

1

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HYDROCARBON RESISTANT GLYCEROL BASE LUBRICANT

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This invention relates to lubricants and particularly to plug valve lubricants of the type which do not become involved in or cause the corrosion of steel and like metal valve surfaces in the presence of hydrocarbons such as gasoline, particularly ethyl gasoline.

In its preferred embodiment the invention will be described as incorporated in a plug valve lubricant which is capable of repeated compressions and expansions without losing its compressibility so that it may be employed for automatic lubrication of most present day plug valves.

The use of plug valve lubricants containing chiefly glycerol mixed with at least a surface wetting agent such as one of the available synthetic detergents and an agent for maintaining viscosity at high temperature such as sodium carboxymethylcellulose (C. M. C.) has been proposed, but it has been found that while this lubricant is remarkably satisfactory for general purposes its glycerol in some manner reacts with certain hydrocarbon line fluids such as gasoline, particularly ethyl gasoline, so as to cause the lubricant to darken, dry out and eventually cause the underlying steel and iron valve surfaces to become corroded. As time passes the metal covered by the lubricant darkens and exhibits pitting and general corrosive attack.

In an effort to secure a non-corrosive lubricant it was at first attempted by the use of certain substitutes and additions to the foregoing type of lubricant formula, to minimize these corrosive effects. Different detergents and equivalent wetting agents were tried, and anti-oxidants such as α -naphthol, propyl gallate, p-benzylaminophenol and diazoaminobenzene were introduced, but the corrosion effects were not appreciably altered. The solution of the problem turned out to be neither obvious nor within the skill of the routine analyst.

The present invention comprises the discovery that the introduction of a small amount of sodium glycerolate, sometimes known as sodium glycerolate $\text{NaC}_3\text{H}_7\text{O}_3$, which is the mono-sodium derivative of glycerol, is particularly effective in reducing the corrosion of metal of plug valve and like surfaces lubricated by glycerol base type lubricants and exposed to gasoline and like hydrocarbons. I believe that potassium glyceroxide will be equally effective and therefore regard it as equivalent for purposes of the invention. Further equivalents are the other similar alkali metal derivatives of glycerol, namely lithium, rubidium and cesium although they are not as commercially practical as the sodium and potassium compounds.

It is therefore the major object of the invention to provide a novel lubricant for plug valve and like surfaces which contains a major amount of glycerol but is effective to prevent corrosion of the underlying metal surfaces in the presence of gasoline and like hydrocarbons.

A further object of the invention is to provide a novel glycerol base lubricant containing an effective amount of an alkali metal glyceroxide present in sufficient quan-

2

tity for inhibiting corrosion of metal surfaces in the presence of line fluids like gasoline.

It is a further object of the invention to provide a novel compressible and expansible lubricant comprising a chiefly glycerol matrix and containing a metal surface wetting agent, a gas bubble stability agent and a sufficient amount of alkali metal glyceroxide, preferably the sodium or potassium derivatives, for inhibiting corrosion of underlying metal surfaces in the presence of gasoline and like hydrocarbons.

A further object of the invention is to provide a novel glycerol base plastic lubricant containing about 0.75 to 3.75 percent alkali metal glyceroxide.

It is still a further object of the invention to provide a novel glycerol base plastic lubricant containing substantially two percent sodium glyceroxide.

Essentially the lubricant of the invention comprises a major amount of glycerol admixed with minor amounts of substances which contribute in known or unexpected manners to modify or add to the properties of the glycerol. Examples of such known substances are sodium carboxymethylcellulose, which is mainly important for maintaining adequate viscosity of the mixture when high temperature line fluids are used, and wetting agents such as one of the usual synthetic detergents for improving the metal surface covering properties of the mixture.

In addition in the invention I add minor amounts of other substances expectedly designed to improve lubricity and, since the lubricant is to be of the compressible and expansible automatic feeding type known as Hypermatic, for improving air bubble retention and stability.

Glycerol admixed with the foregoing additives constitutes a lubricant having good general use lubricity, good metal adhesion and stability with respect to air bubble retention under repeated compressions and expansions, but it permits corrosion of the underlying metal in the presence of hydrocarbon line fluids as in earlier products.

However, it was discovered that the inclusion in the admixture of a minor amount, usually about 0.75 to 3.75 percent by weight and preferably about two percent, of sodium glyceroxide resulted in a glycerol base lubricant which does not react with gasoline and like hydrocarbons to corrode underlying steel and like metal surfaces. This result was neither expected nor known, nor was it predictable from general knowledge of the characteristics of sodium glyceroxide, although once discovered by reason of the present invention several theories, some later set forth, have been advanced in attempted explanation of the phenomenon.

A comprehensive example of a lubricant composition according to the invention comprises the following constituents in preferred percentage ranges.

Substance:	Percentage range (wt.)
Glycerol	78-89
Sodium carboxymethylcellulose	7-3
Water soluble vegetable gum powder	2-1
Sodium stearate	2-1
Detergent wetting agent	4-2
Starch	2-1
Animal glue	3-1
Sodium glyceroxide	0.75-3.75

The glycerol may be any of the commercially available types such as high test, C. P., technical grade or synthetic.

The sodium carboxymethylcellulose is preferably the medium viscosity grade marketed under the trade name C. M. C. by Hercules Powder Company.

The water soluble vegetable gum powder may be from any source but I prefer to use the prepared substance known as Penick's Stabilizer Powder sold by the S. B.

Penick Company who identify it as composed of three vegetable mucilage-yielding water soluble materials, two of which are edible vegetable gums and one an edible vegetable seed of similar characteristics.

The sodium stearate may be the commercial variety of U. S. P. grade.

The detergent wetting agent may be any of the known synthetic detergents available today. I preferably use that known as Oronite D-40 which is represented by the maker to consist of 40 percent alkyl aryl sulfonate and 60 percent sodium sulfate, but other like detergents such as Vel, Tide, Dreft, Trend and Surf or mixtures of them can be substituted. These will be identified herein as synthetic detergent wetting agents.

The preferred starch is corn starch, but other vegetable starches may be used equally well.

Preferably the animal glue is granular for purposes of mixture according to the invention.

The sodium glyceroxide is available. It is a highly alkaline granular powder.

In the lubricant, inclusion of the starch and vegetable gum powder improved the air retention, bubble stability and lubricity of the mass. Inclusion of the animal glue improved lubricity. Inclusion of the sodium stearate gave the mass better body and improved its stick stability. The detergent wetting agent improved the metal surface coverage of the mixture and increased compressibility of the mass. The inclusion of sodium carboxymethylcellulose aided bubble stability but its chief value is to maintain viscosity of the mass at higher operating temperatures than without it. Any of the foregoing constituents can be varied in amount or even omitted with corresponding change in contribution to the mixture and still provide an operable lubricant for certain purposes. However, as a practical matter, a lubricant consisting of a major amount of glycerol, and minor amounts of sodium carboxymethylcellulose for high temperature resistance and a detergent wetting agent, together with a corresponding low percentage of sodium or equivalent alkali metal glyceroxide constitute the essentials of the invention. The other materials are preferable and preferably always used in practice, but they are not essential to a lubricant for purposes of the invention and one or another may even be omitted or varied in amount depending upon the service at hand.

An actual preferred formula for stick type plug valve lubricant consists of 199.5 pounds of glycerol, 15 pounds of C. M. C., 5 pounds of Penick's powder, 5 pounds of sodium stearate, 7.5 pounds of Oronite wetting agent D-40, 5 pounds of corn starch, 7.5 pounds of granular animal glue and 5 pounds of sodium glyceroxide. A softer composition intended for grease gun use consists of 267 pounds of glycerol, 12 pounds of C. M. C., 3 pounds of Penick's powder, 3 pounds of sodium stearate, 6 pounds of Oronite wetting agent D-40, 3 pounds of corn starch, 6 pounds of animal glue and 6 pounds of sodium glyceroxide.

These lubricants are most conveniently prepared in a Baker-Perkins mixer equipped with kneading type blades. The preferred method of preparation is to add about one-half of the total amount of glycerol to the mixer which is kept cold. Slowly and with agitation the C. M. C., Penick's powder, sodium stearate, Oronite D-40 wetting agent, corn starch and glue are added to the mixer. The materials are added one at a time and mixed until uniform before the addition of the next item. The glue is preferably pre-mixed with a portion of the remaining glycerol in a ratio of one part glue to 5 parts glycerol. This insures the complete miscibility of all the glue. The premix is made by dissolving the glue in a small amount of hot water, adding the required amount of glycerol, and heating the resulting mixture to evaporate the water. The residual glue-glycerol mixture is a viscous liquid that is easily introduced into the formulation. After the above ingredients have been thoroughly mixed with the gly-

erol, the remaining portion of glycerol is added and the Baker-Perkins mixer is heated by means of the steam jacket to a temperature of 260° F. This temperature is maintained until the mixture is homogeneous. The steam is then turned off and the mixer is slowly cooled with a small stream of water running through the mixer jacket. At 250° F. the sodium glyceroxide is added to the lubricant mass in the form of a granular powder. A full stream of cold water is now passed through the mixer and the lubricant is cooled with agitation until a temperature of 100° F. to 90° F. is reached. At this point the compressibility of the lubricant is satisfactory and the lubricant can be discharged directly into packing containers or into a receptacle from which it can be extruded in the form of sticks, depending on the type of lubricant prepared.

This lubricant is light tan in color and consists of a multiplicity of minute discrete air particles surrounded with the lubricant matrix. The lubricant may be compressed and reexpanded repeatedly to 1000 p. s. i. without essentially changing the character of the discrete gas phase dispersed throughout the lubricant base.

This lubricant is a viscous, flowable, plastic mass, suitable for use in lubricating and sealing ferrous bearing metal surfaces such as lubricated plug cock valves. The lubricant has excellent wetting properties for metal in the presence of hydrocarbons and does not react on the metal surfaces in any way in the presence of line fluids such as gasoline. Tests have been made in which valve plugs coated with lubricant were immersed in ethyl gasoline for periods in excess of 6 months. No evidence of corrosion of metal was noted. The lubricant is an effective sealant within the temperature range of minus 20° F. to plus 300° F. The lubricant is resistant to aliphatic, aromatic, and cyclic hydrocarbons, to chlorinated hydrocarbons, and to combinations thereof. The lubricant is resistant also to the solvent action of ethyl ether and other non-polar materials within the recommended temperature range.

Tests results support the fact of invention that incorporation of the sodium or equivalent alkali metal glyceroxide in a glycerol base lubricant unexpectedly inhibits the corrosive attack of ferrous valve surfaces hitherto encountered in gasoline and like hydrocarbon lines wherein the valves were lubricated with glycerol base lubricants. The exact theory of action is not known. It is a generally accepted fact that glycerol itself is corrosive to such metal surfaces in the presence of gasoline, and my invention permits the use of glycerol base lubricants, which are preferable because of economic factors and their other physical properties, in services where they were not used formerly.

One theory of action of the new lubricant is that during the period of attack of the metal surfaces by the glycerol certain chemical reactions take place and resultant intermediate products are formed which are destructively corrosive to the ferrous surfaces. The presence of the alkali metal glyceroxide or other equivalent derivative of glycerol may inhibit the formation of these products or may slow or eliminate reaction of the glycerol with the gasoline or metal. Such action may be due to the relatively high pH of the alkali metal derivative, or the foregoing reactions may be prevented from taking place due to the presence of a highly alkaline material most of whose molecule resembles the glycerol itself. In any event I know the improved action is present in the invention regardless of the validity of any theory such as the foregoing.

As stated in the foregoing the benefits of the invention may be obtained through the use of the other alkali metal glyceroxides, to wit lithium, rubidium and cesium, although those of sodium and potassium are most desirable.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be

5

considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by the United States Letters Patent is:

1. A plug valve lubricant and sealant composition made from ingredients comprising substantially the following:

Ingredient:	Percentage range (Wt.)
Glycerol	78-89
Sodium carboxymethylcellulose.....	7-3
Water soluble vegetable gum powder.....	2-1
Sodium stearate	2-1
Detergent wetting agent	4-2
Starch	2-1
Animal glue	3-1
Sodium glyceroxide	0.75-3.75

2. The composition of claim 1 in which there is a stable dispersion of discrete small gas particles uniformly distributed throughout the composition in sufficient amount by volume to render the composition compressible to a fraction of its original volume and reexpandable.

3. A lubricant and sealant composition made from ingredients comprising substantially 78 to 89 percent by weight glycerol, substantially 3 to 7 percent by weight carboxymethylcellulose, substantially 2 to 4 percent by weight of a detergent wetting agent, and substantially 0.75 to 3.75 percent by weight of an alkali metal glyceroxide.

6

4. The composition of claim 3 in which the alkali metal glyceroxide is sodium glyceroxide.

5. The composition of claim 3 in which the carboxymethylcellulose is sodium carboxymethylcellulose.

6. A lubricant and sealant composition comprising as its essential ingredients a major portion of glycerol, substantially 3 to 7 percent by weight sodium carboxymethylcellulose, substantially 2 to 4 percent by weight of a detergent wetting agent, and substantially 0.75 to 3.75 percent by weight sodium glyceroxide.

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