United States Patent

Avery et al.

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[54] CORROSION INHIBITOR SYSTEM FOR FUNCTIONAL FLUIDS

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[52] **U.S. Cl.**.....**252/78,** 252/77, 252/389, 252/390

[51] **Int. Cl.**.....**C09k 3/00,** C23f 11/16

[58] **Field of Search**.....252/70–75, 77, 252/78, 389, 390, 393; 260/340.2

[56] **References Cited**

UNITED STATES PATENTS

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2,799,659	7/1957	Mayhew et al.	252/77 X
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3,334,054	8/1967	Howard et al.	252/75 X
3,338,835	8/1967	Wright	252/77 X
3,341,456	9/1967	Sawyer	252/75 X
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[57] **ABSTRACT**

The SAE corrosion specifications and other SAE specifications for functional fluids are met by the use of an effective amount of an inhibitor system consisting essentially of:

0–81.4% *n*-dodecyldimethylamine
0–81.4% *t*-butylamine
16.6–98% Phosphite ester of an alkylated phenol
1.8–83% Polymerized trimethyl dihydroquinoline
0.2–9.4% Benzotriazole

by weight.

6 Claims, No Drawings

1309

CORROSION INHIBITOR SYSTEM FOR FUNCTIONAL FLUIDS

BACKGROUND OF THE INVENTION

The development of low hygroscopic functional fluids has been severely impaired by the absence of a compatible corrosion inhibitor system that will meet the SAE specifications.

SUMMARY OF THE INVENTION

According to the present invention, the SAE corrosion specifications as well as other SAE specifications are met in low hygroscopic and higher hygroscopic functional fluids by the addition of a effective amount of a corrosion inhibitor consisting essentially of:

0–81.4%	n-Dodecyldimethylamine
0–81.4%	t-Butylamine
16.6–98%	Phosphite ester of an alkylated phenol, hereinafter PEAP, such as that sold under the trade name SANTOLUBE 31 as described in U.S. Pat. No. 3,338,835 which is a tri(tertiary-amylphenyl)phosphite containing up to 10 weight percent dicyclohexyl amine
1.8–83%	Polymerized trimethyl dihydroquinoline, hereinafter TMDHQ, such as that sold under the trade name AGERITE RESIN D or VANLUBE RD as described in U.S. 3,338,835
and	
0.2–9.4%	Benzotriazole.

As a preferred embodiment of the present invention, the corrosion inhibitor may contain by weight:

17–56%	n-dodecyldimethylamine
17–56%	t-Butylamine
11–48%	PEAP
2–16%	TMDHQ
0.5–2.3%	Benzotriazole.

The corrosion inhibitor of the invention may be added to a functional fluid in any effective amount. The amount required for adequate protection varies as the inhibitor is used in different fluid systems; however, as a general rule amounts of about 0.25 to 5 percent by weight of the functional fluid are acceptable with amounts of 0.5 to 1 percent usually being sufficient to meet the corrosion standards of the SAE.

The functional fluid of the present invention may be any of the functional fluids that are generally used, particularly those based predominantly on polyoxyalkylene glycols, polyoxyalkylene glycol esters, polyoxyalkylene glycol ethers, alkylene carbonates and the like.

The low hydroscopic functional fluids are of special interest in the invention. These fluids are distinguished from other functional fluids by the absence or low concentration of free hydroxyl groups. Thus, the glycol ethers, glycol esters and alkylene carbonates form the basis for most such fluids.

In a preferred embodiment of the present invention, the basic functional fluid is an alkylene or polyoxyalkylene glycol ether or ester and a cyclic alkylene carbonate. The ether may suitably contain one to six oxyalkylene units of two to four carbon atoms each capped with one or two alkyl ether groups of one to six carbon atoms each. Thus, suitable glycol ethers include the mono and di methyl, ethyl, propyl, butyl and hexyl ethers of the mono and polyoxyethylene, -propylene and -butylene glycols containing up to about six oxyalkylene groups.

By reacting the alkylene or polyoxyalkylene glycol with a carboxylic acid, the glycol esters may be formed. One or two carboxylic acid groups of up to six carbon atoms each may suitably be used to form the glycol ester. The polyoxyalkylene glycol may contain up to about six oxyalkylene groups of two to four carbon atoms each. Thus, the glycol esters suitable for the functional fluid may suitably include the mono through hexaoxyethylene, -propylene and -butylene mono and di acetates, propionates, butyrates, and hexanoates and the like.

The glycol ether or ester in the preferred functional fluid of the invention may suitably comprise 50 to about 100% of the fluid with 60 to 95% being preferred.

The second component of the preferred low hygroscopic functional fluid is the cyclic alkylene carbonate. These may suitably be the cyclic ethylene, propylene or butylene carbonates. While the vicinal alkylene carbonates are preferred, the 1,3- and 1,4-alkylene carbonates are also useful. The cyclic carbonate may comprise 0.1 to 30% of the fluid with 3 to 20% being preferred.

In the preferred functional fluid of the invention, less than about 25% by weight may suitably be a polyglycol. Although the presence of a polyglycol diminishes the low hygroscopic properties of the fluid due to its free hydroxyls, the polyglycol may be added to obtain other desired properties. These polyglycols are polyoxyethylene, polyoxypropylene and polyoxybutylene glycols having a molecular weight of 400–4,000.

SPECIFIC EMBODIMENTS

Example 1

A functional fluid consisting of 72% by weight of tetraoxyethylene glycol dipropionate, 18% of cyclic vicinal propylene carbonate and 10% of a polyoxypropylene glycol having an average molecular weight of 2,000 was examined under SAE tests 7OR1 and 7OR3. After this standard was run, 0.76% by weight of the following composition was added:

33%	n-dodecyldimethylamine
33%	t-butylamine
26.4%	PEAP
6.6%	TMDHQ
1.0%	Benzotriazole.

The same tests were run, and the results of these tests are compared in Table I.

TABLE I

Test	Requirements 70R1 and 70R3	Results: Without Inhibitors	Results: With Inhibitor system
Corrosion, (weight loss in mg./sq. cm.):			
Tinned iron	Max. 0.2	0	0.01.
Steel	Max. 0.2	0.28	0.00.
Aluminum	Max. 0.1	.06	0.00.
Cast iron	Max. 0.2	.30	+0.19 (gain).
Brass	Max. 0.4	.07	0.01.
Copper	Max. 0.4	.11	0.10.
Pitting or roughening of strips	Max. None	Yes, steel, Al, Fe.	None.
Jelling of fluid/water mixture	do		Do.
Crystalline deposit on glass jar walls or metal strips.	do		Do.
Sedimentation, percent by volume	Max. 0.10%		Do.
pH of water/fluid mixture	7–11.5	5.6	9.3.
Disintegration of rubber cup as evidenced by excessive tackiness or blisters.	Max. None		None.
Sloughing of rubber cup as evidenced by carbon black separation.	do		Do.
Decrease in hardness of rubber cup	Max. 15		9.
Increase in base diameter of rubber cup.	Max. 0.055 in.		0.020 in.

The corrosion inhibitor compositions of the invention are also effective in other functional fluid compositions such as those disclosed in U.S. Pat. Nos. 3,324,035; 3,062,747; 3,342,736 and 3,206,486.

We claim:

1. A low hygroscopic functional fluid consisting essentially of 50–100% by weight of a compound selected from the group

consisting of polyoxyalkylene glycol esters having one to six oxyalkylene units of two to four carbon atoms each capped with one or two carboxylic acid groups of up to six carbons each and polyoxyalkylene glycol ethers having one to six oxyalkylene units of two to four carbon atoms each capped with one or two alkyl groups of one to six carbons each, and mixtures thereof; a cyclic alkylene carbonate where the alkylene is selected from the group consisting of ethylene, propylene and butylene; less than about 25 percent by weight of a polyoxyalkylene glycol having a molecular weight of 400–4,000 where the polyoxyalkylene is selected from the group consisting of polyoxyethylene, polyoxypropylene and polyoxybutylene; and an effective amount to inhibit corrosion of a corrosion inhibitor composition consisting essentially of:

0–81.4% n-Dodecyldimethylamine
0–81.4% t-Butylamine
16.6–98% Tri (tertiary-amylphenyl) phosphite containing up to 10 weight percent dicyclohexyl amine.
1.8–83% Polymerized trimethyl dihydroquinoline
0.2–9.4% Benzotriazole

all parts being by weight.

2. The functional fluid of claim 1 wherein the corrosion inhibitor composition consists essentially of:

17–56%	n-dodecyldimethylamine
17–56%	t-butylamine
11–48%	Tri(tertiary-amylphenyl) phosphite containing up to 10 weight percent dicyclohexylamine
2–16%	Polymerized trimethyl dihydroquinoline
0.5–2.3%	Benzotriazole.

3. The functional fluid of claim 1 wherein the corrosion inhibitor constitutes 0.25 to 5% by weight of the fluid.

4. The functional fluid of claim 1 wherein the corrosion inhibitor constitutes 0.5 to 1% by weight of the fluid.

5. The functional fluid of claim 1 wherein the cyclic alkylene carbonate constitutes 0.1 to 30%.

6. The functional fluid defined in claim 1 wherein 60 to 95% by weight of the fluid is the ether or ester and 3 to 20% by weight is the cyclic alkylene carbonate.

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