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AUTOMATIC TRANSMISSION FLUID

Edward G. Foehr, San Rafael, Calif., assignor to California Research Corporation, San Francisco, Calif., a corporation of Delaware

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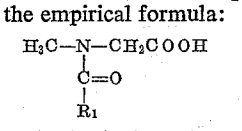
This invention relates to power transmission fluids. Specifically, this invention concerns transmission fluids containing N-acylsarcosines which give improved friction control characteristics in automatic power transmission systems.

Fluids for use in automatic power transmissions must be carefully designed to meet a variety of requirements. The majority of types of automatic transmissions contain planetary gears which are actuated by vertical metal disks, known as "driven disks," which are alternated with vertically spaced "driving disks." The "driving disks" are faced with hard fibrous material, such as brake band material or compressed composition paper. All are immersed in a suitable transmission fluid. During the driving operation the fiber faced disks and the plain metal disks come intermittently into clutching contact with each other, and thus affect change in gear ratios corresponding to the various driving velocities. A transmission fluid is not fully satisfactory if it allows disks to grab or stick and then slip with perceptible vibration of the transmission. This phenomenon is called "squawking" or "chattering." If, however, the transmission fluid is too "oily" the disks will slip upon clutching causing excessive engine speeds or "flaring" which in turn cause an automatic upshift of gears and a jerking motion of the car.

Prior art friction control agents have in some instances consisted of compositions obtained by reaction of unsaturated compounds with elemental sulfur. These compounds generally have been unsatisfactory, since they have a detrimental effect upon the other types of additives which may be present in the transmission fluid. Other known prior art friction control additives have decomposed or lost their friction control properties within a short time.

It has now been discovered that N-acylsarcosines possess outstanding properties which are considered desirable for friction control in modern automatic power transmissions. When added to an automatic transmission base fluid they eliminate both "squawk" (or "chattering") and "flaring" in the automatic power transmissions.

The N-acylsarcosine derivatives of the present invention are illustrated by the empirical formula:



wherein R_1 represents the hydrocarbon group of an aliphatic carboxylic acid of about from 12 to 24 carbon atoms in the carboxylic acid residue. Saturated and unsaturated acyl groups of 12 to 20 carbon atoms are preferred. These include, among others, the acyl groups of dodecene, tridecene, tetradecene, pentadecene, hexadecene, heptadecenes, octa- and nonadecene moiety, as well as the eicosenoic homologues and the corresponding alkanoic acids. Acyl groups derived from acids such as lauric, palmitoleic and oleic are included. Acyl groups derived from oleic acid are preferred.

In accordance with this invention power transmission fluids are provided having a viscosity within the range from about 75 to 1000 SSU at 100° F. and from about 35 to 750 SSU at 210° F. The base oils are light lubricating oils and ordinarily have a viscosity of about 50 to 400 SSU at 100° F. The base oil is a lubricating oil fraction of petroleum either naphthenic or paraffinic base, unrefined, acid refined or solvent refined as required in the particular lubricating need. Synthetic oils may also be used as base stock.

In the exemplification of compositions according to the invention, three base oils are used in preparing the blended base fluids. Base oil A is a blend of California paraffinic and naphthenic oils having a viscosity at 100° F. of 107.6 SSU and a viscosity at 210° F. of 39.7 SSU. Base oil B is a blend of Mid-Continent paraffinic and California naphthenic oils having a viscosity at 100° F. of 109.0 SSU and a viscosity at 210° F. of 39.8 SSU. Base oil C is a blend of California paraffinic and naphthenic oils having a viscosity at 100° F. of 94.0 SSU and a viscosity at 210° F. of 39.0 SSU.

The typical supplementary additives used in these fluids for the purpose of illustration have the following chemical compositions:

CONSTITUENT R

Mixed oil-soluble polymerized alkyl methacrylates having an average of 12 carbon atoms in the alkyl chain and a molecular weight of about 220,000.

CONSTITUENT S

Oil-soluble copolymer comprised of monomeric constituents of alkyl methacrylate and vinyl pyrrolidone having a molecular weight of about 220,000 having mixed higher alkyl radicals in the alkyl chain.

CONSTITUENT U

Oil-soluble mixture of: (1) condensate of chlorinated paraffin wax and naphthalene having a molecular weight of 1500–3000, and (2) polymerized alkyl fumarate having 12–14 carbon atoms in the alkyl groups and a molecular weight of about 3000–8000. The ratio of the two components of the mixture is 1:1.

CONSTITUENT T

Oil-soluble polyisobutylene having a molecular weight of about 220,000.

CONSTITUENT K

Oil-soluble basic calcium petroleum sulfonate having a ratio of basic to neutral calcium of about 7.3:1, and molecular weight of about 400.

CONSTITUENT N

Oil-soluble reaction product of N-methylpiperazine with quadripolymer comprised of monomeric constituents of dodecyl methacrylate, octadecyl methacrylate, polyethylene glycol methacrylate and glycidyl methacrylate in a molar ratio of about 33/17/1/1, wherein the polyethylene glycol has a molecular weight from 500 to 2500 and the molecular weight of the polymer is from 100,000 to 300,000.

The Constituent R, Constituent S, Constituent T and Constituent N are added to the oil to improve the Viscosity Index. Constituent N and Constituent S are also added to improve detergency. Constituent U reduces the pour point of the fluid. Constituent K is basic and neutralizes acids formed in base fluid. Di-tert-butyl-p-cresol and phenyl-α-naphthylamine are oxidation inhibitors. The dimethylsilicone polymer is a foam inhibitor.

The following listed compositions illustrate the finished automatic transmission fluids in which the compounded base fluids are:

(D) Oil A containing—

Constituent K, millimoles per kilogram		58.5
Constituent S	percent	3.0
Constituent T	do	3.5
Di-tert-butyl-p-cresol	do	0.4
Constituent U	do	0.2
Dimethylsilicone polymer	do	0.001

(E) Oil B containing—

Constituent K, millimoles per kilogram	53.0
Constituent N ——percent	2.0
Constituent T ——do	4.75
Di-tert-butyl-p-cresol ——do	0.4
Constituent U ——do	0.2
Dimethylsilicone polymer ——do	0.001

(F) Oil C containing—

Constituent K, millimoles per kilogram	58.5
Constituent S ——percent	3.0
Constituent T ——do	3.6
Di-tert-butyl-p-cresol ——do	0.4
Dimethylsilicone polymer ——do	0.001

(G) Oil B containing—

Constituent K, millimoles per kilogram	105.0
Constituent T ——percent	6.2
Constituent R ——do	1.0
Di-tert-butyl-p-cresol ——do	0.3
Phenyl-α-naphthylamine ——do	0.2
Constituent U ——do	0.2
Dimethylsilicone polymer ——do	0.001

The particular additives and the base oil can be combined in a variety of weight ratios with respect to each other. For instance, the ratio of Constituent K may vary from 10 to 250 millimoles per kilogram of the base oil; Constituent N and Constituent S may vary from 1.0 to 15% by weight of base oil; Constituent T may vary from 1.0 to 15% by weight of base oil; Constituent U may vary from 0.1 to 1.0% by weight of the base oil; di-tert-butyl-p-cresol may vary from 0.1 to 1.0% by weight of the base oil; phenyl-α-naphthylamine may vary from 0.1 to 1% by weight of base oil; dimethylsilicone may vary from 0.0008 to 0.01% by weight of the base oil. The amount of N-acylsarcosines in the transmission fluid may vary from 0.10% to .75% based on weight of the compounded fluid, an amount from 0.15 to 0.30% is preferred.

Table I presents data showing the sliding friction properties of compositions of this invention. In the examples the letters A, D, etc. refer to the above-described compositions. The fluids with the additive have been compared with a hydrocarbon oil which is a mixed base stock having about 20% of solvent refined paraffinic oil of Western origin having a V.I. (Viscosity Index) of 92 and a viscosity of 150 SSU at 100° F. and 80% solvent refined and acid treated oil of Western origin having a V.I. of about 50 and a viscosity of 80 SSU at 100° F. and containing no additives.

method is similar with minor variations to the method described by Haviland et al., Lubrication Engineering, vol. 17, No. 3, pp. 110–117, March 1961. As hereinafter disclosed, the test results correlate with results obtained in standard test transmissions under test driving conditions.

Experience has shown that in an acceptable fluid the coefficient of friction for each fluid must decrease as the rubbing speed decreases at any given temperature. The coefficient of friction is determined at the velocity and temperature conditions set forth in the table. The coefficient of friction should not exceed about 0.18 at low rubbing speeds or grabbing and "squawk" will occur. At the same time the coefficient of friction should be greater than about 0.06 or slipping and "flare" will occur. It has now been found that the particular N-acylsarcosines have coefficients of friction above about 0.06. The coefficients of friction are also below about 0.18. The designation "f.p.m." signifies feet per minute.

The last example shows compounded fluid G to be unacceptable without the N-acylsarcosines of the invention because of the reverse trend of the coefficient of friction.

The friction properties of the novel fluids are superior to those of hydrocarbon oil by reason of the reverse coefficients of friction at low temperatures. The transmission fluids containing the N-acylsarcosines of the invention possess temperature-velocity-coefficient of friction variables which are satisfactory for use in automatic transmissions.

The outstanding N-acylsarcosines of this invention were evaluated according to the commercially accepted standard tests which correspond to actual driving conditions encountered on the road. The test procedure was conducted by following the Durability Test specified by General Motors Corporation, Type A Suffix A Test for automatic transmission fluids. Briefly, according to this procedure a certain model power transmission unit of an Oldsmobile car driven by an Oldsmobile engine is employed. This power transmission unit goes through a maximum throttle acceleration to 4500 r.p.m. and is then allowed to go to idle operating conditions. This cycle is repeated 2400 times. The "squawk" or "chatter" phenomenon is determined by the audible noise and the vibrational characteristics of the power transmission unit. The engine "flare" is determined by the monitored engine characteristics. During and at the end of the test an acceptable fluid does not exhibit either "squawk"

Table I

FRICTIONAL CHARACTERISTICS OF N-OLEYLSARCOSINE

Example	Base Fluid	Friction Control Agent	Conc., Percent	Temp., ° F.	Sliding Coeff. of Friction At—			
					0 f.p.m.	5 f.p.m.	10 f.p.m.	15 f.p.m.
1	Hydrocarbon	None		75	0.181	0.178	0.179	0.174
				176	0.192	0.160	0.160	0.160
				300	0.230	0.177	0.162	0.158
2	D	N-oleylsarcosine	0.20	75	0.14	0.166	0.175	0.176
				175	0.09	0.131	0.141	0.144
				300	0.08	0.127	0.128	0.129
3	F	do	0.20	75	0.15	0.175	0.182	0.183
				175	0.08	0.130	0.140	0.146
				300	0.12	0.132	0.132	0.132
4	G	None		75	0.210	0.178	0.180	0.175
				176	0.178	0.160	0.160	0.160
				300	0.164	0.177	0.162	0.159

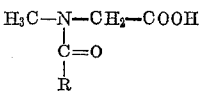
The data in Table I were obtained by taking a piece of the commercial clutch plate facing (a combination of cork and composition paper) and testing it under the temperature velocity conditions in a low load friction apparatus. The apparatus consists of rotating steel disks of the type found in automatic transmissions. The fluid tested surrounds the disk while the clutch facing material is held against the disk by a constant load. This test or "flare" phenomenon. According to this test, the compounded fluids with N-acylsarcosines performed outstandingly, meeting all the imposed requirements.

All percentages in the specification and claims are by weight. Amounts of the N-acylsarcosine are by weight of the base fluid, unless otherwise indicated.

I claim:

1. A power transmission fluid having a viscosity of

from about 75 to 1000 SSU at 100° F., consisting essentially of a major proportion of a mineral lubricating oil base having a viscosity of from 50 to 400 SSU at 100° F. and from 0.10% to 0.75% by weight of N-acylsarcosine of the general formula:



in which R represents an aliphatic hydrocarbon radical containing from 11 to 23 carbon atoms, wherein said mineral lubricating oil base contains

(*a*) from 1.0 to 15% by weight of a polymeric viscosity index improver selected from the group consisting of

(1) mixed oil-soluble polymerized alkyl methacrylates having an average of 12 carbon atoms in the alkyl chain and a molecular weight of about 220,000, and

(2) oil-soluble polyisobutylene having a molecular weight of about 220,000;

(*b*) from 1.0 to 15% by weight of a polymeric detergent selected from the group consisting of

(1) an oil-soluble reaction product of N-methyl piperazine with a quadripolymer comprised of monomeric constituents of dodecyl methacrylate, octadecyl methacrylate, polyethylene glycol methacrylate and glycidyl methacrylate in a molar ratio of about 33/17/1/1, wherein the polyethylene glycol has a molecular weight of from 500 to 2500 and the molecular weight of the polymer is from 100,000 to 300,000, and

(2) an oil-soluble copolymer of alkyl methacrylate and vinyl pyrrolidone having a molecular weight of about 220,000 having mixed higher alkyl radicals in the alkyl chain;

(*c*) from 10 to 250 millimoles per kilogram of base oil of calcium petroleum sulfonate having a molecular weight of about 400;

(*d*) from 0.1 to 1.0% by weight of an oxidation inhibitor selected from the group consisting of phenyl-α-napthylamine and di(tertiary butyl)-p-cresol; and

(*e*) from 0.0003 to 0.01% by weight of a dimethyl silicone polymer foam inhibitor.

2. The power transmission fluid of claim 1, in which the N-acylsarcosine is N-oleylsarcosine.

3. The power transmission fluid of claim 1, in which the polymeric viscosity index improver is a mixed alkyl methacrylate polymer having an average of 12 carbon atoms in the carbon chain and a molecular weight of about 220,000.

4. The power transmission fluid of claim 1, wherein the polymeric detergent is an oil-soluble copolymer of alkyl methacrylate and vinyl pyrrolidone having a molecular weight of about 220,000 having mixed higher alkyl radicals in the alkyl chain.

5. The power transmission fluid of claim 1, in which the polymeric viscosity index improver is polyisobutylene having a molecular weight of about 220,000.

References Cited in the file of this patent

UNITED STATES PATENTS

2,681,891	Bos et al.	June 22, 1954
2,841,555	Lyons et al.	July 1, 1958
2,851,421	Manteuffel et al.	Sept. 9, 1958
2,961,404	Francis	Nov. 22, 1960
3,042,612	Roebuck et al.	July 3, 1962
3,112,232	Early et al.	Nov. 26, 1963

FOREIGN PATENTS

856,773	Germany	Nov. 24, 1952