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LUBRICANTS

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This invention relates to low temperature lubricants. More particularly the invention relates to lubricants which have a comparatively uniform viscosity over a wide temperature range.

Some pieces of mechanism such as the aeroplane, motor vehicle, guns and superstructures of ships, are subject to a wide range of temperatures in their normal operations. The aeroplane encounters this wide temperature range by operation in different altitudes while the motor vehicle, ships, guns and the like are subjected to changes in temperature in accordance with the seasons or in accordance with the particular location on the earth's surface where the operations may take place.

It is important that lubricants for some types of mechanism should have good lubricating characteristics, such as low viscosity, throughout the entire temperature range in which it is operated. It is also important that the lubricants shall have a proper boiling point, melting point and vapor pressure in order to function properly throughout a wide temperature range.

Many different metals and alloys are now used for bearings and it is important that the lubricants shall not be corrosive. Also good lubricants should be capable of standing high bearing pressures.

The primary object of the present invention is to provide a lubricant which will effectively lubricate at subzero temperatures as well as at high temperatures.

Another object of the invention is to provide a lubricant having comparatively uniform viscosity over a wide range of temperatures and which is adaptable for high bearing pressures.

A further object of the invention is to provide a lubricant which is not corrosive and which is stable while operating over a wide temperature range.

With these and other objects in view the invention consists in the improved lubricant hereinafter described and particularly defined in the claims.

The preferred lubricant of the present invention consists of synthetic chemical compounds which are manufactured and sold to the trade under the trade-mark "Carbitols." There are four Carbitols which have desirable characteristics as lubricants, namely, monomethyl ether of diethylene glycol; monoethyl ether of diethylene glycol; monobutyl ether of diethylene glycol; and diethyl ether of diethylene glycol. These Carbitols have the following physical characteristics:

	Boiling point	Flash point	Freezing point
	° F.	° F.	° F.
Monomethyl ether of diethylene glycol.....	380	200	-75
Monoethyl ether of diethylene glycol.....	396	210	-105
Monobutyl ether of diethylene glycol.....	448	230	-60
Diethyl ether of diethylene glycol.....	367	180	-----

All of these Carbitols have oiliness or lubricating characteristics and when from 1% to 5% of the Carbitols are dissolved in a mineral lubricating oil they will raise the load-carrying characteristics of the mineral oil to give it ability to stand high bearing pressures. It is desirable, however, to use the Carbitols as the base lubricants by adding to the Carbitols extreme pressure additives, such as tricresyl phosphite, Polane, or Santolube No. 261, to increase the oiliness and load-carrying characteristics of the Carbitols. About 1% by volume of these additives will impart sufficient load-carrying characteristics to the Carbitols for most lubricating purposes.

The Carbitols all have low freezing points and show comparatively uniform viscosities over a wide range of temperature. The viscosities of some of the Carbitols have been determined as follows:

	Temperatures	Viscosity
	° F.	Centistokes
Monobutyl ether of diethylene glycol....	-40	173
	0	33.7
	100	4.1
	200	1.36
Monomethyl ether of diethylene glycol....	-40	132
	0	25.9
	100	3.17
	200	1.21

The monomethyl ether of diethylene glycol and the monobutyl ether of diethylene glycol (preferably with an additive agent therein) are well adapted as the base lubricant for the manufacture of low temperature greases. For example, sodium base greases may be made by dissolving from 4% to 20% of sodium base soaps in the monobutyl or monomethyl Carbitols. The sodium base soaps may be sodium stearate, sodium oleate, or sodium palmitate. To these greases may be added 1% of Polane, or 1% of tricresyl phosphite, or 1% of Santolube #261.

Among the extreme pressure additives which may be added to the glycols to increase their load-carrying capacities are Polane, a commercial product on the market sold by the Patent Chem-

icals Company which is understood to be an ester of a fatty acid or a chlorinated ester of a fatty acid, such as ethyl laurate, or chlormethyl stearate. Another additive is Santolube #261 which is manufactured by the Monsanto Chemical Company. This product is defined as a metallic derivative of an alkylated carboxylic acid containing compounds of tin and sulfur. The tricresyl phosphite, referred to above, is described in the patent to Engelke No. 2,260,303 granted October 28, 1941 as a tricresyl phosphite or a mixture of tricresyl phosphite and tricresyl phosphate. All of the above additives act as anti-corrosion agents as well as extreme pressure and oiliness agents.

The Carbitols themselves are neutral and non-corrosive to all of the bearing metals and alloys with which the product has been used. These Carbitols are water-soluble but have good viscosity characteristics and good boiling point and flash point characteristics for use in the lubrication of bearings which are operated particularly at low temperatures.

The preferred form of the invention having been thus described, what is claimed as new is: 25

1. A lubricant consisting of from approximately 96% to 80% of a diethylene glycol monoalkyl ether, and from approximately 4% to 20% of a sodium soap.
- 5 2. A lubricant consisting of from approximately 4% to 20% of a sodium soap, approximately 1% of an extreme pressure agent, the remainder of the lubricant consisting essentially of a diethylene glycol monoalkyl ether.
- 10 3. A lubricant consisting of from approximately 96% to 80% of a diethylene glycol monoethyl ether, and from approximately 4% to 20% of a sodium soap.
- 15 4. A lubricant consisting of from approximately 96% to 80% of a diethylene glycol monoethyl ether, and from approximately 4% to 20% of a sodium soap.
- 20 5. A lubricant consisting of from approximately 96% to 80% of a diethylene glycol monobutyl ether, and from approximately 4% to 20% of a sodium soap.

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