CONVENTION

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APPLICATION FOR A STANDARD PATENT 630401

The Dow Chemical Company
2030 Dow Center, Abbott Road, Midland, Michigan 48640, UNITED STATES OF AMERICA

hereby applies for the grant of a standard patent for an invention entitled:

LUBRICANTS FOR REFRIGERATION COMPRESSORS

which is described in the accompanying complete specification.

Details of basic application(s):-
295,612 UNITED STATES OF AMERICA 10 January 1989

Address for Service:

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DATED this NINTH day of JANUARY 1990

PHILLIPS ORMONDE & FITZPATRICK
Attorneys for:
The Dow Chemical Company

By:

Our Ref : 157770
POF Code: 1037/1037

6010

Dow Case No. 37,535-F bt

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Patent Declaration

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DECLARATION FOR A PATENT APPLICATION

INSTRUCTIONS
(a) Insert "Convention" if applicable
(b) Insert FULL name(s) of applicant(s)

In support of the (a) CONVENTION application made by (b) THE DOW CHEMICAL COMPANY
2030 Dow Center, Abbott Road
Midland, Michigan 48640, U.S.A.
(hereinafter called "applicant(s)") for a patent (c) for an invention entitled (d)

(c) Insert "of addition" if applicable
(d) Insert TITLE of invention

LUBRICANTS FOR REFRIGERATION COMPRESSORS

(e) Insert FULL name(s) AND address(es) of declarant(s) (See headnote*)

I/~~We~~ (e) Richard G. Waterman, General Patent Counsel
THE DOW CHEMICAL COMPANY
2030 Dow Center, Abbott Road
Midland, Michigan 48640, U.S.A.
do solemnly and sincerely declare as follows:

~~1. I am/We are the applicant(s).~~
(or, *in the case of an application by a body corporate*)
1. I am/~~We are~~ authorized to make this declaration on behalf of the applicant~~(s)~~.
~~2. I am/We are the actual inventor(s) of the invention.~~
(or, *where the applicant(s) is/are not the actual inventor(s)*)
2. (f)

(f) Insert FULL name(s) AND address(es) of actual inventor(s)

Philip W. McGraw, 57 Raintree Court, Lake Jackson, Texas 77566
United States of America

Eldon L. Ward, 1309 Clover, Angleton, Texas 77515
United States of America

(g) Recite how applicant(s) derive(s) title from actual inventor(s) (See headnote**)

~~is~~/are the actual inventor(s) of the invention and the facts upon which the applicant~~(s)~~ is/~~are~~ entitled to make the application are as follows:
(g) The applicant Company is the assignee of the said invention from the said actual inventor(s).

(Note: *Paragraphs 3 and 4 apply only to Convention applications*)

(h) Insert country, filing date and basic applicant(s) for the/or EACH basic application

3. The basic application(s) for patent or similar protection on which the application is based is/~~are~~ identified by country, filing date, and basic applicant(s) as follows:
(h)

United States of America filed on January 10, 1989, in the names of Philip W. McGraw and Eldon L. Ward

4. The basic application(s) referred to in paragraph 3 hereof was/~~were~~ the first application(s) made in a Convention country in respect of the invention the subject of the application.

(k) Insert PLACE of signing

(l) Insert DATE of signing

(m) Signature(s) of declarant(s)

CORP.
SEAL

Declared at (k) Midland, Michigan 48640, U.S.A.
Dated (l) 4 December 1989
(m) THE DOW CHEMICAL COMPANY
By: R S Waterman
RICHARD G. WATERMAN
General Patent Counsel

To: The Commissioner of Patents

Agent: Phillips, Ormonde & Fitzpatrick

Note No legalization or witness required.

(12) PATENT ABRIDGMENT (11) Document No. AU-B-47825/90
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LUBRICANTS FOR REFRIGERATION COMPRESSORS

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(56) Prior Art Documents
EP 227477
US 4302343

(57) Claim

1. A lubricant composition miscible in hydrofluorocarbon and hydrochlorofluorocarbon refrigerants in the range of from -20° to greater than 65°C and having a viscosity greater than 75 centistokes (75×10^{-6} m^2/s) at 38°C comprising:

(A) from 95 to 5 percent of a polyether polyol which has the formula

$$Z-\left[(CH_2-CH(R_1)-O-)_n-(CH_2-CH(CH_3)-O-)_m-R_2\right]_p$$

where

Z is the residue of a compound having from 1 to 8 active hydrogens,

R_1 is hydrogen, ethyl, or mixtures thereof,

n is 0 or a positive number,

m is a positive number,

n+m is a number having a value which will give a polyether polyol with a number average molecular weight range of from 400 to 5000,

.../2

R_2 is hydrogen or an alkyl group of from 1 to 6 carbon atoms,

p is an integer having a value equal to the the number of active hydrogens of Z, and

(B) from 5 to 95 percent of an ester selected from

(1) esters made from polyhydric alcohols with alkanoic acids, and

(2) esters made from alkanedioic acids with alkanols.

4. A fluid composition for use in compression refrigeration comprising

(A) a refrigerant selected from hydrochlorofluorocarbons and hydrofluorocarbons, and

(B) a lubricant composition as claimed in Claim 1 or Claim 2

9. A process for preparing a lubricant composition miscible in hydrofluorocarbon and hydrochlorofluorocarbon refrigerants in the range of from -20° to greater than 65°C and having a viscosity greater than 75 centistokes (75 x 10^{-6} m^2/s) at 38°C which comprises mixing :

(A) from 95 to 5 percent of a polyether polyol which has the formula

$$Z-\left[(CH_2-CH(R_1)-O-)_n-(CH_2-CH(CH_3)-O-)_m-R_2\right]_p$$

where

Z is the residue of a compound having from 1 to 8 active hydrogens,

R_1 is hydrogen, ethyl, or mixtures thereof,

n is 0 or a positive number,

m is a positive number,

.../3

n+m is a number having a value which will give a polyether polyol with a number average molecular weight range of from 400 to 5000,

R_2 is hydrogen or an alkyl group of from 1 to 6 carbon atoms,

p is an integer having a value equal to the number of active hydrogens of Z, and

(B) from 5 to 95 percent of an ester selected from

(1) esters made from polyhydric alcohols with alkanoic acids, and

(2) esters made from alkanedioic acids with alkanols.

AUSTRALIA 630401

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COMPLETE SPECIFICATION
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Application Number:
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Priority

Related Art:

Applicant(s):

The Dow Chemical Company
2030 Dow Center, Abbott Road, Midland, Michigan 48640, UNITED STATES OF AMERICA

Address for Service is:

PHILLIPS ORMONDE & FITZPATRICK
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Melbourne 3000 AUSTRALIA

Complete Specification for the invention entitled:

LUBRICANTS FOR REFRIGERATION COMPRESSORS

Our Ref : 157770
POF Code: 1037/1037

The following statement is a full description of this invention, including the best method of performing it known to applicant(s):

6006

LUBRICANTS FOR REFRIGERATION COMPRESSORS

This invention relates to a blend of glycols and esters useful for lubricating heat pumps and air conditioning compressors.

Refrigerant R12 (dichlorodifluoromethane), is used in automotive air conditioners and many other types of refrigeration and air conditioning compressors. It is a chlorofluorocarbon that has been identified as depleting atmospheric ozone. The Montreal Accords restrict the production of R12 by 1990. Refrigerant R134a (1,1,1,2-tetrafluoroethane) has a vapor pressure that is very similar to R12 and it has the advantage that it does not deplete atmospheric ozone. R134a can replace R12 in most refrigeration systems without major redesign of present equipment. It could be used in automotive air conditioners without any re-tooling by the automotive companies.

The major problem of using R134a is that conventional lubricants such as naphthenic mineral oils are not soluble over the temperature range -20° to 80°C, the operating temperatures encountered in the different

refrigeration applications. Some polyglycols are soluble in R134a at 25°C and below but phase separate below 60°C. Phase separation of the lubricant from the refrigerant can cause poor lubrication of the compressor which results in increased wear and decreased compressor life. It is well known in the refrigeration industry that lubricant concentration in the refrigerant is limited to the range of about 10 to 20 percent due to thermodynamic considerations. The usefulness of this invention is that it will enable compressor manufacturers to substitute R134a and other hydrofluorocarbons or hydrochlorofluorocarbons for chlorofluorocarbons such as R12 in most compressors without mechanical modification to existing compressors and be able to operate over a broad temperature range.

The fundamentals of lubrication in air conditioners are set forth by H.H. Kruse et al. in "Fundamentals of Lubrication in Refrigeration Systems and Heat Pumps" pages 763-783; ASHRAE Transactions Vol 90 part 2B (1984).

Lubricants for various air compressors are known from U.S. Patents 4,302,343 and 4,751,012. These patents show that various blends of esters and polyether polyols make a long lasting lubricant. However, these blends either have a neat viscosity less than 75 centistokes (75×10^{-6} m^2/s) at 38°C or are immiscible at the high temperatures used in refrigeration.

U.S. Patent 4,755,316 discloses compositions containing one or more polyether polyols for lubricating refrigeration compressors using R134a. However, those compositions of the '316 patent which display adequate viscosity at the high temperatures in the compressor are

not miscible at the same high temperature. Conversely, those compositions of the '316 patent which exhibit miscibility at the low temperatures are of too low a viscosity for adequate lubrication.

The invention comprises lubricant compositions that are miscible in hydrofluorocarbon and hydrochlorofluorocarbon refrigerants in the range of from -20°C to greater than 65°C and at the same time have a neat viscosity greater than 75 centistokes (75×10^{-6} m^2/s) at 38°C.(100°F). In general, the compositions consist of

(A) from 5 to 95 percent of a polyether polyol which has the formula

$$Z-\left[(CH_2-CH(R_1)-O-)_n-(CH_2-CH(CH_3)-O-)_m-R_2\right]_p$$

where

Z is the residue of a compound having 1 to 8 active hydrogens,

R_1 is hydrogen, ethyl, or mixtures thereof,

n is 0 or a positive number,

m is a positive number,

n+m is a number having a value which will give a polyether polyol with a number average molecular weight range from about 400 to about 5000,

R_2 is hydrogen or an alkyl group of 1 to 6 carbon atoms,

p is an integer having a value equal to the number of active hydrogens of Z, and

(B) from 95 to 5 percent of an ester selected from

(1) esters made from polyhydric alcohols with alkanoic acids, and

(2) esters made from alkanedioic acids with alkanols.

The present invention provides a lubricant composition miscible in hydrofluorocarbon and hydrochlorofluorocarbon refrigerants in the range of from -20° to greater than 65°C and having a viscosity greater than 75 centistokes (75 x 10^{-6} m^2/s) at 38°C comprising:

(A) from 95 to 5 percent of a polyether polyol which has the formula

$$Z-[(CH_2-CH(R_1)-O-)_n-(CH_2-CH(CH_3)-O-)_m-R_2]_p$$

where

Z is the residue of a compound having from 1 to 8 active hydrogens,

R_1 is hydrogen, ethyl, or mixtures thereof,

n is 0 or a positive number,

m is a positive number,

n+m is a number having a value which will give a polyether polyol with a number average molecular weight range of from 400 to 5000,

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R_2 is hydrogen or an alkyl group of from 1 to 6 carbon atoms,

p is an integer having a value equal to the number of active hydrogens of Z, and

(B) from 5 to 95 percent of an ester selected from

(1) esters made from polyhydric alcohols with alkanoic acids, and

(2) esters made from alkanedioic acids with alkanols.

The present invention further provides a lubricant composition miscible in hydrofluorocarbon and hydrochlorofluorocarbon refrigerants in the range of from -20° to greater than 65°C and having a viscosity greater than 75 centistokes (75 x 10^{-6} m^2/s) at 38°C comprising:

(A) from 95 to 5 percent of a polyether polyol which has the formula

$$Z-[(-CH_2-CH(CH_3)-O-)_n-R]_p$$

where

Z is the residue of a compound having from 1 to 8 active hydrogens,

n is a number having an average value which will give a polyether polyol with a number average molecular weight range of from 400 to 5000,

R is hydrogen or an alkyl group of 1 to 6 carbon atoms,

p is an integer having a value equal to the

number of active hydrogens of Z, and

(B) from 5 to 95 percent of an ester selected from

(1) esters made from polyhydric alcohols with alkanoic acids, and

(2) esters made from alkanedioic acids with alkanols.

The present invention still further provides a fluid composition for use in compression refrigeration comprising

(A) a refrigerant selected from hydrochlorofluorocarbons and hydrofluorocarbons, and

(B) a lubricant composition as defined above.

The present invention still further provides a process for preparing a lubricant composition miscible in hydrofluorocarbon and hydrochlorofluorocarbon refrigerants in the range of from -20° to greater than 65°C and having a viscosity greater than 75 centistokes (75 x 10^{-6} m^2/s) at 38°C which comprises mixing:

(A) from 95 to 5 percent of a polyether polyol which has the formula

$$Z-[(CH_2-CH(R_1)-O-)_n-(CH_2-CH(CH_3)-O-)_m-R_2]p$$

where

Z is the residue of a compound having from 1 to 8 active hydrogens,

R_1 is hydrogen, ethyl, or mixtures thereof,

n is 0 or a positive number,

m is a positive number,

n+m is a number having a value which will give a polyether polyol with a number average molecular weight range of from 400 to 5000,

R_2 is hydrogen or an alkyl group of from 1 to 6 carbon atoms,

p is an integer having a value equal to the number of active hydrogens of Z, and

(B) from 5 to 95 percent of an ester selected from

(1) esters made from polyhydric alcohols with alkanoic acids, and

(2) esters made from alkanedioic acids with alkanols.

The present invention still further provides a process for preparing a lubricant composition miscible in hydrofluorocarbon and hydrochlorofluorocarbon refrigerants in the range of from -20° to greater than 65°C and having a viscosity greater than 75 centistokes (75 x 10^{-6} m^2/s) at 38°C which comprises mixing:

(A) from 95 to 5 percent of a polyether polyol which has the formula

$Z-[(-CH_2-CH(CH_3)-O-)_n-R]p$

where

Z is the residue of a compound having from 1 to 8 active hydrogens,

n is a number having an average value which will give a polyether polyol with a number average molecular weight range of from 400 to

5000,

R is hydrogen or an alkyl group of 1 to 6 carbon atoms,

p is an integer having a value equal to the number of active hydrogens of Z, and

(B) from 5 to 95 percent of an ester selected from

(1) esters made from polyhydric alcohols with alkanoic acids, and

(2) esters made from alkanedioic acids with alkanols.

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~~R_2 is hydrogen or an alkyl group of 1 to~~ 6 carbon atoms,

p is an integer having a value equal to the the number of active hydrogens of Z, and

(B) from 95 to 5 percent of an ester selected from

(1) esters made from polyhydric alcohols with alkanoic acids, and

~~(2)~~ esters made from alkanedioic acids with ~~alkanols.~~

The neutral esters used in this invention are well known and/or available. Examples of suitable esters are the esters of dihydric alcohols, trihydric alcohols, and tetrahydric alcohols having 4 to 18 carbons such as glycerine, ethylene glycol, propylene glycol pentaerythritol, dipentaerythritol, tripentaerythritol, trimethylolpropane, trimethylolbutane, and trimethylolethane with alkanoic acids of from 4 to 18 carbon atoms. These are illustrated by ethylene glycol distearate, propylene glycol dipelargonate, glycerine trioleate, trimethylolpropane triheptonate, and pentaerythritol tetraheptonate.

Also useful are the esters of monohydric alcohols having from 4 to 8 carbons with alkanedioic acids having from 4 to 18 carbons such as succinic,

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adipic, suberic, tetradecane 1,14-dioic acid, and hexadecane-1,16-dioic acid.

Examples of the polyether polyols or polyoxyalkylene polyols used in this invention are those derived from ethylene oxide, propylene oxide, 1-2, or 2-3 butylene oxide. The above oxides may be polymerized alone, i.e., homopolymerized or in combination. The combined oxides may also be combined in a random or block addition. While some of the above compounds may be of a hydrophilic nature, those of a hydrophobic nature are preferred, such as those derived from propylene oxide, butylene oxides or combinations thereof.

Examples of suitable capped polyoxyalkylene glycols are those derived from ethylene, propylene, and butylene oxides wherein the alkylene oxides are initiated from a compound having from 1 to 8 active hydrogens in a known manner. The terminal hydroxyl groups may be further reacted with alkyl halides to form alkyl capped polyoxyalkylene glycols. These polyether polyols and their preparation are well known from the book "Polyurethanes" by Saunders and Frisch, Interscience Publishers (1962), pages 33-39.

Examples of suitable initiator compounds which are employed to prepare the above polyether polyols are compounds having from 1 to 8 active hydrogens such as, for example, water, methanol, ethanol, propanol, butanol, ethylene glycol, propylene glycol, butylene glycol, 1,6-hexane diol, glycerine, trimethylolpropane, pentaerythritol, polyamines, sorbitol, sucrose and mixtures thereof.

Other initator compounds which are useful include monohydric phenols and dihydric phenols and their alkylated derivatives such as phenol, o, m, and p cresol, guaiacol, saligenin, carvacrol, thymol, o and p -hydroxy diphenyl, catechol, resorcinol, hydroquinone, pyrogallol and phloroglucinol.

Other initator compounds which are useful include ammonia, ethylene diamine, aminoethylethanolamine, N-aminoethylpiperazine, diethylenetriamine and triethylene tetramine.

The foregoing polyether polyols should have a number average molecular weight range of from 400 to 5000 and preferably in the range of from 500 to 1500.

The foregoing polyether polyols are blended to give a base lubricant composition containing from 5 to 95 weight percent of the esters and from 95 to 5 weight percent of the polyols with the ranges of from 70 to 90 polyols and from 30 to 10 esters being the preferred ranges, respectively.

The preferred polyether polyols are based on an initiator selected from glycerine or ethylene diamine and the preferred ester is a pentaerythritol tetraester of a mixture of alkanoic acids having from 7 to 9 carbons.

The final lubricant compositions of this invention may contain effective amounts of ashless additives, such as antioxidants, corrosion inhibitors, metal deactivators, lubricity additives, viscosity index

improvers and extreme pressure additives as may be required.

Examples of useful ashless antioxidants which could be used herein are phenyl naphthylamines, i.e., both alpha and beta-naphthyl amines; diphenyl amine; iminodibenzyl; p,p-dibutyl-diphenylamine; p,p'-dioctyldiphenylamine; and mixtures thereof. Other suitable antioxidants are hindered phenolics such as, for example, 6-t-butylphenol, 2,6-di-t-butylphenol and 4-methyl-2,6-di-t-butylphenol.

Examples of suitable ashless metal corrosion inhibitors are commercially available, such as N-oleoylsarcosine and Irgalube 349 from Ciba-Geigy which is an aliphatic amine salt of phosphoric acid monohexyl ester. Other useful metal corrosion inhibitors are NA-SUL DTA and NA-SUL EDS from the White Chemical Company (diethylenetriamine dinonylnapthalene sulfonate and ethylene diamine dinonylnaphthalene sulfonate), respectively.

Examples of suitable ashless cuprous metal deactivators are imidazole, benzimidazole, pyrazole, benzotriazole, tolutriazole, 2-methyl benzimidazole, 3,5-dimethyl pyrazole, and methylene bis-benzotriazole.

An effective amount of the foregoing additives for use in a refrigerant compression is generally in the range of from 0.1 to 5.0 percent by weight for the antioxidants, from 0.1 to 5.0 percent by weight for the corrosion inhibitors, and from 0.001 to 0.5 percent by weight for the metal deactivators. The foregoing weight percentages are based on the total weight of the polyether polyols and the esters It is to be

understood that more or less of the additives may be used depending upon the circumstance for which the final composition is to be used.

Examples of refrigerants useful in this invention are hydrochlorofluorocarbons such as chlorodifluoromethane, chlorofluoromethane, 2,2-dichloro-1,1,1-trifluoroethane, 1-chloro-1,2,2,2-tetrafluoroethane, 2-chloro-1,1,2,2-tetrafluoroethane, 1-chloro-2,2,2-trifluoroethane, 1,1-dichloro-1-fluoroethane and 2-chloro-2,2-difluoroethane.

Examples of hydrofluorocarbon refrigerants useful in this invention are 1,1,1,2-tetrafluoroethane, 1,1,2,2-tetrafluoroethane, 1,1,1-trifluoroethane, 2,2-difluoroethane, trifluoromethane, methylene fluoride, methyl fluoride, difluoroethylene and pentafluoroethane.

Several examples of the present invention with the refrigerant R134a (1,1,1,2-tetrafluoroethane) are given in Table II. Several control runs with the refrigerant R134a (1,1,1,2-tetrafluoroethane) are given in Table I. Table III illustrates the invention with other refrigerants such as R141b, R22, and R123.

The general procedure for the preparation of the controls and the examples was as follows. The selected polyol and ester were mixed and vacuum stripped. Glass ampoules were washed with acetone and vacuum dried at 110°C. The empty ampoule or tube was weighed and the mixture to be evaluated was syringed into the tube. The tube was re-weighed to determine the weight of lubricant. The tube was evacuated to remove air and then immersed in a dry ice/methylene chloride slurry in a Dewar flask. The R134a was transferred at a

pressure of 8 psig (56 MPa gauge) into the tube to give the desired lubricant concentration. The filled ampoule was then disconnected and allowed to equilibrate at room temperature, 25°C. The ampoules were placed in a controlled temperature bath and the temperature varied from -20 to 85°C while observing for phase separation. The temperature of phase separation is called the upper solution critical temperature (USCT) and is reported in degrees C. Temperatures above 85°C were not investigated because of pressure limitations of the glass ampoule apparatus. Systems with USCT's above this temperature measurement limit are denoted as greater than 85°C.

Table I. R134a Upper Solution Critical Temperature Data

Run Number	Lubricant/Neat Viscosity, cs @ 100°F or 38°C (m^2/s)	Lubricant Wt % in R134a	USCT °C
Control A	100 Mobil P51 (Pentaerythritol tetraester of a mixture of alkanoic acids having 7-9 carbons) 25 (25×10^{-6})	25	80
Control B	100 Mobil P41 (Trimethylolpropane triheptonate) 15 (15×10^{-6})	16	>83
Control C	100 Emery 2914-D (Dimethyl azelate) 3 (3×10^{-6})	15	>85
Control D	100 L-1150 (n-butanol + PO to 1150 Mol Wt) 57 (57×10^{-6})	16	60
Control E	100 P-1000 (Propylene glycol + PO to 1000 Mol Wt) 73 (73×10^{-6})	25	70
Control F	100 P-2000 (Propylene glycol + PO to 2000 Mol Wt) 160 (16×10^{-5})	12	<25
Control G	70/30 P2000/P425 (n-butanol + PO to 425 Mol Wt) 95 (95×10^{-6})	15	45
Control H	70/30 L-1150/Emery 2914D 20 (2×10^{-5})	11	>70
Control I	70/30 P-2000/Mobil P51 87 (87×10^{-6})	13	<35
Control J	30/70 P-2000/Mobil P41 40 (4×10^{-5})	20	80

Table I shows that the esters and the polyols by themselves do not have both the required viscosity or USCT. Controls H, I and J show that even certain polyol/ester blends do not have the required viscosity to be effective.

Table II R134a Upper Solution Critical Temperature Data

Run Number	Lubricant/Neat Viscosity cs @ 100°F (m^2/s @ 38°C)	Lubricant Wt % in R134a	USCT °C
Example 1	90/10 CP700 (glycerine + PO to 700 mol wt) Mobil P51 89 (89 x 10^{-6})	9	>85
Example 2	90/10 CP700/Mobil P51 89 (89 x 10^{-6})	12	>85
Example 3	90/10 CP700/Mobil P51 89 (89 x 10^{-6})	17	80
Example 4	90/10 CP700/Mobil P51 89 (89 x 10^{-6})	22	80
Example 5	75/25 EDA511 (ethylene diamine + PO to 511 mol wt)/Mobil P41 203 (203 x 10^{-6})	8	80
Example 6	75/25 EDA511 Mobil P41 203 (203 x 10^{-6})	19	83
Example 7	75/25 EDA511 Mobil P41 203 (203 x 10^{-6})	29	>85
Example 8	75/25 EDA511 Mobil P51 245 (245 x 10^{-6})	9	>85
Example 9	75/25 EDA511 Mobil P51 245 (245 x 10^{-6})	11	>85
Example 10	75/25 EDA511 Mobil P51 245 (245 x 10^{-6})	20	>85
Example 11	70/30 CP1406(glycerine + PO to 1406 mol wt) Mobil P51 78 (78 x 10^{-6})	18	65

Table III. Upper Solution Critical Temperature Data

Run Number	Lubricant/Neat Viscosity cs @ 100°F (m^2/s @ 38°C)	Lubricant Wt % in Refrigerant	USCT °C
Example 12 with R141b	75/25 EDA511/Mobil P51 245 (245×10^{-6})	22	>65
Example 13 with R22	75/25 EDA511/Mobil P51 245 (245×10^{-6})	18	>65
Example 14 with R123	75/25 EDA511/Mobil P51 245 (245×10^{-6})	18	>65

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A lubricant composition miscible in hydrofluorocarbon and hydrochlorofluorocarbon refrigerants in the range of from -20° to greater than 65°C and having a viscosity greater than 75 centistokes (75×10^{-6} m^2/s) at 38°C comprising:

(A) from 95 to 5 percent of a polyether polyol which has the formula

$$Z-\left[(CH_2-CH(R_1)-O-)_n-(CH_2-CH(CH_3)-O-)_m-R_2\right]_p$$

where

Z is the residue of a compound having from 1 to 8 active hydrogens,

R_1 is hydrogen, ethyl, or mixtures thereof,

n is 0 or a positive number,

m is a positive number,

n+m is a number having a value which will give a polyether polyol with a number average molecular weight range of from 400 to 5000,

R_2 is hydrogen or an alkyl group of from 1 to 6 carbon atoms,

p is an integer having a value equal to the the number of active hydrogens of Z, and

(B) from 5 to 95 percent of an ester selected from

(1) esters made from polyhydric alcohols with alkanoic acids, and

(2) esters made from alkanedioic acids with alkanols.

2. A lubricant composition miscible in hydrofluorocarbon and hydrochlorofluorocarbon refrigerants in the range of from -20° to greater than 65°C and having a viscosity greater than 75 centistokes (75×10^{-6} m^2/s) at 38°C comprising:

(A) from 95 to 5 percent of a polyether polyol which has the formula

$$Z-\left[(-CH_2-CH(CH_3)-O-)_n-R\right]_p$$

where

Z is the residue of a compound having from 1 to 8 active hydrogens,

n is a number having an average value which will give a polyether polyol with a number average molecular weight range of from 400 to 5000,

R is hydrogen or an alkyl group of 1 to 6 carbon atoms,

p is an integer having a value equal to the number of active hydrogens of Z, and

(B) from 5 to 95 percent of an ester selected from

(1) esters made from polyhydric alcohols with alkanoic acids, and

(2) esters made from alkanedioic acids with alkanols.

3. A lubricant composition as claimed in Claim 2 wherein the polyether polyol is based on a residue selected from glycerine and ethylene diamine and the ester is a pentaerythritol tetraester of a mixture of alkanoic acids having from 7 to 9 carbons.

4. A fluid composition for use in compression refrigeration comprising

(A) a refrigerant selected from hydrochlorofluorocarbons and hydrofluorocarbons, and

(B) a lubricant composition as claimed in Claim 1 or Claim 2

5. A composition as claimed in Claim 4 wherein said fluid composition contains a concentration of from 1 to 30 percent by weight of lubricant composition.

6. A composition as claimed in Claim 4 wherein said hydrochlorofluorocarbons are selected from chlorodifluoromethane, chlorofluoromethane, 2,2-dichloro-1,1,1-trifluoroethane, 1-chloro-1,2,2,2-tetrafluoroethane, 2-chloro-1,1,2,2-tetrafluoroethane, 1-chloro-2,2,2-trifluoroethane, 1,1-dichloro-1-fluoroethane and 2-chloro-2,2-difluoroethane and said

hydrofluorocarbons are selected from 1,1,1,2-tetrafluoroethane, 1,1,2,2-tetrafluoroethane, 1,1,1-trifluoroethane, 2,2-difluoroethane, trifluoromethane, methylene fluoride, methyl fluoride, difluoroethylene and pentafluoroethane.

7. A composition as claimed in Claim 4 wherein said hydrofluorocarbon is 1,1,1,2-tetrafluoroethane.

8. A composition as claimed in Claim 4 wherein the polyether polyol is based on a residue selected from glycerine and ethylene diamine and the ester is a pentaerythritol tetraester of a mixture of alkanoic acids having 7 to 9 carbons.

9. A process for preparing a lubricant composition miscible in hydrofluorocarbon and hydrochlorofluorocarbon refrigerants in the range of from -20° to greater than 65°C and having a viscosity greater than 75 centistokes (75 x 10^{-6} m^2/s) at 38°C which comprises mixing :

(A) from 95 to 5 percent of a polyether polyol which has the formula

$$Z-\left[(CH_2-CH(R_1)-O-)_n-(CH_2-CH(CH_3)-O-)_m-R_2\right]_p$$

where

Z is the residue of a compound having from 1 to 8 active hydrogens,

R_1 is hydrogen, ethyl, or mixtures thereof,

n is 0 or a positive number,

m is a positive number,

n+m is a number having a value which will give a polyether polyol with a number average molecular weight range of from 400 to 5000,

R_2 is hydrogen or an alkyl group of from 1 to 6 carbon atoms,

p is an integer having a value equal to the number of active hydrogens of Z, and

(B) from 5 to 95 percent of an ester selected from

(1) esters made from polyhydric alcohols with alkanoic acids, and

(2) esters made from alkanedioic acids with alkanols.

10. A process for preparing a lubricant composition miscible in hydrofluorocarbon and hydrochlorofluorocarbon refrigerants in the range of from -20° to greater than 65°C and having a viscosity greater than 75 centistokes (75 x 10^{-6} m^2/s) at 38°C which comprises mixing:

(A) from 95 to 5 percent of a polyether polyol which has the formula

$$Z-\left[(-CH_2-CH(CH_3)-O-)_n-R\right]_p$$

where

Z is the residue of a compound having from 1 to 8 active hydrogens,

n is a number having an average value which will give a polyether polyol with

a number average molecular weight range of from 400 to 5000,

R is hydrogen or an alkyl group of 1 to 6 carbon atoms,

p is an integer having a value equal to the number of active hydrogens of Z, and

(B) from 5 to 95 percent of an ester selected from

(1) esters made from polyhydric alcohols with alkanoic acids, and

(2) esters made from alkanedioic acids with alkanols.

11. A lubricant composition as claimed in claim 1 or 2 substantially as hereinbefore described with reference to any one of the Examples.

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