

1

2,741,598

HEAT TRANSFER, HYDRAULIC AND THERMOREGULATOR FLUIDS

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No Drawing. Application October 1, 1952, Serial No. 312,650

1 Claim. (Cl. 252—78)

The instant invention relates to novel compositions of matter which are eminently suitable for use as heat transfer, hydraulic and thermoregulator fluids, particularly at high temperatures.

An object of the invention is to provide novel compositions of matter which are stable over a wide range of temperatures but remain liquid at relatively low temperatures.

Another object of the invention is to provide thermally stable compositions of matter which have high boiling points and relatively low freezing or pour points.

An additional object of the invention is to provide novel compositions of matter which have low viscosities at relatively low temperatures, are non-toxic, and are non-corrosive to metals, particularly copper, brass, iron, steel, nickel and silver.

A further object of the invention is to provide novel compositions of matter of the foregoing type having a cubical coefficient of expansion of at least 0.0007.

A still further object of the invention is to provide novel compositions of matter which are particularly suitable for use as heat transfer, hydraulic and thermoregulator fluids.

Other objects and advantages will become apparent to those skilled in the art as the description of the invention proceeds.

It is highly desirable to provide functional fluids which permit the use of the same equipment at relatively low and relatively high temperatures in heat transfer, hydraulic and thermoregulator systems. Examples of such situations are those instances where it is necessary to transfer the equipment from tropical to arctic regions, to transport same to high altitudes in a relatively short time, to store or operate such equipment in very cold climates or allow it to stand overnight in a shut-down condition. In such cases, it is highly undesirable for excessive warm-up periods to be required, and excessive viscosity of the functional fluid employed in such equipment will produce this result due to the failure of the fluid to rapidly transfer heat. Furthermore, it is even more undesirable for the controls, such as thermostats, on such equipment to fail, and this does occur if there is a failure of prompt transmission of heat or mechanical energy to the control switch. Even a temporary obstruction to the prompt transmission of heat or mechanical energy, such as might occur while the fluid is being heated outside the oven, can result in the destruction of the heating elements of the oven or the permanent distortion of the controlling device. In view of the foregoing, it is evident that it is quite essential that the functional fluids in such equipment be operative over a wide range of temperatures.

Moreover, it is important that such fluids be thermally stable, as a number of disadvantages flow from the thermal decomposition of such materials during their use

2

as heat transfer, hydraulic and thermoregulator fluids. For example, thermal decomposition results in the formation of sludge, and in changes in the active volume of these fluids with the ultimate result of adversely affecting their physical, mechanical and heat transfer properties or of distorting or otherwise damaging the equipment in which they are used. In addition, such decomposition leads to the production of materials which excessively corrode the equipment in which such fluids are used.

Heretofore, numerous compounds and compositions have been employed as heat transfer, hydraulic and thermoregulator fluids. Illustrative examples of these are diphenyl oxide, chlorinated biphenyl, chlorinated diphenyl oxide, diphenylbenzene, chlorobenzene, ortho-dichlorobenzene, toluene, xylene, ethylbenzene, ethanol, mixtures of water with alcohol; mixtures of water with glycerine; mixtures of diphenyl oxide, diphenylamine and naphthalene; mixtures of diphenyl and diphenyl oxide; and mixtures of tetraphenoxysilane and a phenol silicate. However, these materials have not been entirely satisfactory since they have the objectionable property of solidifying or becoming too viscous at relatively low temperatures, boiling at too low a temperature, decomposing at elevated temperatures, or a combination of two or more of these.

In accordance with this invention, it has been found that by blending chlorinated biphenyl with at least one compound selected from the group consisting of biphenyl, o-terphenyl and m-terphenyl in the proportions hereinafter indicated, compositions are obtained which overcome the objections and disadvantages of the compounds and compositions of the prior art.

Broadly stated, the compositions of the instant invention are compounded by blending the above compounds in all proportions in which they are mutually compatible. More specifically, these compositions are prepared by mixing the above compounds, with heating, if necessary, in the following proportions by weight.

	Percent
40 Chlorinated biphenyl (48%–62% Cl)-----	62–90
Biphenyl -----	0–15
o-Terphenyl -----	0–25
m-Terphenyl -----	0–15

45 Within this range of compositions, the following more restricted range is preferred:

	Percent
45 Chlorinated biphenyl (48%–60% Cl)-----	62–90
Biphenyl -----	10–15
50 o-Terphenyl -----	20–25
m-Terphenyl -----	5–10

It is understood that components within these ranges are so selected that they add up to 100%.

These compositions are thermally stable and display no evidence of decomposition on heating in sealed glass tubes for 1 week in a muffle at about 330° C. Moreover, they have relatively low viscosities and pour points as compared with their individual components. In addition, they are characterized by having a boiling point in the range of about 270° C. to about 500° C., or more specifically, in the range of about 280° C. to about 430° C.; by thermal stability at these temperatures; by a freezing point or pour point below room temperature, or more particularly below 10° C.; by being substantially non-toxic; by being non-corrosive to metals, particularly copper, brass, iron, steel, nickel and silver; and by possessing a combination of all of these desirable properties.

The following are typical practical compositions within the scope of the instant invention.

Composition, Percent by Weight				Pour Point, ° C.	Viscosity, Centipoises
Chlorinated Biphenyl	o-Ter- phenyl	m-Ter- phenyl	Bi- phenyl		
90 (54% Cl)	-----	-----	10	-7	393 (25° C.)
90 (54% Cl)	-----	-----	10	---	95 (37.8° C.)
80 (54% Cl)	20	-----	---	+6.0	4,500 (25° C.)
75 (54% Cl)	-----	10	15	-9	41 (37.8° C.)
62 (54% Cl)	25	---	13	-13	188.8 (25° C.)
60 (54% Cl)	19	---	14	-9	64 (37.8° C.)
65 (54% Cl)	25	10	---	+4	209 (37.8° C.)
65 (60% Cl)	23	---	12	0	800 (25° C.)
70 (48% Cl)	20	---	10	-26	92 (25° C.)

These compositions are useful as heat transfer, hydraulic and thermoregulator media, particular at high temperatures. More particularly, these products are useful for heat transfer purposes in chemical processes, in power plants and in indirect heating and reheating operations; in hydraulic systems such as those actuating brakes, wing-flaps, retractable landing gears, etc., in airplanes, and in industrial molding and extrusion operations; and as thermoresponsive liquids in heat responsive devices of the type disclosed in Reissue Patent No. 22,961 to Vaughan

Morrill, Jr., Patent No. 1,978,362 to Edward L. Fonseca, and Patent Nos. 2,185,421 and 2,185,422 to Carl F. Prutton et al.

While certain preferred embodiments of the invention have been illustrated and described herein, it is to be understood that the invention is not limited thereby, but is susceptible of various changes in form and detail within its scope.

Having now described my invention, what I desire to claim as new and desire to secure by Letters Patent is:

A heat transfer, hydraulic and thermoregulator medium consisting of 62% by weight of chlorinated biphenyl (54% Cl), 25% by weight of o-terphenyl and 13% by weight of biphenyl.

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