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(56) References cited :
BE-A- 829 962
DE-A- 1 644 978
DE-A- 2 147 416
DE-C- 939 045
DE-C- 2 457 097
DE-C- 2 724 193
FR-A- 1 233 918
FR-A- 2 158 523
US-A- 2 998 389
Methoden der Organischen Chemie, Houben-Weil, Band VI/2 (1963), pages 212-212 and 214, 218

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EP 0 129 240 B2

Description

The present invention relates to liquid compositions that are suited a hydraulic fluids for the transmission of power, particularly as hydraulic brake fluids, and which may contain boron, and consist of mixtures of glycols, glycolethers of various molecular weights and, optionally, boric glycolesters.

The braking systems of motor vehicles represent an important safety element, and the efficient performance of the brakes is, to a large extent, determined by the characteristics of the hydraulic fluids used in said braking systems. Therefore. according to current regulations, said fluids have to meet very strict requirements as to e.g. boiling point, viscosity at hign and low temperatures, the pH value, the stability at low and high temperatures, corroding effect on metals and swelling action on rubbers.

Among the requirements just mentioned, particularly decisive for the question of whether a fluid is suitable for use as a brake fluid or not are the boiling point at total reflux after humidification (WET PERT) and the viscosity at low temperatures.

Said characteristics are closely related to the hygroscopicity of the fluids in question.

In fact, it is known that the affinity for water not only manifests itself in the absorption of water from a humid gaseous surrounding (atmosphere), but also in the strength of the intramolecular bonds which affect the value of the total reflux boiling temperature at atmospheric pressure (PERT) and the viscosity at low temperatures.

The gradual absorption of moisture by the brake fluids, however this may occur, leads to a gradual lowering of the boiling point. This lowering of the boiling point makes the brake fluid less reliable for use in brakes, since modern motor vehicles develop a considerable amount of friction heat which may cause the boiling of the brake fluid, with a resulting formation of a vapor phase which impairs the compressibility of the fluid necessary for achieving the power transmission.

Occurrence of such a phenomenon is unavoidable in the long run, whatever the fluid may be, and makes said fluid unsuitable for use. An effective remedy for this is the periodical change of the fluid for the braking system.

However, since this is after all a not too simple ooeration, and at any rate a somewhat expensive one, it would be desirable, the principle of the periodical change of the braking fluid still remaining valid. to have available a brake fluid having the characteristic of reducing the harmful effect of the absorbtion of water, thereby proionging the period of operation under conditions of full suitability.

The hydraulic brake fluids normally used must meet all FMVSS 116, DOT-3 and DOT-4 (i.e.: Federal Motor-Vehicle Safety Standard-Department of Transportation) and SAE J 1703 (Society of Automotive Engineers N.Y.) standards.

The brake fluids belonging to the classes DOT-3 and DOT-4 have the following characteristics:

	DOT-3	DOT-4
Boiling point (in the dry state) PERT	min. 205°C	min. 230°C
Boiling point (in the wet state) WET PERT	min. 140°C	min. 155°C
Viscosity at −40°C	max. 1500 mm^2/s (cSt)	max. 1800 mm^2/s (cSt)

It is known from the patent and scientific literature of the last decades that almost all hydraulic brake fluids consist of a mixture of alcohols, glycols, glycolethers, polyglycols, polyglycolethers and derivatives thereof.

For instance, FR-A-2 158 523 describes liquid compositions for brakes belonging to the class DOT-4, consisting of mixtures of tetraethylene glycol, other glycols and lower glycolethers. Said compositions possess a WET PERT slightly greater than 155°C (max. 156.5°C in Example 2). and high viscosity values at low temperatures, due to the presence of tetraethylene glycol (1590 mm^2/s (cSt) at -40°C in Example 1).

It is quite obvious that a too high viscosity at low temperatures is an unfavourabie property for use in hydraulic brakes.

Numerous studies were carried out in the attempt of obtaining brake fluids having always a high WET PERT, greater than 155°C, but being of a low viscosity at -40°C. not greater than 1500 mm^2/s (cSt).

Said liquids named DOT-3/DOT-4 have been found in the boric esters of the glycols, and more particularly in the products of the partial or total esterification with boric acid of one or more of the components of the traditional formulations based on alcohols, glycols, glycolethers, polyglycols and polyglycolethers.

DE-C-939045 discloses the use of boric esters of mono- or polyvalent alcohols, alkanol amines or thiopolyglycols as additive for hydraulic fluids based on glycols. Said boric esters are used in amounts of 5 to 15% by weight and are supposed to improve the lubrication provided by said hydraulic fluids.

US-A-3 625 899 describes hydraulic brake fluids consisting of mixtures of at least one boric ester of an etherified glycol, of a polyglycol and a monoether or diether glycol.

In the steps of this patent different streams or currents of research were followed. which differ from each other in the way of emphasizing a particular type of boron ester, but all of them having in common that in order to make the composition fall within the DOT-4 class, the presence of boron in the composition, in concentrations greater than a certain minimum value, is necessary.

In said compositions part of the absorbed water is removed by hydrolysis reactions of the ester, the resulting boric acid showing the undesired tendency to precipitate.

Moreover, the organoborates used in the process have the drawback of either causing the swelling of the rubber (esters of etherified glycols) or resulting in high viscosities (esters of glycols). At any rate, they unavoiaaoiy cause higher costs in comparison to the traditional formulations.

For this reason the formulations containing organoborates have not met wide acceptance on the market so far. Thus. there is the need for a brake fluid that may be a DOT-4 also in the absence of boron and, more in general, that shall have superior characteristics of resistance to moisture also in the presence of only slight quantities of boric esters.

Thus it is one object of the present invention to provide compositions suited for use as hydraulic fluids which, though not containing boron compounds, possess WET PERT greater than 155°C and viscosities at -40°C below 1500 mm^2/s (cSt), that is, fluids belonging to the classes DOT-3 (as regards the viscosity) and DOT-4 (as regards the WET PERT) at the same time.

Still another object of this invention is to provide compositions containing boric esters which, at the same boron content, have WET PERT values greater than those of the compositions of the prior art.

A further object of the present invention is to provide brake fluids which meet all the DOT-3 and DOT4 specifications; more particularly such which meet the non-aggressiveness standards towards rubber and the metals present in the braking system.

This invention refers to boron containing a hydraulic fluid containing a glycol, a light ether of a glycol and a heavy ether of a glycol, characterized in that:

- said glycol is selected from diethylene glycol and triethylene glycol, the amount thereof ranging from 2 to 25% by weight;
- said light ether is the monoalkyl ether of diethylene glycol or triethylene glycol, the amount thereof ranging from 40 to 60% by weight and the alkyl group of the ether containing from 1 to 4 C-atoms;
- said heavy ether is the monoalkylether of a polyoxyalkylene glycol of the general formula

$$R\{OCHR'\text{-}CH_2\}_n OH$$

wherein

R is a C_1-C_4 alkyl group;

R′ is H or CH_3 and

n is an integer, said heavy ether having an average molecular weight of from 208 to 600, and the amount thereof ranging from 15 to 35% by weight; and

the boron containing compound is obtained by reacting H_3BO_3 with diethyleneglycol and wherein the amount of said compound is ranging from 3 to 24% by weight, all amounts based on the total weight of the fluid.

A preferred light ether is triethylene glycol monoethylether and preferred heavy ethers are those wherein R′=H in the general formula.

According to a particularly preferred embodiment the heavy ether is selected from the monomethylether of tetraethylene glycol, the monomethylether of pentaethylene glycol, the methyl or butyl ether of a polyoxyalkylene glycol (having a molecular weight substantially equal to or lower than 520 and containing both oxypropylene and oxyethylene monomeric units) and mixtures thereof. Whenever required, to the hydraulic fluids of the present invention there may be added additives for the purpose of boosting the performance of the braking fluids. The various possible types of additives comprise: buffering agents, corrosion inhibitors, antioxidants, substances increasing the protective power with respect to ferrous metals in a humid and oxidizing environment, stabilizers, dyestuffs.

In general the quantity of additives that may be incorporated into the hydraulic fluids varies from 0% to 10%, based on the total weight of the hydraulic fluids.

A preferred hydraulic fluid contains from 0 to 10% by weight, based on the total weight of the fluid, of an inhibitor consisting of a mixture of:

- dibutylamine;
- sodium nitrate; and
- a substance selected from bisphenol and polymerized 1,2-dihydro-2,2,4-trimethyl-quinoline.

The preparation of the boric esters is carried out at atmospheric pressure, preferably in the presence of an azeotropic solvent, or at a reduced pressure in the absence of a solvent, at temperatures between 50°C and 200°C.

According to a further embodiment of the present invention, the hydraulic fluid contains a glycol, a light ether of a glycol and a heavy ether of a glycol, but no boron, and is characterized in that

- said glycol is selected from diethylene glycol and triethylene glycol, the amount thereof ranging from 23 to 33% by weight;
- said light ether is the monomethylether of triethylene glycol, the amount thereof ranging from 20 to 45% by weight; and
- said heavy ether is the monomethylether of a polyoxyalkylene glycol of the general formula

$$CH_3\{OCHR'\text{-}CH_2\}_n OH$$

wherein

R′ is H or CH_3 and

n is an integer, said heavy ether having an average molecular weight of from 208 to 600 and the amount thereof ranging from 20 to 50% by weight, all amounts being based on the total weight of the fluid.

The liquid compositions obtained by means of the present invention display all a WET PERT greater than 155°C (lower limit of DOT-4 class), viscosity values at -40°C lower than 1500 mm^2/s (cSt) (upper limit of class DOT-3), and PERT values of about 250°C and above.

Moreover, they are characterized by an almost total lack of aggressiveness towards the various types of rubber and metals present in the braking systems, with a resulting considerable advantage as to the life times of said systems.

Moreover, they display all the properties typical for the traditional products of highest quality.

The formulation of the hydraulic fluids according to the present invention is accomplished by mixing together the individual components and additives in a mixer until achieving a thorough and complete homogenization. In general the mixing is carried out at atmospheric pressure, room temperature and, preferably, in the absence of humidity.

FR-A-1 233 918 discloses hydraulic fluids containing more than 20% by weight of a polyoxyalkylene having a molecular weight of >500, at least 35% by weight of an ether of diethylene glycol and at least 5% by weight of a glycol, an alcohol, a triethylene glycol ether or mixtures thereof. According to said patent a preferred molecular weight of the polyoxyalkylene which, among others, may be a monoether of a polyalkylene glycol, is 2000 to 6000.

In comparison thereto, in the hydraulic fluids of the present invention the molecular weight of the heavy ether may at the most be 600. This allows to reduce the amount of glycol to a minimum and at the same time to maintain a WET PERT which is considerably higher than that of the hydraulic fluids of the prior art.

The present invention is further illustrated by the following examples.

Example 1

A braking fluid was prepared by mixing together the following components:

	% by weight
diethylene glycol	30.00
triethylene glycol monomethylether	33.20
tetraethylene glycol monomethylether	27.20
pentaethylene glycol monomethylether	9.00
bisphenol	0.28
dibutylamine	0.30
sodium nitrate	0.02
Total	100.00

This braking fluid possesses the following properties:

boiling point at total reflux (PERT)	250°C
boiling point after wetting (WET PERT)	161°C
viscosity at −40°C	1276 mm^2/s (cSt)
viscosity at +100°C	2.1 mm^2/s (cSt)
vapor lock temperature (VLT)	>250°C
vapor lock temperature +0.5% H_2O	223°C
pH	10.7
stability at high temperature	test passed
chemical stability	test passed
corrosion (variation in weight in mg/cm^2):	
tinned iron	−0.01
steel	−0.01
aluminum	−0.01
cast iron	+0.06
copper	−0.10
brass	−0.13
fluidity and other properties at low temperature:	
6 days at −40°C	test passed
6 hours at −50°C	test passed
tolerance to water	test passed
evaporation (% weight/weight of evaporated substance)	77
compatibility	test passed
resistance to oxidization (variation in weight mg/cm^2):	
cast iron	+0.01
aluminum	−0.01
effect on the rubber	test passed
simulated service test	test passed

(Note: The determinations of the properties indicated above as well as those of the following examples, were carried out according to SAE J 1703, FMVSS 116 and CUNA NC 956-01 standards).

For comparative purposes Example 1 of FR-A-2 158 523, relating to the preparation of a mixture of the following composition, was repeated:

	Parts
tetraethylene glycol	30.0
triethylene glycol monomethylether	55.0
diethylene glycol	15.0
dibutylamine	0.3
'Age Rite Resin D' (*)	0.1
sodium nitrate	0.02
Total	100.42

(*) polymerized 1,2-dihydro-2,2,4-trimethyl-quinoline

On the fluid thus obtained the following properties were determined:

boiling point at total reflux	248°C
boiling point after humidification	156.5°C
viscosity at −40°C	1585 mm^2/s (cSt)

Example 2

A hydraulic fluid was prepared by mixing together the following components:

triethylene glycol	30.0%
triethylene glycol monomethylether	33.0%
tetraethylene glycol monomethylether	33.0%
pentaethylene glycol monomethylether	4.0%
Total	100.00%

This fluid showed the following properties:

boiling point at total reflux	266°C
boiling point after humidification	159°C
viscosity at −40°C	1192 mm^2/s (cSt)
fluidity and other properties at low temperatures	test passed

Example 3

A hydraulic fluid was prepared by mixing together the following components:

diethylene glycol	25.0%
triethylene glycol monomethylether	30.0%
tetraethylene glycol monomethylether	16.0%
pentamethylene glycol monomethylether	2.0%
methoxypolyalkylene glycol of an average molecular weight (MW) of about 270, obtained by condensating a mixture of propylene oxide and ethylene oxide in a proportion of 60/40 p/p with triethylene glycol monomethylether	27.0%
Total	100.00%

This fluid showed the following properties:

boiling point at total reflux	249°C
boiling point after humidification	158°C
viscosity at −40°C	1178 mm^2/s (cSt)
vapor lock temperature	>250°C
vapor lock temperature +0.5% H_2O	219°C
evaporation (% p/p)	65

Example 4

A hydraulic brake fluid was prepared by mixing the following components:

diethylene glycol	30.0%
triethylene glycol monomethylether	30.0%
tetraethylene glycol monomethylether	40.0%
Total	100.00%

This fluid showed the following properties:

boiling point at total reflux	246°C
boiling point after humidification	160°C
viscosity at −40°C	1264 mm^2/s (cSt)
fluidity and other properties at low temperature	test passed
evaporation (% parts of evaporated substance)	75

Example 5

A hydraulic fluid was prepared by mixing together the following components:

diethylene glycol	30.0%
triethylene glycol	43.0%
methoxypolyalkylene glycol of an average M.W. of about 270, obtained by condensing a mixture of propylene oxide and ethylene oxide in a 60/40 p/p with triethylene glycol monomethylether	27.0%
Total	100.00%

This fluid showed the following properties:

boiling point at total reflux	246°C
boiling point after humidification	159°C
viscosity at −40°C	1227 mm^2/s (cSt)
vapor lock temperature	>250°C
vapor lock temperature +0.5% H_2O	219°C
fluidity and other properties at low temperature	test passed

Example 6

A hydraulic fluid was prepared, containing 0.1% of boron, by mixing together the following components:

	weight %
diethylene glycol	22.00
triethylene glycol monomethylether	47.58
methoxypolyalkylene glycol of an average molecular weight of about 270, obtained by condensing a mixture of propylene and ethylene oxides at 60/40 p/p with triethylene glycol monomethylether	27.00
reaction production of H_3BO_3 with diethylene glycol (molar ratio: 1:3)	3.00
dibutylamine	0.30
Age Rite Resin D (*)	0.10
Sodium nitrate	0.02
Total	100.00

(*) cf Example 1

The fluid showed the following properties:

boiling point at total reflux	249°C
boiling point after humidification	161°C
viscosity at −40°C	1146 mm^2/s (cSt)

For comparative purposes there was prepared a fluid like the one described in Example 3 of FR-A-2 158 524, containing an equivalent quantity of boron (about 0.1%) and consisting of:

	parts
tetraethylene glycol	37.2
triethylene glycol monobutylether	20.0
triethylene glycol monomethylether	37.8
the reaction product of H_3BO_3 with tetraethylene glycol (molar ratio: 1/3)	5.0
Age Rite Resin D	0.1
Sodium nitrate	0.02
Total	100.00

On the fluid thus obtained the following properties were determined:

boiling point at total reflux	246°C
boiling point after humidification	156°C
viscosity at −40°C	1360 mm^2/s (cSt)

Example 7

A hydraulic fluid, containing 0.46% of boron, was prepared by mixing together the following components:

diethylene glycol	8.2%
triethylene glycol monomethylether	53.0%
tetraethylene glycol monomethylether	20.0%
butoxypolyalkylene glycol with a molecular weight of about 330, obtained by condensing a mixture of propylene and ethylene oxides at 50/50 p/p with n-butanol	5.0%
reaction product of H_3BO_3 with diethyleneglycol (molar ratio: 1/3)	13.8%
Total	100.00%

This fluid showed the following properties:

boiling point at total reflux	252°C
boiling point after humidification	167°C
viscosity at −40°C	1096 mm^2/s (cSt)

For comparative purposes there was prepared a fluid according to that of Example 1 of FR-A-2 158 522 containing an equal quantity of 0.46% boron and consisting of:

triethylene glycol monomethylether	75 parts
reaction product of H_3BO_3 with tetraethylene glycol (molar ratio: 1:3)	25 parts
	100 parts

On the fluid thus obtained the following properties were determined:

boiling point at total reflux	264°C
boiling point after humidification	159°C
viscosity at −40°C	1030 mm^2/s (cSt)

Example 8

A hydraulic fluid, containing 0.5% of boron, was prepared by mixing together the following components:

diethylene glycol	8.0%
triethylene glycol monomethylether	52.0%
tetraethylene glycol monomethylether	20.0%
pentaethylene glycol monomethylether	5.0%
reaction product of H_3BO_3 with diethylene glycol (molar ratio=1:3)	15.0%
Total	100.00%

This fluid showed the following properties:

boiling point at total reflux	253°C
boiling point after humidification	169°C
viscosity at −40°C	1143 mm^2/s (cSt)
evaporation (% weight/weight evaporated substance)	78

Example 9

A hydraulic fluid, containing 0.7% of boron, was prepared by mixing together the following components:

diethylene glycol	2.0%
triethylene glycol monomethylether	56.9%
tetraethylene glycol monomethylether	20.0%
production of the reaction between H_3BO_3 and diethylene glycol (molar ratio=1:3)	21.1%

This fluid showed the following properties:

boiling point at total reflux	250°C
boiling point after humidification	175°C
viscosity at −40°C	1409 mm^2/s (cSt)

Example 10

A hydraulic fluid, containing 0.46% of boron. was prepared by mixing together the following components:

diethylene glycol	7.2%
triethylene glycol monomethylether	54.0%
tetraethylene glycol monomethylether	20.0%
butoxypolyalkylene glycol having an average molecular weight of about 520, obtained by condensing a mixture of propylene oxide and ethylene oxide at 50/50 p/p with n-butanol	5.0%
a reaction product of H_3BO_3 with diethylene glycol (in a molar ratio of 1:3)	13.8%
Total	100.0%

This fluid showed the following properties:

boiling point at total reflux	252°C
boiling point after humidification	162°C
viscosity at −40°C	1096 mm^2/s (cSt)
fluidity and other properties at −50°C	test passed

Example 11

A hydraulic fluid, containing 0.43% boron, was prepared by mixing together the following components:

diethylene glycol	9.0%
triethylene glycol monomethylether	53.04%
butoxypolyalkyleneglycol with a mean molecular weight of about 330, obtained by condensing a mixture of propylene and ethylene oxide at 50/50 p/p with n-butanol	5.00%
reaction product of H_3BO_3 with diethylene glycol (in a molar ratio of 1:3)	12.96%
Total	100.00%

This fluid showed the following properties:

boiling point at total reflux	249°C
boiling point after humidification	167°C
viscosity at −40°C	1092 mm^2/s (cSt)
fluidity and other properties at −50°C	test passed

For comparative purposes there was prepared a fluid like the one of Example 38 of US-A-3 711 410, containing 0.43% of boron, and consisting of the following basic components:

triethylene glycol monomethylether	75.01 parts
tetraethylene glycol monomethylether	4.70 parts
boric ester of triethylene glycol monomethylether	20.00 parts
Total	99.71 parts

This fluid showed the following properties:

boiling point at total reflux	243°C
boiling point after humidification	162°C
viscosity at −40°C	361 mm^2/s (cSt)

Claims

1. A boron containing hydraulic fluid containing a glycol, a light ether of a glycol and a heavy ether of a glycol, characterized in that:
   - said glycol is selected from diethylene glycol and triethylene glycol, the amount thereof ranging from 2 to 25% by weight;
   - said light ether is the monoalkyl ether of diethylene glycol or triethylene glycol, the amount thereof ranging from 40 to 60% by weight and the alkyl group of the ether containing from 1 to 4 C-atoms;
   - said heavy ether is the monoalkylether of a polyoxyalkylene glycol of the general formula

$$R\{OCHR'\text{-}CH_2\}_n OH$$

wherein

R is a C_1-C_4 alkyl group;

R′ is H or CH_3 and

n is an integer, said heavy ether having an average molecular weight of from 208 to 600, and the amount thereof ranging from 15 to 35% by weight; and

the boron containing compound is obtained by reacting H_3BO_3 with diethyleneglycol and wherein the amount of said compound is ranging from 3 to 24% by weight, all amounts based on the total weight of the fluid.

2. A hydraulic fluid according to claim 1, wherein said heavy ether is selected from the monomethylether of tetraethyleneglycol, the monomethylether of pentaethyleneglycol, the methyl or butyl ether of a polyoxyalkyleneglycol (having a molecular weight substantially equal to or lower than 520 and containing both oxypropylene and oxyethylene monomeric units) and mixtures thereof.

3. A hydraulic fluid according to any of claims 1 to 2, also containing from 0 to 10% by weight, based on the total weight of the fluid, of an inhibitor consisting of a mixture of:
   - dibutylamine;
   - sodium nitrate; and
   - a substance selected from bisphenol and polymerized 1,2-dihydro-2,2,4-trimethyl-quinoline.

4. A hydraulic fluid containing a glycol, a light ether of a glycol and a heavy ether of a glycol, but no boron, characterized in that
   - said glycol is selected from diethylene glycol and triethylene glycol, the amount thereof ranging from 23 to 33% by weight;
   - said light ether is the monomethylether of triethylene glycol, the amount thereof ranging from 20 to 45% by weight; and
   - said heavy ether is the monomethylether of a polyoxyalkylene glycol of the general formula

$$CH_3\{OCHR'\text{-}CH_2\}_n OH$$

wherein

R′ is H or CH_3 and

n is an integer. said heavy ether having an average molecular weight of from 208 to 600 and the amount thereof ranging from 20 to 50% by weight, all amounts being based on the total weight of the fluid.

Patentansprüche

1. Eine borhaltige hydraulische Flüssigkeit, enthaltend ein Glykol, einen leichten Ether eines Glykols und einen schweren Ether eines Glykols, dadurch gekennzeichnet, daß
   - das Glykol ausgewählt ist aus Diethylenglykol und Triethylenglykol, wobei dessen Menge von 2 bis 25 Gew.-% beträgt;
   - der leichte Ether der Monoalkylether von Diethylenglykol oder Triethylenglykol ist, wobei dessen Menge von 40 bis 60 Gew.-% beträgt und die Alkylgruppe des Ethers 1 bis 4 C-Atome enthält;
   - der schwere Ether der Monoalkylether eines Polyoxyalkylenglykols der allgemeinen Formel

$$R\{OCHR'\text{-}CH_2\}_n OH$$

ist, worin

R eine C_1-C_4-Alkylgruppe ist,

R′ H oder CH_3 ist und

n eine ganze Zahl ist, wobei der schwere Ether ein durchschnittliches Molekulargewicht von 208 bis 600 hat und seine Menge von 15 bis 35 Gew.-% beträgt; und
   - die borhaltige Verbindung durch Umsetzung von H_3BO_3 mit Diethylenglykol erhalten wird und worin die Menge dieser Verbindung von 3 bis 24 Gew.-% beträgt,

wobei alle Mengen auf das Gesamtgewicht der Flüssigkeit bezogen sind.

2. Eine hydraulische Flüssigkeit nach Anspruch 1, worin der schwere Ether ausgewählt ist aus dem Monomethylether von Tetraethylenglykol, dem Monomethylether von Pentaethylenglykol, dem Methyl- oder Butylether eines Polyoxyalkylenglykols (mit einem Molekulargewicht im wesentlichen gleich oder niedriger als 520 und sowohl Oxypropylen- als auch Oxyethylenmonomer-Einheiten enthaltend) und Mischungen derselben.

3. Eine hydraulische Flüssigkeit nach irgendeinem der Ansprüche 1 bis 2, die weiterhin von 0 bis 10 Gew.-%, bezogen auf das Gesamtgewicht der Flüssigkeit, eines Inhibitors enthält, der aus einer Mischung aus
   - Dibutylamin;
   - Natriumnitrat; und
   - einer Substanz, ausgewählt aus Bisphenol und polymerisiertem 1,2-Dihydro-2,2,4-trimethyl-chinolin besteht.

4. Eine hydraulische Flüssigkeit, enthaltend ein Glykol, einen leichten Ether eines Glykols und einen schweren Ether eines Glykols, jedoch kein Bor, dadurch gekennzeichnet, daß
   - das Glykol ausgewählt ist aus Diethylenglykol und Triethylenglykol, wobei deren Menge von 23 bis 33 Gew.-% beträgt;
   - der leichte Ether der Monomethylether von Triethylenglykol ist, wobei dessen Menge von 20 bis 45 Gew.-% beträgt; und
   - der schwere Ether der Monomethylether eines Polyoxyalkylenglykols der allgemeinen Formel

$$CH_3\{OCHR'\text{-}CH_2\}_n\ OH$$

   ist, worin
   R′ H oder CH_3 ist und
   n eine ganze Zahl ist, wobei der schwere Ether ein durchschnittliches Molekulargewicht von 208 bis 600 hat und seine Menge von 20 bis 50 Gew.-% beträgt, wobei alle Menge auf das Gesamtgewicht der Flüssigkeit bezogen sind.

Revendications

1. Un fluide hydraulique contenant du bore et comprenant un glycol, un éther léger d'un glycol et un éther lourd d'un glycol, caractérisé en ce que:
   - ledit glycol consiste en diéthylène-glycol ou triéthylène-glycol, employé en une proportion de l'ordre de 2 à 25% en poids;
   - ledit éther léger est le monoalkyl-éther de diéthylène-glycol ou de triéthylène-glycol employé en une proportion de l'ordre de 40 à 60% en poids, le groupe alkyle de l'éther contenant de 1 à 4 atomes de carbone;
   - ledit éther lourd est le monoalkyl-éther d'un polyoxyalkylène-glycol de formule générale

$$R\text{-}(\text{-}OCHR'\text{-}CH_2\text{-})_n\text{-}OH$$

   dans laquelle
   R est un groupe alkyle C_1 à C_4,
   R′ est H ou CH_3 et
   n est un nombre entier,
   ledit éther lourd ayant un poids moléculaire moyen compris entre 208 et 600 et étant employé en une proportion de l'ordre de 15 à 35% en poids; et
   - le composé contenant du bore est obtenu par réaction de H_3BO_3 avec du diéthylèneglycol et la proportion dudit composé étant comprise entre 3 et 24% en poids,

   toutes ces proportions étant exprimées par rapport au poids total du fluide.

2. Un fluide hydraulique selon la revendication 1, caractérisé en ce que ledit éther lourd est choisi parmi le monométhyl-éther de tétraéthylène-glycol, le monométhyl-éther de pentaéthylène-glycol, le méthyl-éther ou butyl-éther d'un polyoxyalkylène-glycol (ayant un poids moléculaire sensiblement égal ou inférieur à 520 et contenant à la fois des unités monomères oxypropylèniques et oxyéthylèniques) ou des mélanges de ces constituants.

3. Un fluide hydraulique selon l'une des revendications 1 ou 2 contenant également de 0 à 10% en poids, par rapport au poids total du fluide, d'un inhibiteur consistant en un mélange de:
   - dibutylamine,
   - nitrate de sodium, et
   - un composé consistant en bisphénol ou 1,2-dihydro-2,2,4-triméthyl-quinoléine.

4. Un fluide hydraulique contenant un glycol, un éther léger d'un glycol et un éther lourd d'un glycol, mais ne contenant pas de bore, caractérisé en ce que:
   - ledit glycol consiste en diéthylène-glycol ou triéthylène-glycol, employé en une proportion de l'ordre

de 23 à 33% en poids;

- ledit éther léger est le monométhyl-éther de triéthylène-glycol employé en une proportion comprise entre 20 et 45% en poids; et
- ledit éther lourd est le monométhyl-éther d'un polyoxyalkylène-glycol de formule générale

$$CH_3\text{-}(\text{-}OCHR'\text{-}CH_2\text{-})_n\text{-}OH$$

dans laquelle

R′ est H ou CH_3 et

n est un nombre entier,

ledit éther lourd ayant un poids moléculaire moyen compris entre 208 et 600 et étant employé en une proportion de l'ordre de 20 à 50% en poids,

toutes ces proportions étant exprimées par rapport au poids total du fluide.