United States Patent Office 2,909,489 Patented Oct. 20, 1959

2,909,489

NON-FOAMING FUNCTIONAL FLUIDS

Joseph E. Fields, Dayton, Ohio, assignor to Monsanto Chemical Company, St. Louis, Mo., a corporation of Delaware

No Drawing. Application June 7, 1956
Serial No. 589,860

20 Claims. (Cl. 252—78)

The present invention relates to functional fluids and more particularly provides non-foaming, functional fluids comprising an organic phosphate ester base.

Functional fluids containing esters of phosphoric acid have general utility as force-transmission fluids for the transmission of pressure, power or torque in fluid pressure or torque-activated mechanisms; as synthetic lubricants between relatively moving parts; as liquid materials in the filters of air-conditioning systems, etc. They are highly valuable for these and related uses, because of their flame-resistant qualities, their very good pumpability under varying pressures encountered over wide temperature ranges, their desirable lubricating properties, their resistance to mechanical shear and to mechanical breakdown, etc.

As examples of phosphate-base functional fluids may be mentioned the tricresyl phosphate-containing fluids disclosed in U.S. patent application Serial No. 206,128, filed January 15, 1951, now U.S. Patent No. 2,707,176, by H. R. Gamrath and R. E. Hatton; the mono-alkyl diaryl phosphate-containing force transmission fluids described in the R. E. Hatton application, Serial No. 291,795, filed June 4, 1952, now abandoned, the dialkyl mono-aryl phosphate base transmission fluids described in the R. E. Hatton application, Serial No. 291,805, filed June 4, 1952, now abandoned, and the phosphate-base lubricant and hydraulic fluids described in the F. J. Watson U.S. Patent Nos. 2,636,861–2, issued April 28, 1953.

While the above-enumerated valuable properties of the phosphate-base fluids adapt them to a great variety of uses in the mechanical fields, many of such fluids are at a disadvantage in that they often have a pronounced tendency to foam under use. Hence, the problem of foam-inhibition is one of major importance to all industries employing the phosphate-base fluids under foam-inducing conditions. The foaming of the fluids becomes a particularly great problem when loss of the fluid occurs by foam seepage whereby proper transmission of force, lubrication, heat-transfer, etc., are impeded.

Now I have found that the foaming tendency of a functional fluid containing at least 45% by weight of a liquid, tribasic, organic phosphate ester is suppressed or entirely eliminated by incorporating thereto from 0.0001% to 1.0% of a polymeric alkyl vinyl ether having from 3 to 8 carbon atoms in the alkyl radical. The presently useful liquid polymeric alkyl vinyl ethers are further characterized in that 1.0% solutions thereof in benzene have specific viscosities which range from 0.1 to 1.0 at a temperature of 25° C.

The quantity of the tribasic phosphate present in any particular functional fluid is regulated by the use for which the fluid is intended and the nature of the individual phosphate, as may be apparent to those skilled in the art. The present functional fluids may consist entirely of a liquid organic phosphate, entirely of mixtures of such phosphates or they may be mixtures of one or more liquid organic phosphates with other fluids known in the art to be useful as constituents of functional fluids, e.g., the known "hydraulic fluids," "torque converter fluids," "heat-transmission fluids," etc. As examples of

such constituents of the present non-foaming phosphate-based fluids may be mentioned the partially chlorinated biphenyls known to the trade as "Aroclors," technical mixtures of biphenyl and terphenyl and other fluids having the property of remaining liquid under a wide range of temperature conditions and contributing to the utility for which said fluid is designed. The present functional fluids may also contain small amounts of agents adapted to modify the various properties thereof and generally known to the trade as "additives." Such additives may be minor, but effective, amounts of materials such as corrosion-inhibitors, anti-rusting agents, detergent additives, extreme pressure-resisting additives, viscosity index improving agents such as the polymeric higher alkyl methacrylates known to the trade as "Acryloids," alkylated polystyrenes obtained by alkylating styrene with olefins having from 6 to 12 carbon atoms, etc.

The phosphate which is an essential constituent of the present functional fluids may be any normally liquid tribasic ester of phosphoric acid. Because they are more easily available, the hydrocarbon esters are generally preferred. They may be trialkyl phosphates, triaryl phosphates, alkyl diaryl phosphates, aryl dialkyl phosphates, tris(alkaryl) or tris(aralkyl) phosphates, alkyl bis(aralkyl) phosphates, aryl bis(aralkyl)phosphates, alkyl aryl alkaryl phosphates, aralkyl dialkyl phosphates, alkaryl dialkyl phosphates, etc. As exemplary of particularly useful phosphates may be mentioned:

Trialkyl phosphates in which the alkyl radical has from 4 to 12 carbon atoms, e.g., tributyl phosphates, triamyl phosphates, tri-hexyl phosphates, trioctyl phosphates, tridecyl phosphates, tridodecyl phosphate, and particularly the branched homologs such as tris(2-ethylbutyl) phosphate, tris(2-methylpentyl) phosphate, tris(2-ethylhexyl) phosphate, and tris(3,5,5-trimethylhexyl) phosphate.

Triaryl phosphates such as tricresyl phosphate, diphenyl cresyl phosphate, liquid mixtures of triphenyl and tricresyl phosphate, etc.

Aryl dialkyl phosphates such as dibutyl phenyl phosphate, amyl phenyl phosphate, butyl 2-ethylhexyl phenyl phosphate, butyl octyl cresyl phosphate, di(2-ethylhexyl) phenyl phosphate, di(6-methylheptyl) cresyl phosphate, dioctyl chlorophenyl phosphate, 2-ethylhexyl 6-methylheptyl phenyl phosphate, butyl 2-ethylbutyl phenyl phosphate, 2-ethylhexyl 2-methylpentyl cresyl phosphate, n-octyl n-hexyl phenyl phosphate, 2-ethylhexyl 2-ethylbutyl phenyl phosphate and butyl n-hexyl cresyl phosphate.

Alkyl diaryl phosphates such as 2-ethylhexyl diphenyl phosphate, 6-methylheptyl diphenyl phosphate, n-octyl diphenyl phosphate, 2-ethylhexyl dicresyl phosphate, 2-ethylhexyl phenyl cresyl phosphate, 2-ethylbutyl diphenyl phosphate, 2-methylpentyl dicresyl phosphate, n-hexyl phenyl cresyl phosphate, nonyl diphenyl and decyl dicresyl phosphate.

A specific embodiment of the invention is the provision of non-foaming functional fluids consisting essentially of a mixture of a liquid, tribasic phosphate ester and a partially chlorinated diphenyl having from, say, 40% to 80% by weight of combined chlorine. Such mixtures may have varying proportions of the phosphate and the biphenyl compound. When designed for use as force transmission fluid, however, the phosphate-chlorinated biphenyl mixtures generally contain from 45 to 55 parts of the phosphate ester and from 45 to 55 parts of the chlorinated biphenyl. A base stock fluid comprising such a mixture may have added to it from 0.2 to 8 parts by weight of "additives" compatible therewith and required for specific applications.

Another embodiment of the invention of particular interest is the provision of a non-foaming functional fluid having improved viscosity index properties. Such a func-

tional fluid may consist essentially of a mixture of the phosphate and the chlorinated biphenyl together with a small proportion, say, from 0.4 to 2 percent by weight of the fluid composition, of an alkylated polystyrene as the viscosity index-improving agent.

Still another significant embodiment of the invention is the provision of non-foaming functional fluids comprising as the base stock, a mixture of a liquid, tribasic organic phosphate and a partially chlorinated biphenyl, to which base stock has been added a small quantity, say, from 1 percent to 5 percent, of a polymeric higher alkyl methacrylate as a viscosity index improving agent.

The polymeric alkyl vinyl ethers which I have found to possess foam suppressing properties for functional fluids containing at least 45% by weight of the phosphate esters are viscous liquid to balsam-like products having a 1% benzene specific viscosity of from 0.1 to 1.0 at 25° C. They are obtainable in known manner by heating the monomeric alkyl vinyl ethers or by contacting them at relatively low temperatures, say, at temperatures of from 10° C. to 100° C., with a catalyst such as iodine, sulfur dioxide or an acidic catalyst, e.g., concentrated mineral acid, aluminum chloride, aluminum sulfate, ferric chloride, zinc chloride, stannous chloride, etc., as described, e.g., by Chalmers in "Canadian Journal of Research," 7, 472–80 (1932) or in the Reppe U.S. Patent 2,104,000. Examples of presently useful polymers are polymeric isopropyl vinyl ether, isobutyl vinyl ether, n-hexyl vinyl ether, 2-ethylhexyl vinyl ether, n-propyl vinyl ether, tert-amyl vinyl ether, n-octyl vinyl ether, etc., having the specific viscosity properties herein described. The quantity of the polymeric ether which is employed will vary, of course, with the nature of the polymer, the functional fluid and with the use for which it is designed; but will be sufficient to render said fluid substantially non-foaming when incorporated therein in a minor amount. Generally, very small quantities, say, quantities of from 0.0001 percent to 1.0 percent of the polymer are sufficient, and for most purposes a quantity of say, 0.001 to 0.05 percent gives complete suppression of the foaming-tendency exhibited by functional fluids containing 45% or more of the present phosphate esters.

The invention is further illustrated, but not limited, by the following examples:

Example 1

The antifoaming property of a functional fluid may be determined according to the procedure generally described in designation L–12–445 of the Coordinating Lubricants Research Committee of the Coordinating Research Council, New York. Briefly this procedure involves bubbling air or an inert gas such as nitrogen through the fluid to be tested employing standard apparatus and standard conditions. The following procedure was employed:

The fluid was placed in a standard 100-ml. graduated cylinder in the top of which was inserted a two-hole rubber stopper. An air-inlet tube extended through this stopper, to the bottom of which was attached a gas diffuser or porous stone sphere. The length of the inlet tube was adjusted so that when the apparatus was assembled, the sphere just touched the bottom of the cylinder. Dry nitrogen was supplied at the rate of 0.2 cubic feet per hour, employing a calibrated flowmeter. A 25 cc. test sample was used for each test.

With the air hose disconnected between the flowmeter and the delivery tube to the diffuser stone, the stone was allowed to soak in the test fluid for 5 minutes, at the end of which time the air flow (0.2 cu. ft. per hour) was started through the stone. Zero time was noted when the air or nitrogen bubbles started to rise from the stone. Readings of the top and bottom foam levels were taken at the end of a 1-minute period. The volume of foam was calculated from the two readings.

The following fluids were tested:

I. Dibutyl phenyl phosphate

II. Octyl diphenyl phosphate

The following antifoam agents were employed with the above fluids at the concentrations shown in the table below:

(A) A viscous low molecular weight polymeric isobutyl vinyl ether, a 1% benzene solution of the polymer having a specific viscosity of 0.07 at 25° C.

(B) A very viscous higher molecular weight polymeric isobutyl vinyl ether, a 1% benzene solution of the polymer having a viscosity of 0.6 at 25° C.

(C) A commercially available, polymeric siloxane antifoaming agent known to the trade as "DCF 200."

Samples of the respective fluids were mixed respectively with the antifoamants and the resulting mixtures were tested by the testing procedures described above. The following results were obtained:

Test Sample	Foam (cc.) at 1-Min. Additive in Percent Concentration			
	None	.005	.01	.02
I	90			
I plus C		40	22	
I plus B		0		
I plus A		0		
II	100			
II plus C			90	95
II plus A			40–50	0
II plus B			0	

Example 2

In order to test the effect of a viscosity index improver on the antifoaming effect of the polymeric alkenyl alkyl ethers, antifoaming agents were added to dibutyl phenyl phosphate containing 4.0 percent by weight of a polymethacrylate known to the trade as "Acryloid V. I. Improver U." The following results were obtained using the testing procedure of Example 1:

Additive	Foam (cc.) 1-Min. Additive in Percent Concentration	
	.005	0.03
Low molecular weight polyisobutyl vinyl ether (A of Example 1)	0	
Higher molecular weight polyisobutyl ether (B of Example 1)	0	
Silicone: DCF 200	43	23

Example 3

Employing the general procedure of Example 1 but conducting the test on a larger scale, i.e., using a 1000-ml. graduate instead of a 100-ml. graduate and a 150-ml. test sample rather than a 25-ml. sample, and employing a 5-minute nitrogen flow period, there was tested the antifoaming effect of the polymeric isobutyl vinyl ethers (A) and (B) of Example 1 on a hydraulic fluid consisting of equal parts by weight of tricresyl phosphate and a chlorinated biphenyl containing 48 percent by weight of combined chlorine (herein referred to as "base stock") either in the presence or absence of 0.85 percent by weight of polymeric 2-ethylhexyl acrylate as a viscosity index improving agent. The following results were obtained:

Test Sample	Foam (cc.) at 5-Min. Additive in Percent Concentration		
	None	.005	.0025
Base stock plus polymeric 2-ethylhexyl acrylate	425		
Base stock plus polymeric 2-ethylhexyl plus low molecular weight polymer A		150	
Base stock plus polymeric 2-ethylhexyl acrylate plus higher molecular weight polymer B		50	70
Base stock plus polymeric 2-ethylhexyl acrylate plus commercial siloxane defoamant DCF 200		480	555

Example 4

A functional fluid was prepared by dissolving one part by weight of an alkylated polystyrene made by alkylating one part by weight of polystyrene having a molecular weight of about 70,000 with about 0.5 parts by weight of a 9 carbon polymeric C_3 olefin, into 64 parts by weight of chlorinated biphenyl containing 48 percent by weight of combined chlorine; and thereafter, 52 parts by weight of this solution of the alkylated polystyrene dissolved in the chlorinated biphenyl were combined with 48 parts by weight of tricresyl phosphate. Testing of the foam-susceptibility of the fluid conducted as described in Example 3 gave 750 ml. of foam after 5 minutes. Incorporation of .005 percent by weight of the higher molecular weight polymeric isobutyl vinyl ether B of Example 1 into this functional fluid reduced the foam to 70 ml. after 5 minutes, employing the same testing procedure.

Similarly good results are obtained by incorporating into the functional fluids of Examples 1–4, instead of the viscous or very viscous polymeric isobutyl vinyl ethers, balsam-like polymers of isobutyl vinyl ether or the balsam-like to viscous liquid polymers of other alkyl vinyl ethers, e.g., polymeric isopropyl vinyl ether, n-amyl vinyl ether, tert-amyl vinyl ether, n-heptyl vinyl ether or 2-ethylhexyl vinyl ether, the specific viscosity of 1% benzene solutions of said alkyl vinyl ether polymers being from 0.1 to 1.0 at 25° C.

The present polymeric alkenyl alkyl ethers suppress or entirely eliminate the foam susceptibility of other phosphate-base functional fluids, for example, the following:

(1) The trialkyl phosphates, from tributyl to trilauryl with the preferred species generally being tri(2-ethylhexyl) phosphate.

(2) The dialkyl monoaryl phosphates wherein the alkyl groups are C_4 to C_{12} and the aryl groups are phenyl or cresyl, particularly dibutyl phenyl phosphate and di(2-ethylhexyl) phenyl phosphate.

(3) The monoalkyl diaryl phosphates wherein the alkyl groups are C_4 to C_{12} and the aryl groups are phenyl and/or cresyl, especially 2-ethylhexyl diphenyl phosphate and 6-methylheptyl diphenyl phosphate.

(4) The liquid triaryl phosphates, namely tricresyl phosphate, cresyl diphenyl phosphate and phenyl dicresyl phosphate.

Other components which may be present together with the liquid phosphate esters are e.g., the partially chlorinated biphenyls containing from, say, 42 percent by weight to 75 percent by weight of combined chlorine; di-esters of dicarboxylic acids such as dioctyl sebacate and dioctyl adipate; and liquid polymeric silicones, all of which components are known in prior art to be useful in the formulation of functional fluids.

This application is a continuation-in-part of my application, Serial No. 370,212, filed July 24, 1953, now abandoned.

What I claim is:

1. A composition consisting essentially of a functional fluid which is a liquid tribasic organic phosphate of the formula $O{=}P(OR)_3$ in which each R is selected from the class consisting of alkyl, aryl, aralkyl and alkaryl radicals and as a defoamant for said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymer of an alkyl vinyl ether having from 3 to 8 carbon atoms in the alkyl radical, a 1% benzene solution of said polymer having a specific viscosity of 0.1 to 1.0 at 25° C.

2. A composition consisting essentially of a functional fluid which is a liquid tribasic organic phosphate of the formula $O{=}P(OR)_3$ in which each R is selected from the class consisting of alkyl, aryl, aralkyl and alkaryl radicals, a viscosity-index improving quantity of a polymeric alkyl methacrylate, and as a defoamant for said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymer of an alkyl vinyl ether having from 3 to 8 carbon atoms in the alkyl radical, a 1% benzene solution of said polymer having a specific viscosity of 0.1 to 1.0 at 25° C.

3. A composition consisting essentially of a functional fluid which is a mixture consisting of at least 45% by weight of a liquid tribasic organic phosphate of the formula $O{=}P(OR)_3$ in which each R is selected from the class consisting of alkyl, aryl, aralkyl and alkaryl radicals, with the balance being a partially chlorinated biphenyl having from 40% to 80% by weight of combined chlorine and as a defoamant for said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymer of an alkyl vinyl ether having from 3 to 8 carbon atoms in the alkyl radical, a 1% benzene solution of said polymer having a specific viscosity of 0.1 to 1.0 at 25° C.

4. A composition consisting essentially of a functional fluid which is a mixture consisting of at least 45% by weight of a liquid tribasic organic phosphate of the formula $O{=}P(OR)_3$ in which each R is selected from the class consisting of alkyl, aryl, aralkyl and alkaryl radicals, with the balance being a partially chlorinated biphenyl having from 40% to 80% by weight of combined chlorine and a viscosity-index improving quantity of an alkylated polystyrene, and as a defoamant for said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymer of an alkyl vinyl ether having from 3 to 8 carbon atoms in the alkyl radical, a 1% benzene solution of said polymer having a specific viscosity of 0.1 to 1.0 at 25° C.

5. A composition consisting essentially of a functional fluid which is a mixture consisting of at least 45% by weight of a liquid tribasic organic phosphate of the formula $O{=}P(OR)_3$ in which each R is selected from the class consisting of alkyl, aryl, aralkyl and alkaryl radicals, with the balance being a partially chlorinated biphenyl having from 40% to 80% by weight of combined chlorine and a viscosity-index improving quantity of a polymeric alkyl methacrylate, and as a defoamant for said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymer of an alkyl vinyl ether having from 3 to 8 carbon atoms in the alkyl radical, a 1% benzene solution of said polymer having a specific viscosity of 0.1 to 1.0 at 25° C.

6. A composition consisting essentially of a functional fluid which is a liquid triaryl phosphate and as a defoamant for said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymer of an alkyl vinyl ether having from 3 to 8 carbon atoms in the alkyl radical, a 1% benzene solution of said polymer having a specific viscosity of 0.1 to 1.0 at 25° C.

7. A composition consisting essentially of a functional fluid which is a liquid aryl dialkyl phosphate and as a defoamant for said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymer of an alkyl vinyl ether having from 3 to 8 carbon atoms in the alkyl radical, a 1% benzene solution of said polymer having a specific viscosity of 0.1 to 1.0 at 25° C.

8. A composition consisting essentially of a functional fluid which is a liquid alkyl diaryl phosphate and as a defoamant for said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymer of an alkyl vinyl ether having from 3 to 8 carbon atoms in the alkyl radical, a 1% benzene solution of said polymer having a specific viscosity of 0.1 to 1.0 at 25° C.

9. A functional fluid consisting essentially of dibutyl phenyl phosphate and as a defoamant for the phosphate from 0.0001% to 1.0% of a viscous liquid to balsam-like polymeric isobutyl vinyl ether, a 1% benzene solution of said polymeric ether having a specific viscosity of 0.1 to 1.0 at 25° C.

10. A composition consisting essentially of a functional fluid which is a mixture consisting of at least 45% by weight of a tricresyl phosphate with the balance being a partially chlorinated biphenyl having from 40% to

80% by weight of combined chlorine and as a defoamant for said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymeric isobutyl vinyl ether, a 1% benzene solution of said polymeric ether having a specific viscosity of 0.1 to 1.0 at 25° C.

11. A functional fluid consisting essentially of octyl diphenyl phosphate and as a defoamant for said phosphate from 0.0001% to 1.0% of a viscous liquid to balsam-like polymeric isobutyl vinyl ether, a 1% benzene solution of said polymeric ether having a specific viscosity of 0.1 to 1.0 at 25° C.

12. A composition consisting essentially of a functional fluid which is a mixture of dibutyl phenyl phosphate and a viscosity-index improving quantity of a polymeric alkyl methacrylate and as a defoamant for said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymeric isobutyl vinyl ether, a 1% benzene solution of said polymeric ether having a specific viscosity of 0.1 to 1.0 at 25° C.

13. A composition consisting essentially of a functional fluid which is a mixture containing at least 45% by weight of tricresyl phosphate with the balance being partially chlorinated biphenyl having from 40% to 80% by weight of combined chlorine and an alkylated polystyrene in a viscosity-index improving quantity, said composition containing as a defoamant for said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymeric isobutyl vinyl ether, a 1% benzene solution of said polymeric ether having a specific viscosity of 0.1 to 1.0 at 25° C.

14. The method of suppressing the foaming tendency of a functional fluid consisting essentially of a liquid tribasic organic phosphate of the formula $O=P(OR)_3$ in which each R is selected from the class consisting of alkyl, aryl, aralkyl and alkaryl radicals which comprises adding to said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymer of an alkyl vinyl ether having from 3 to 8 carbon atoms in the alkyl radical, a 1% benzene solution of said polymer having a specific viscosity of 0.1 to 1.0 at 25° C.

15. The method of suppressing the foaming tendency of a functional fluid consisting essentially of a liquid triaryl phosphate, which comprises adding to said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymer of an alkyl vinyl ether having from 3 to 8 carbon atoms in the alkyl radical, a 1% benzene solution of said polymer having a specific viscosity of 0.1 to 1.0 at 25° C.

16. The method of suppressing the foaming tendency of a functional fluid consisting essentially of a liquid diaryl alkyl phosphate, which comprises adding to said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymer of an alkyl vinyl ether having from 3 to 8 carbon atoms in the alkyl radical, a 1% benzene solution of said polymer having a specific viscosity of 0.1 to 1.0 at 25° C.

17. The method of suppressing the foaming tendency of a functional fluid consisting essentially of a liquid aryl dialkyl phosphate, which comprises adding to said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymer of an alkyl vinyl ether having from 3 to 8 carbon atoms in the alkyl radical, a 1% benzene solution of said polymer having a specific viscosity of 0.1 to 1.0 at 25° C.

18. The method of suppressing the foaming tendency of a functional fluid consisting essentially of a mixture consisting of at least 45% by weight of a liquid tribasic organic phosphate of the formula $O=P(OR)_3$ in which each R is selected from the class consisting of alkyl, aryl, aralkyl and alkaryl radicals with the balance being a partially chlorinated biphenyl having from 40% to 80% by weight of combined chlorine, which comprises adding to said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymer of an alkyl vinyl ether having from 3 to 8 carbon atoms in the alkyl radical, a 1% benzene solution of said polymer having a specific viscosity of 0.1 to 1.0 at 25° C.

19. The method of suppressing the foaming tendency of a functional fluid consisting essentially of dibutyl phenyl phosphate, which comprises adding to said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymeric isobutyl vinyl ether, a 1% benzene solution of said polymer having a specific viscosity of 0.1 to 1.0 at 25° C.

20. The method of suppressing the foaming tendency of a functional fluid consisting essentially of a mixture consisting of at least 45% by weight of tricresyl phosphate with the balance being a partially chlorinated biphenyl having from 40% to 80% by weight of combined chlorine, which comprises adding to said fluid from 0.0001% to 1.0% of a viscous liquid to balsam-like polymer of an alkyl vinyl ether having from 3 to 8 carbon atoms in the alkyl radical, a 1% benzene solution of said polymer having a specific viscosity of 0.1 to 1.0 at 25° C.

References Cited in the file of this patent

UNITED STATES PATENTS

2,430,858	Borsoff et al.	Nov. 18, 1947
2,469,285	White	May 3, 1949
2,575,298	Ryznar	Nov. 13, 1951
2,695,892	Jaccard et al.	Nov. 30, 1954
2,707,176	Gamrath et al.	Apr. 26, 1955

FOREIGN PATENTS

64,456	Netherlands	Oct. 15, 1949