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(54) **Oil composition for manual transmission.**

(57) The present invention provides an oil composition for manual transmissions in which (A) 80 to 90 parts by weight of a base oil having a viscosity of 1 to 50 cSt at 100°C is blended with, as essential ingredients, (B) 0.2 to 5 parts by weight of a sulfurized oil or a sulfurized ester, (C) 0.1 to 5 parts by weight of phosphorous ester, - (D) 0.2 to 5 parts by weight of zinc dithiophosphate, and (E) 2 to 5 parts by weight of a metallic detergent.

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Oil Composition for Manual Transmission

BACKGROUND OF THE INVENTION

(1) Field of the Invention

The present invention relates to an oil composition for manual transmissions which is used to lubricate manual transmissions [manual transmissions of FR (Front engine, Rear drive) automobiles and manual transaxle of FF (Front engine, Front drive) automobiles] of automobiles which include passenger cars, trucks, large-sized cars such as buses, and tractors.

(2) Description of the Prior Art

As a feeling of ride on passenger cars and large-sized cars is investigated and improved, much attention has been paid to "gear clashing" and "sticking" which take place in shifting gear by a manual transmission, which troubles have not been considered so far. The gear clashing generally occurs in a car which is running for a long distance, and in particular, it is often generated in the case that engine brakes are applied by shifting down abruptly at the time of a high-speed running, so as to reduce a speed of the car. If the gear clashing occurs in such a state, a gear change will not be performed smoothly, with the result that serious accidents will happen on occasion.

On the other hand, the sticking is also called "double gearing" and is a phenomenon which tends to occur in shifting gear at a low-speed running or at idling, and when the car is in the state of the sticking, the operation of a gear change is felt to be very heavy.

This fact makes it difficult that not only male drivers but also annually increasing female drivers drive the cars.

Heretofore, in the manual transmissions, there have been used gear oils in which a sulfur-phosphorus extreme pressure additive is blended, engine oils and automatic transmission fluids (ATF), but any of these substances are not so satisfactory as to solve the above mentioned problems.

SUMMARY OF THE INVENTION

The inventors of the present application have intensively conducted researches on problems of "gear clashing" and "sticking", and as a result, it has been found that these problems are attributable to a lubricating state in the synchromesh mechanism of a manual transmission, and in the end the present invention has now been completed. That is, when a coefficient of friction between synchronizer rings and gear cones is too low, sliding will occur therebetween and in consequece, the gear clashing will be perceptible. Inversely, when the friction coefficent therebetween is too high, the sticking will occur.

The friction between the synchronizer rings and the gear cones is naturally connected closely with a used lubricating oil. The present inventors have extensively studied with the intention of solving these problems by using a new lubricating oil, and they have found that the occurrence of the sticking can be prevented by lowering a static coefficient of friction or a dynamic coefficient of friction under low-speed conditions and that the occurrence of the gear clashing can be inhibited by heightening a dynamic frinction coefficient under high-speed conditions. On the basis of this finding, an epochal lubricating oil has been developed which satisfies the above requirements and which has all properties such as an extreme pressure character and a stability against oxidation that the oil for manual transmissions should possess.

That is, the present invention is directed to an oil composition for manual transmissions in which (A) 80 to 90 parts by weight of a base oil having a viscosity of 1 to 50 cSt at 100°C is blended with, as essential ingredients, (B) 0.2 to 5 parts by weight of a sulfurized oil or a sulfurized ester, (C) 0.1 to 5 parts by weight of phosphorous ester, (D) 0.2 to 5 parts by weight of zinc dithiophosphate, and (E) 2 to 5 parts by weight of a metallic detergent.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Fist, reference will be made to the respective ingredients used in a lubricating oil of the present invention.

A base oil (A) is a lubricating oil fraction of a mineral oil series, a synthesized lubricating oil or a mixture thereof. Examples of the synthesized lubricating oils include poly-α-olefins, olefin polymers, carboxylates of monovalent or polyvalent alcohols, polyethers, silicones, polyglycols, silicates, alkyl aromatic compounds, carbonates and hydrocarbon halides. Viscosities of these base oils at 100°C are within the range of 1 to 50 cSt, preferably 4 to 18 cSt.

Sulfurized oils and the sulfurized esters each of which is the essential ingredient (B) include sulfurized animal and vegetable oils as well as sulfurized fatty acid esters of synthesized oils. An amount of an ingredient (B) to be blended is within the range of 0.2 to 5 parts by weight, preferably 1 to 3 parts by weight.

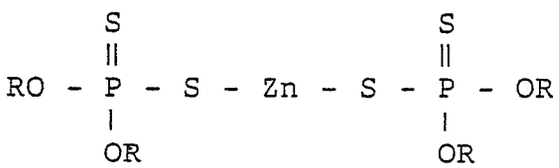
A phosphorous ester which is an essential ingredient (C) is a compound represented by the following general formula:

$(RO)_aP(OH)_b$

wherein a is a value of 1 to 3, preferably 2; b is a value of 0 to 2, preferably 1; and R is an alkyl group, an aryl group, an alkylaryl group having 3 to 25 carbon atoms, or a mixture thereof.

Concrete examples of the phosphorous esters include laurylhydrogen phosphite and oleylhydrogen phosphite. An amount of the phosphorous ester to be blended is within the range of 0.1 to 5 parts by weight, preferably 0.5 to 2 parts by weight.

A zinc dithiophosphate which is an essential ingredient (D) is a compound represented by the following general formula:



wherein R is an alkyl group, an aryl group, an alkylaryl group having 3 to 25 carbon atoms, or a mixture thereof.

Concrete examples of the zinc dithiophosphates include zinc diisopropyldithiophosphate, zinc di-2-ethylhexyldithiophosphate and zinc dinonylphenyldithiophosphate. An amount of the zinc dithiophosphate to be blended is within the range of 0.2 to 5 parts by weight, preferably 0.5 to 3 parts by weight.

Metallic detergents each of which is an essential ingredient (E) include sulfonates, phenates, salicylates and phosphonates, and examples of the metals for them include Ca, Ba, Mg and Na. An amount of the metallic detergent to be blended is within the range of 0.2 to 5 parts by weight, preferably 0.5 to 4 parts by weight.

In addition to the above mentioned ingredients, there may be employed a phenol series or an amine series antioxidant, a rust preventive, a pour point depressant such as a polymethacrylate and a viscosity index improver which are all used usually in the lubricating oil.

Now, the present invention will be described in detail in accordance with examples, but the latter does not intend to limit the scope of the present invention. Therefore, modifications and alterations of the present invention can be achieved in so far as they do not deviate from its purport.

Examples

Compositions I to IV were prepared, in the following proportions, from ingredients which correspond to essential ingredients (A) to (E) in the order of top to bottom of each composition. Values in the following compositions represent amounts of the respective ingredients in terms of "part by weight".

Composition I

Paraffinic mineral oil (10 cSt at 100°C)	92.5
Sulfurized lard (S = 9.5%)	2
Dioleylhydrogen phosphite	1.5
Zinc di-2-ethylhexyldithiophosphate	2
Mg sulfonate (TBN 400)	2

Composition II

Paraffinic mineral oil (10 cSt at 100°C)	92.5
Sulfurized rice bran oil (S = 10%)	2
Dilaurylhydrogen phosphite	1
Zinc diisopropyldithiophosphate	1.5
Ca salicylate (TBN 160)	3

Composition III

Poly-α-olefin (12 cSt at 100°C)	91.5
Sulfurized rape oil (S = 12%)	2
Dibehenylhydrogen phosphite	2
Zinc dinonylphenyldithiophosphate	2.5
Ca sulfonate (TBN 300)	2

Composition IV

Hindered ester (11 cSt at 100°C)	90.5
Sulfurized lauryl oleate (S = 10%)	3
Dinonylphenylhydrogen phosphite	1.5
Zinc diisostearyldithiophosphate	2.5
Ca phenate (TBN 300)	2.5

For the respective compositions above, coefficients of frinction were measured in accordance with the following test procedure. The results are compared with those of commercially available products in Table 1.

Measurement of frinction coefficent between synchonizer rings and gear cones:

A manual transmission was put on a test stand, and measurement was then carried out under the following conditions:

High-speed conditions (1): At an input revolutional speed of 4,000 rpm at a lever-pressing load of 4 kgf and at an oil temperature of 70°C, a gear change cycle of passing through neutral and four gear positions was repeaded 50,000 times, and the friction coefficient at this point of time was measured.

Low-speed conditions (2): At an input revolutional speed of 300 rpm at a lever-pressing load of 4 kgf and at an oil temperature of 70°C, a gear change cycle of passing through neutral and one gear position was repeaded 100 times, and the friction coefficient at this point of time was measured.

Table 1 Measurment results of friction coefficent.

	Example				Comparative Example		
	I	II	III	IV	Gear Oil (SAE80W)	Engine Oil (10W/30)	ATF (DexronII)
Conditions (1)	0.10	0.09	0.10	0.09	0.06	0.10	0.06
Conditions (2)	0.12	0.11	0.11	0.12	0.14	0.15	0.15

As is definite from the results set forth in Table 1, the compositions I to IV of the present invention have the excellent properties that the dynamic frinction coefficients under the high-speed conditions (1) are high and the dynamic frinction coefficients under the low-speed conditions (2) are low, and it can thus be appreciated that the compositions of the present invention are desirable as the oils for manual transmissions.

In contrast, the commercially available gear oil, engine oil and ATF are fairly inferior to the compositions of the present invention in frictional properties, and it can be understood that they are not preferable as the oils for manual transmissions.

The functional effects provided by the present invention can be enumerated as follows:

(a) In shifting gear, any sticking and any gear clashing do not occur, and thus a feeling of the car ride is improved, with the result that a comfortable drive can be enjoyed.

(b) In running at a high speed, shifting down can be carried out smoothly, which fact contributes to the prevention of accidents.

(c) Usually, the gear clashing occurs by the contact between chamfers of a gear and a sleeve, and if this contact is often made, the chamfers will be worn away, and in consequence, a life of the manual transmission will be shortened. However, according to the present invention, such an undesirable phenomenon can be prevented.

Claims

1. An oil composition for manual transmissions in which

(A) 80 to 90 parts by weight of a base oil having a viscosity of 1 to 50 cSt at 100°C is blended with, as essential ingredients,

(B) 0.2 to 5 parts by weight of a sulfurized oil or a sulfurized ester,

(C) 0.1 to 5 parts by weight of a phosphorous ester,

(D) 0.2 to 5 parts by weight of zinc dithiophosphate, and

(E) 2 to 5 parts by weight of a metallic detergent.

2. An oil composition for manual transmissions according to Claim 1 wherein said base oil is selected from the group consisting of lubricating oil fractions of mineral oil series, synthesized lubricating oils and mixtures thereof.

3. An oil composition for manual transmissions according to Claim 1 wherein said sulfurized oil or sulfurized ester is selected from the group consisting of sulfurized animal and vegetable oils as well as sulfurized fatty acid esters of synthesized oils.

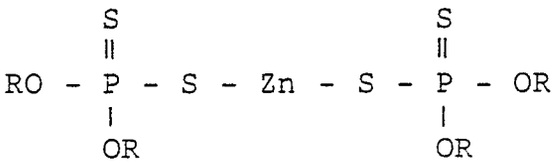
4. An oil composition for manual transmissions according to Claim 1 wherein said phosphorous ester is a compound represented by the following general formula:

$(RO)_aP(OH)_b$

wherein a is a value of 1 to 3, preferably 2; b is a value of 0 to 2, preferably 1; and R is an alkyl group, an aryl group, an alkylaryl group having 3 to 25 carbon atoms, or a mixture thereof.

5. An oil composition for manual transmissions according to Claim 4 wherein said phosphorous ester is selected from the group consisting of laurylhydrogen phosphites and oleylhydrogen phosphites.

6. An oil composition for manual transmissions according to Claim 1 wherein said zinc dithiophosphate is a compound represented by the following general formula:



wherein R is an alkyl group, an aryl group, an alkylaryl group having 3 to 25 carbon atoms, or a mixture thereof.

7. An oil composition for manual transmissions according to Claim 6 wherein said zinc dithiophosphate is selected from the group consisting of zinc diisopropyldithiophosphate, zinc di-2-ethylhexyldithiophosphate and zinc dinonylphenyldithiophosphate.

8. An oil composition for manual transmissions according to Claim 1 wherein said metallic detergent is selected from the group consisting of sulfonates, phenates, salicylates and phosphonates, and a metal is selected from the group consisting of Ca, Ba, Mg and Na.