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PHOSPHORIC ACID ESTERS OF DIETHYLENE GLYCOL ETHERS AND LUBRICANTS CONTAINING THE SAME

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1 Claim. (Cl. 252—49.8)

The present invention relates to a new group of chemical compounds, namely the phosphoric acid esters of diethylene glycol mono-ethers. More particularly it relates to an improved lubricant composition comprising one or more of these compounds and a hydrocarbon oil.

These compounds may be represented by the following formula:

$$\begin{matrix}(ROCH_2CH_2OCH_2CH_2O)\\(R'OCH_2CH_2OCH_2CH_2O)\text{—}PO\\(R''OCH_2CH_2OCH_2CH_2O)\end{matrix}$$

wherein R, R' and R'' represent aliphatic, aryl, alkaryl, aralkyl or naphthenic radicals. Tributyl carbityl phosphate and triphenyl carbityl phosphate are examples of the compounds included in the above generic formula.

For the sake of convenience the generally recognized term "carbityl phosphate" is used throughout the specification and claim in place of the more scientifically correct term "phosphoric acid ester of diethylene glycol mono-ether."

The novel compounds of my invention in general are oily viscous liquids soluble in or miscible with hydrocarbon oils and substantially stable against decomposition or hydrolysis. I have found that they are of particular utility in compounding synthetic lubricants. For example, in combination with mineral oil fractions the the phosphoric acid esters of aliphatic mono-ethers of diethylene glycol form lubricants of improved viscosity and pour point. The corresponding aromatic compounds are useful as anti-wear and extreme pressure agents in greases, lubricating oils or other synthetic oils. The following table shows some of the properties of typical compounds of this series which make them suitable for use per se as lubricants or as components of lubricant compositions:

Table

	Pour point, ° F.	Kinematic viscosity		V. I.	Flash point, ° F.
		100° F.	210° F.		
Tributyl carbityl phosphate	−65	13.03	3.33	142	310
Triphenyl carbityl phosphate	+15	181.6	10.05	−24	525

Although the properties of these novel compounds make them particularly suitable for use in lubricating compositions, it is not intended to limit my invention to this particular use or to any combination of the compounds with other compounds or materials. An inspection of their properties indicates that they may be expected to find a variety of uses, such as solvents, plasticizers, heat transfer media, emulsifying agents for cutting and grinding oils, chemical intermediates, and so forth. They find particular application as hydraulic oils.

The compounds of my invention may be prepared by the usual esterification reactions between alcohols or metal

alcoholates and oxygen-containing compounds of pentavalent phosphorus. According to my preferred method I react an alcohol with phosphorus oxychloride. For example, tributyl carbityl phosphate was obtained by reacting butyl carbitol with phosphorus oxychloride and triphenyl carbityl phosphate was obtained by reacting phenyl carbitol with phosphorus oxychloride. While this may be regarded as the preferred method of preparing these compounds it is not intended to limit my invention to any particular method of preparation, as other methods may also be employed.

The following examples illustrate the preferred method of preparing my novel compounds by means of detailed procedures. Tributyl carbityl phosphate was prepared by the procedure described in Example 1, and triphenyl carbityl phosphate was prepared by the procedure described in Example 2. It is understood that these examples are given by way of illustration only and are not to be construed as limiting the scope of my invention.

Example 1

2 moles of butyl carbitol and 500 cc. of solvent naphtha were dried by shaking with calcium chloride and introduced into a glass flask. Phosphorus ovychloride was added in a dropwise manner with stirring until 0.67 mole had been added. The temperature was held between 30° C. and 35° C. during the addition of the phosphorus oxychloride. After the addition of the phosphorus oxychloride was completed, the reaction mixture was heated for 15 hours under reflux. The mixture was then cooled and a stream of air passed through it under vacuum to remove hydrogen chloride. The solvent was removed by distillation and a viscous liquid product having a refractive index of 1.4444(n^{25}/D) was obtained as the distillation residue. Analysis of the tributyl carbityl phosphate obtained by this procedure showed a composition of 52.72 per cent C, 9.32 per cent H, and 5.79 per cent P, as compared with calculated theoretical values of 54.31 per cent, 9.69 per cent and 5.84 per cent, respectively.

Example 2

4.3 moles of phenyl carbitol and 2500 cc. of benzene were dried by shaking with calcium chloride and introduced into a glass flask. Phosphorus oxychloride was added in a dropwise manner with stirring until 1.35 moles had been added. The temperature was held between 30° C. and 35° C. during the addition of the phosphorus oxychloride. After the addition of the phosphorus oxychloride was completed the reaction mixture was heated for 6 hours under reflux. The mixture was then cooled and a stream of air passed through it under vacuum to remove hydrogen chloride. The solvent was removed by distillation and a viscous liquid product having a refractive index of 1.5360 (n^{25}/D) was obtained as the distillation residue. Analysis of the triphenyl carbityl phosphate obtained by this procedure showed a composition of 59.78 per cent C, 6.67 per cent H, and 5.10 per cent P, as compared with calculated theoretical values of 61.01 per cent, 6.65 per cent and 5.25 per cent, respectively.

The proportion of the phosphate esters of my invention added to lubricant compositions may vary widely depending upon the uses involved and the properties desired. As additives to lubricating oils as little as 0.10% by weight may produce a measurable improvement, although in general approximately 0.5% to approximately 25% is preferred where the compounded oil is to be used as a crankcase lubricant for internal combustion engines. For other purposes a lubricant may be made comprising one or more of these compounds in major proportion with an oil of lubricating characteristics. Although the use of mineral oil bases has been indicated for preparing these compounded lubricants, it is also within the scope

of my invention to use other oil bases such as fatty acids or synthetic polymer oils.

The compounds of this invention are generally compatible with other compounding ingredients commonly employed, such as pour point depressors, oiliness agents, extreme pressure additive agents, corrosion inhibitors, viscosity index improvers and the like, so that they may be added to hydrocarbon oils containing such additives also. It is also possible to use the phosphate esters of this invention in combination with lubricants containing thickening agents and/or metal soaps in grease-forming proportions.

Obviously, many modifications and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof, and therefore, only such limitations should be imposed as are indicated in the appended claim.

I claim:

A lubricant comprising a major portion of a mineral oil of lubricating characteristics and 0.5 to 25 weight per cent tributyl carbityl phosphate, said carbityl phosphate acting as a pour point depressant in said lubricant.

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