where R is an alkyl group having from 8 to 16 carbon atoms such as cetyl, lauryl or octyl groups, and n is the number of molecules of similar structure condensed together to form a high molecular weight polymer. The "Acryloids" are clear viscous concentrates of methacrylic polymer in a solvent refined neutral oil and have a typical concentration of about 40 weight percent. "Acryloid 710," in which R is a mixture of lauryl and octyl groups, is particularly useful and is generally characterized by having the following physical properties:

Sp. gr., 60° F./60° F.	0.096
Lbs./gal.	7.54
Flash point, C.O.C., ° F.[1]	400
Pour point, ASTM, ° F.[2]	25
Viscosity, cs./100° F.	9,400
Viscosity, SUS/100° F.	43,000
Viscosity, cs./210° F.	800
Viscosity, SUS/210° F.	3,700
Color, ASTM	3
Neut. No.	0.2

[1] When diluted with three parts of a 400° F. flash mineral oil to decrease the viscosity.
[2] Viscosity pour point.

The sulfurized sperm oil used in the present composition is a well-known product which functions as an extreme pressure lubricant and oiliness agent. This material can be prepared by sulfurizing sperm oil with about 10 to 15% of sulfur at a temperature of about 400° F. for a period of 1 hour or more. The resulting sulfurized product contains about 8 to 13% of combined sulfur and is preferably employed in the lubricant in a proportion of about 2.5 weight percent.

The anti-foaming agents incorporated in the lubricant can be any of the dialkyl, diaryl or alkyl-aryl silicone polymers which have known properties for reducing foam or froth. Generally, these materials are identified chemically as hydrocarbon substituted silicon ethers or silicones containing from about 6 to 18 silicon atoms with a corresponding number of interposed oxygen atoms. Materials of this type are dimethyl silicone polymers which have a kinematic viscosity at 25° C. of about 100 to 1000 centistokes. These silicone anti-foam agents are available commercially as Dow Corning Fluids which are sold under several viscosity ranges such as, for example, "Dow Corning Fluid 175," "Dow Corning Fluid 200," "Dow Corning Fluid 1000," or "Dow Corning Anti-foam A." The numbers such as 175 refer to the kinematic viscosity of the polymer at 25° C. The latter material, "Dow Corning Anti-foam A," which is comprised of the dimethyl silicone absorbed on silica gel, has been found especially effective when used in combination with the above-described additive materials for providing acceptable power transmitting fluids. The silicone anti-foam agent is conveniently handled as a concentrate in a hydrocarbon solvent, usually a ten percent concentrate in kerosene, and is preferably employed in the lubricant in a proportion of about 0.002 percent by weight.

The waxy component which can be used is lanolin, slack wax or any soluble wax component derived from petroleum oils. The waxy component helps to eliminate squawk and aids in obtaining good low temperature flow properties for the fluid. Slack wax is preferred as it is inexpensive and affords good low temperature properties. The slack wax useful in our fluids is obtained from the manufacture of paraffin wax wherein a paraffin distillate is chilled to a low temperature and the resultant slack wax is separated from the oil. Preferably light lubricating oil distillates are used. A typical slack wax has the following properties: a gravity of 41.4; a melting point in ° F. of 116; 17 percent oil; a viscosity at 210° F. of 36.8 and a cone penetration at 77° F. of 42.

The hydrocarbon oils useful in our invention are preferably petroleum distillates from paraffinic, naphthenic, aromatic or mixed base crudes, but the oils can range from

neutral oils to bright stocks. Petroleum lubricating oils are preferred. Preferably, the viscosity index ranges from about 20 to 100.

The fluids of our invention will be further illustrated by the following examples.

In the examples, the base oil used in preparing the formulations was a blend of four lubricating oil stocks. The blend was as follows:

Lubricating oil	Vol. percent in blend	Viscosity [1]		VI [2]	Spec. [3] disp.
		100° F.	210° F.		
A. Convent. refined Coastal	30	55.9	33.7	39.1	133
B. Convent. refined Coastal	30	104	38.3	22.3	128
C. Solvent refined Mid-Cont	32-33	165	44.0	96.0	106
D. Solvent refined Mid-Cont	7-8	1,737	120.4	96.2	116

[1] In Saybolt seconds universal.
[2] Viscosity index.
[3] Specific dispersion.

The squawk testing was carried out in 1952 and 1954 model Oldsmobile cars equipped with new or newly rebuilt Hydramatic transmissions at the following temperature ranges:

(1) 95–105° F.
(2) 140–150° F.
(3) 195–205° F.

At each temperature range three quarter and full throttle acceleration tests were made from full stop. The shifting characteristics were observed particularly at the critical second to third shifting point.

EXAMPLE I

Fluids containing barium dialkyl dithiophosphate of varying alkyl chains and the corresponding zinc salt were screened for squawking properties.

The base composition was the above-described base oil blend containing 0.66 weight percent of 55–60 percent barium di "Lorol" dithiophosphate oil solution (0.38% on a dry soap basis), 2.5 weight percent of sulfurized sperm oil (12% sulfur), 3.8 weight percent of Acryloid 710, which is a 40% oil solution of polymer, (1.5% on a dry soap basis), 0.002 weight percent of Anti-foam A, 0.6 weight percent of lanolin and 0.1 weight percent of sodium petroleum mahogany sulfonate.

The barium dithiophosphates used in the fluids were prepared as in the following illustration of the preparation of barium di "Lorol" dithiophosphate:

850 grams of technical grade lauryl alcohol and 220 grams of P_2S_5 were reacted at 230° F. for about 10 hours and then air blown at 160° F. for 1 hour to give 1040 grams of acid ester $(RO)_2P(S)SH$. 84 grams of BaO and 10 grams of water were added with stirring over a 1-hour period to 515 grams of acid ester. Heating and stirring at 140° F.–175° F. continued for 1 hour, following which the reaction mixture was dehydrated, diluted with 500 grams of lubricating oil A described above and filtered with filter aid. 1019 grams of product were obtained which analyzed 6.2 percent Ba, 3.15 percent P, and 5.0 percent S. Some of the sulfur in the acid ester is lost by hydrolysis during the preparation of the barium salt. Other preparations gave equally useful products. For example, one product analyzed 9.3 percent Ba, 3.8 percent P and 4.9 percent S.

"Lorol No. 5" used in preparing the di "Lorol" dithiophosphates is a technical grade of lauryl alcohol and has the following composition.

Alcohol:	Wt. percent
Decyl (C_{10})	2.6
Lauryl (C_{12})	61.0
Myristyl (C_{14})	23.0
Cetyl (C_{16})	11.2
Octadecyl (C_{18})	2.2

Screening tests showed that alcohols of at least 12 carbon atoms are essential in preparing a barium dialkyl dithiophosphate that passes the squawk test. The base composition containing the dithiophosphate prepared from "Lorol No. 5," i.e. containing mostly 12 to 14 carbon atoms, passed the squawk test as did barium dioctadecyl dithiophosphate. Barium dialkyl dithiophosphate made from alcohol containing mostly 6 and 7 carbon atoms, however, did not pass the squawk test. Also, zinc dialkyl dithiophosphates made from alcohols containing mostly 6 and 7, mostly 12 and 14 and mostly 18 carbon atoms did not pass the squawk test, indicating that they are unsatisfactory.

EXAMPLE II

Screening tests were performed on various detergent sulfonates in transmission fluids to determine their squawking properties. Several detergents and different concentrations of the same detergents were tested in combination with other compounds known to be squawk suppressors by formulating the agents in the finished fluids so that any occurrence of squawk could be attributed to the detergent material. The screening tests showed that a neutral barium petroleum sulfonate was not satisfactory. They also showed that carbonated barium sulfonate (basic barium sulfonate made from didodecyl benzene and carbonated) was not satisfactory. They also showed that basic barium petroleum sulfonate in amounts less than about 0.5 or above about 1 weight percent on a dry soap basis was not satisfactory. Basic barium petroleum sulfonate in an amount of about 0.5 to 1 weight percent on a dry soap basis, however, was satisfactory and passed the squawk test.

EXAMPLE III

The balance between barium dithiophosphate and basic barium sulfonate is important in obtaining fluids that are satisfactory for automatic transmissions.

The two formulations I and II described below were prepared. The compositions are described in weight percent.

	I	II	Dry soap basis
Basic barium sulfonate [1]	12	12	1.7.
Barium DTP [2]	0.72	0.72	0.4.
Sulfurized sperm oil [3]	2.5	2.5	2.5.
Methacrylate polymer [4]	3.5	3.5	1.
Dimethyl silicone [5]	0.002	0.002	0.002.
Slack wax [6]	----------	0.5	— or 0.5.
Lanolin	0.5	----------	0.5 or —.
Base oil	Bal.	Bal.	Bal.

[1] Basic barium petroleum mahogany sulfonate made from fuming acid treatment of dewaxed Sweet West Texas gas oil. Percent Ba=3.6. Base No.=15.8. 4% Basic barium sulfonate and 86% oil.
[2] Barium di "Lorol" dithiophosphate. Percent Ba=9.3, percent P=3.8, percent S=4.9. 55-60% dithiophosphate in 45 to 40% oil.
[3] 12 percent S.
[4] "Acryloid 710", 40N concentrate in oil solution.
[5] "Anti-foam A."
[6] Slack wax from a light paraffin distillate.

When formulations I and II were tested in a 1954 Oldsmobile automatic transmission, they proved to have squawking properties. It was found, however, that by decreasing the amount of basic barium sulfonate from 12 percent to 6 percent and increasing the amount of barium dithiophosphate from 0.72 percent to 1.4 percent, fluids resulted which performed satisfactorily in the 1954 Oldsmobile test without squawking. Thus, the balance between basic barium sulfonate and barium dithiophosphate is important in obtaining satisfactory fluids.

Two formulations that proved to be particularly effective had the following compositions in weight percent:

	III	IV	Dry soap basis
Basic barium sulfonate	6.0	6.0	0.84.
Barium DTP	1.4	1.4	0.8.
Sulfurized sperm oil	2.5	2.5	2.5.
Methacrylate polymer	3.7	3.7	1.5.
Dimethyl silicone	0.002	0.002	0.002.
Slack wax	0.5		0.5 or —.
Lanolin		0.5	— or 0.5.
Base oil	Bal.	Bal.	Bal.

NOTE.—All components were those of above table.

The formulations III and IV were subjected to various tests to determine their suitability for hydraulic transmission fluids. The results were:

Laboratory tests	I	II
Gravity	26.1	26.3
Flash	350	360
Fire	380	390
Vis. at 0° F. (extrap.)	6,700	6,200
Vis. at 100° F. SUS	195	194
Vis. at 130° F. SUS	109	107
Vis. at 210° F. SUS	50.2	50.0
Viscosity index	136.8	136.5
Pour	−55	−65
Color	6−	6−
Carbon residue	0.73	0.71
SO_4 ash	0.60	0.59
Acid number, D-974	0.08	0.11
Sulfur, percent	0.48	0.49
Barium, percent	0.33	0.33
Phosphorous, percent	0.044	0.044
Can pour at −55° F. sec. [1]	7.1, 6.3	9.8, 9.2
Copper strip [2]	10	10
Rubber swell [3]	4.2, 3.7	4.6, 4.1
Seal cracking [3]	Passes	Passes
Heat test [4]	Passes	Passes
Turbine oil rust test	Passes-A	Passes-A
Squawk test	Passes	Passes

L-4 test	I		II	
	Straight	Dilution [5]	Straight	Dilution [5] 50/50
Piston varnish	9.5	9.5	9.0	10.0
Total varnish	48.5	48.5	48.0	50.0
Total sludge	45.5	45.0	46.0	45.0
Varnish and sludge, total	93.5	93.5	94.0	95.0
Bearing weight	0.051	0.041	0.064	0.053
Loss g./whole acid number, 36 hrs.		1.14		0.91
Vis. rise at 100° F., percent		40.9		35.5

[1] *GM can pour test.*—A sample of AT fluid is taken through a temperature cycle from 115° F. to room temperature. The sample is then maintained at −55° F. for 8 hours in a quart can. Without removing sample from the cold environment, it is tilted through a 90° angle and time required for the fluid to reach the lip of the can is recorded. In this manner AT fluids are screened for their low temperature flow properties for qualification testing in the cold room starting tests at −40° F.

[2] *Copper strip test.*—Run in an air oven at 300° F. Properly balanced fluids should cause no excessive sulfiding of the copper strip, as it might result in corrosion of the bronze parts of the transmission.

[3] *Rubber seal test.*—Properly balanced fluids should not attack the rubber seals so they become hard and brittle or so they shrink. Both types of deterioration will result in fluid leakage. It is most desirable to have the seals show a slight swell by this test.

[4] *Heat test.*—This is a beaker test carried out at 250° F. for 125 hours. It gives a measure of the stability of the additives at typical operating temperatures.

[5] *Dilution L-4 test.*—Regular CRC Chevrolet L-4 oxidation test run at 265° F. crankcase temperature on a transmission fluid that has been diluted with an equal volume of a well refined unhibited base oil reference fluid.

The results clearly show the advantageous effectiveness and suitability of the formulations III and IV for use as hydraulic transmisison fluids.

EXAMPLE IV

Power transmitting fluids prepared in accordance with this invention which contained either carbonated or non-carbonated basic barium mahogany sulfonate were screened for anti-squawk characteristics in a 1954 Oldsmobile Hydramatic transmission unit of proven squawking tendencies. From the data obtained, blends containing the carbonated or non-carbonated sulfonate were effective squawk suppressors even when the sulfonate materials were diluted to 50 percent of their original concentration with a solvent refined Mid-Continent neutral oil. The two formulations tested had the following compositions in weight percent:

Additive, weight percent	V	VI	Dry soap basis
Carbonated basic barium sulfonate [1]	4.7		.63
Non-carbonated basic barium sulfonate [1]		4.7	.63
Barium dithiophosphate [2]	2.4	2.4	
Sulfurized sperm oil [3]	2.5	2.5	2.5
Slack wax [6]	0.5	0.5	
Methacrylate polymer [4]	3.7	3.7	1.5
Dimethyl silicone [5]	0.002	0.002	0.002
Base oil	Bal.	Bal.	Bal.

[1] Basic barium petroleum mahogany sulfonate made from fuming acid treatment of dewaxed Sweet West Texas gas oil. Percent Ba = 3.6. Base No. = 15.8. 14% Basic barium sulfonate and 86% oil. The carbonated sulfonate analyzed 2.86% barium and had a Base No. to pH 4 of 11.3.

[2] Barium di "Lorol" dipthiohosphate. Percent Ba = 9.3, percent P = 3.8, percent S = 4.9. 55-60% dithiophosphate in 45 to 40% oil.

[3] 12 percent S.

[4] "Acryloid 710", 40% concentrate in oil solution.

[5] "Anti-foam A".

[6] Slack wax from a light paraffin distillate.

In order to completely evaluate blends V and VI, it was necessary to rebuild the Hydramatic unit after each test. This included installation of new bands, drums and clutch plates. The automatic transmission unit is filled with the test blends and the driving program is carried out as follows.

A. Straight fluid:

(1) Transmission cold (ambient to 120° F.) ¼, ½, ¾, and full throttle accelerations.

(2) Transmission warm (160–180° F.) ¼, ½, ¾, and full throttle accelerations.

(3) Transmission hot (220–250° F.) ¼, ½, ¾, and full throttle accelerations.

B. Drain half of test fluid (A) from transmission, bring up the "full" with a solvent refined, Mid-Continent Oil. Repeat schedule (1), (2) and (3) under A.

C. Completely drain transmission and charge with mild pro-squawking reference fluid:

(1) Prove transmission a sensitive squawker by getting squawk during shifts as in (1), (2) and/or (3) under A.

The results obtained are shown in the tables below.

Hydramatic Transmission 1st Rebuild

	Blend No. V		Blend No. VI		Pro-squawking fluid
	Straight	50% dilution	Straight	50% dilution	
Squawk test:					
Cold	None	None	None	None	Squawk.
Warm	do	do	do	do	DO.
Hot	do	do	do	do	

Hydramatic Transmission 2nd Rebuild

	Blend No. 1		Pro-squawking fluid
	Straight	50% dilution	
Squawk test:			
Cold	None	None	None.
Warm	do	do	Do.
Hot	do	do	Do.

Since the second rebuild job on the transmission produced one which was not sensitive to the pro-squawking fluid, it was necessary to rebuild the transmission again, with the following results.

Hydramatic Transmission 3rd Rebuild

	Blend No. 1		Pro-squawking fluid
	Straight	50% dilution	
Squawk test:			
Cold	None	None	
Warm	do	do	Squawk.
Hot	do	do	Do.

This application is a continuation-in-part of our application Serial No. 562,950, filed January 2, 1956, now abandoned.

We claim:

1. A power transmitting fluid comprising a major proportion of a hydrocarbon oil and on a dry soap basis, about 0.5 to 2 weight percent of a barium salt of a dialkyl dithiophosphate in which the alkyl group contains at least 12 carbon atoms and about 0.5 to 1 weight percent of a detergent basic barium sulfonate material selected from the group consisting of basic barium petroleum mahogany sulfonate and carbonated basic barium mahogany sulfonate; said basic barium sulfonate material having been prepared with a barium neutralizing agent in an amount of at least about 1.5 times that required to obtain the normal salt.

2. The power transmitting fluid of claim 1 in which the alkyl group contains from 12 to 18 carbon atoms.

3. The power transmitting fluid of claim 2 in which there is an anti-foaming agent consisting essentially of dimethyl silicone polymer on silica gel.

4. The power transmitting fluid of claim 1 in which the detergent material is carbonated basic barium petroleum mahogany sulfonate.

5. A power transmitting fluid which comprises a major proportion of a mineral oil and on a dry basis, about 0.5 to 2 weight percent of barium dialkyl dithiophosphate wherein the alkyl group contains from 12 to 18 carbon atoms, about 0.5 to 1 weight percent of a detergent basic barium sulfonate material selected from the group consisting of basic barium petroleum mahogany sulfonate and carbonated basic barium mahogany sulfonate, about 0.001 to 0.003 weight percent of a dimethyl silicone polymer, about 2 to 3 weight percent of sulfurized sperm oil

and about 1 to 2 weight percent of a methacrylate polymer; said basic barium sulfonate material having been prepared with a barium neutralizing agent in an amount of at least about 1.5 times that required to obtain the normal salt.

6. The power transmitting fluid of claim 5 in which the silicone polymer is on silica gel.

7. The power transmitting fluid of claim 5 in which the detergent material is carbonated basic barium petroleum mahogany sulfonate.

8. A power transmitting fluid which comprises a major proportion of a mineral oil and on a dry soap basis, about 0.8 weight percent of barium dialkyl dithiophosphate wherein the alkyl group contains from 12 to 18 carbon atoms, about 0.8 weight percent of a detergent basic barium sulfonate material selected from the group consisting of basic barium petroleum mahogany sulfonate and carbonated basic barium petroleum mahogany sulfonate, about 0.001 to 0.003 weight percent of a dimethyl silicone polymer on silica gel, about 2.5 weight percent of sulfurized sperm oil and about 1.5 weight percent of a methacrylate polymer; said basic barium sulfonate material having been prepared with a barium neutralizing agent in an amount of at least about 1.5 times that required to obtain the normal salt.

9. The power transmitting fluid of claim 8 in which the detergent material is carbonated basic barium petroleum mahogany sulfonate.

10. The power transmitting fluid of claim 8 which also contains about 0.5 weight percent of slack wax.

11. The power transmitting fluid of claim 8 which also contains about 0.5 weight percent of lanolin.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,049,494 August 14, 1962

Robert C. Palmer et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, footnote 4 of the table, for "40N" read -- 40% --; column 9, line 12, for "January 2, 1956" read -- February 2, 1956 --; line 36, after "dry" insert -- soap --.

Signed and sealed this 11th day of December 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents