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LUBRICANT

Clarence M. Loane and Bernard H. Shoemaker, Hammond, Ind., assignors to Standard Oil Company, Chicago, Ill., a corporation of Indiana

No Drawing. Original application September 17, 1937, Serial No. 164,310, which is a division of application Serial No. 108,832, November 2, 1936. Divided and this application December 18, 1939, Serial No. 309,828

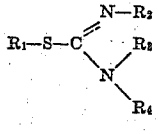
13 Claims. (Cl. 252—47)

This invention relates to lubricants and, in particular, to addition agents imparting to lubricants improved properties.

Our invention has particular utility in preventing and/or inhibiting the corrosion of "hard metal" alloy bearing such as copper-lead, cadmium-nickel, and cadmium-silver bearings which, to a large extent, have replaced soft metal bearings such as Babbitt metal in the trend toward internal combustion engines having high compression ratios and having increased acceleration and increased speed characteristics. The use of the "hard metal" bearings has created lubrication and corrosion problems, particularly in connection with "highly refined" oils some of which may be very corrosive to the "hard metal" bearings.

By "highly refined" lubricating oils we mean viscous oils which have a minimum viscosity in the range of S. A. E. 10 oils and which have been subjected to such refining processes, for example, solvent extraction, that the paraffinicity of the oil is markedly increased. It has been found that highly refined lubricating oils cause corrosion to alloy bearings of the cadmium-silver type to the extent of 5 mg./cm.^{2} and even greater when such bearings are submerged for 25 hours or less in an air agitated oil which has been preoxidized at about 340° F. for 25 to 50 hours. The motor oils may be highly refined lubricating oils as such or mixtures of highly refined lubricating oils with less highly refined lubricating oils, or stated in another way, mixtures of corrosive oils and non-corrosive oils, examples of the latter being lubricating oil fractions from Winkler crude or crudes of the Winkler type.

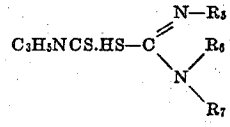
We have found that corrosiveness is inhibited and highly desirable properties are imparted to lubricating oils by adding thereto up to 1%, but preferably 0.05% to 0.75% of certain organic materials, particularly aliphatic or open chain organic compounds containing nitrogen, oxygen and/or sulfur, such as the pseudo thioureas having the general formula



in which R_1, R_2, R_3 and R_4 may be hydrogen or an alkyl radical, or an alkylene radical or an aryl radical or other hydrocarbon radical such as

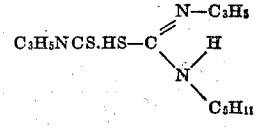
Cetyl pseudo thio urea,
Lauryl pseudo thio urea,
Naphthyl pseudo thio urea.

We have also found that the condensation products of a thio urea and mustard oil are very effective for the purposes contemplated within our invention. These condensation products, which have the general formula

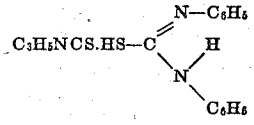


in which R_5, R_6 and R_7 may be hydrogen, an alkyl radical, an alkylene radical or an aryl radical or other hydrocarbon radicals, may be prepared by heating together equivalent molecular quantities of mustard oil and thiourea on a steam bath until the odor of the mustard oil is no longer detected.

The symmetrical amyl allyl thiourea-mustard oil condensation product having the formula



and the thio carbanilide-mustard oil condensation product having the formula



prepared as above described are very effective.

Since these compounds are subjected to high temperature conditions it is highly desirable that compounds of the aforementioned type having boiling points of about 400° F. or greater be used.

The effectiveness of compounds of the above type as corrosion inhibitors is demonstrated by the following examples in which they were subjected to one or more different sets of conditions, each of which is more severe than those en-

countered in the actual operation of internal combustion engines.

Method I.—By this method a "highly" refined oil, to which the corrosion inhibitor is to be added, is preoxidized for either 25 hours or 50 hours by air agitating the same at about 341° F. The corrosion inhibitor and the weighed bearings are placed in the preoxidized oil and the oil air-agitated at about 341° F. The bearings are removed at periodic intervals, washed free of oil and the loss in weight determined.

Method II.—By this method the weighed bearings are placed in a "highly" refined oil containing the inhibitor which is air-agitated at about 341° F. At periodic intervals the bearings are removed from the oil bath, washed free of oil and the loss in weight determined. Each time before being replaced in the oil bath the bearings are polished bright and reweighed and again tested for predetermined periods. This method differs from Method I in that the test is started with an unoxidized "highly" refined oil and the test bearings are polished at predetermined intervals.

In each of the above methods the oil used was a motor oil refined to such an extent that a loss in weight of more than 5 mg./cm.^{2} was obtained in 25 hours or less on a cadmium-silver alloy bearing submerged in an air-agitated oil at 340° F., which oil had been preoxidized for 25–50 hours at about 340° F.

In Table I are tabulated the results obtained with representative compounds when tested according to the above described test Method I.

Table I

Oil	Loss in mg./cm.^{2} in—	
	3 hrs.	24 hrs.
Control	4.3	43.0
Control +0.2% cetyl pseudo thiourea	0.0	0.0

In Table II are the results obtained with several representative compounds when tested according to the above described test Method II.

Table II

Oil	Loss in mg./cm.^{2}		
	Periods, hrs.		
	1st 24	2nd 6	3rd 16
Control	3.6	5.0	20.5
Control+0.2% Sym amyl allyl thiourea mustard oil	0.0	0.0	0.0
Control+0.2% cetyl pseudo thiourea	0.0	0.0	0.0
Control+0.2% thiocarbanalide-mustard oil	0.0	0.0	0.1

While we have described in detail the use of the hereinbefore mentioned compounds as corrosion inhibitors in "highly" refined lubricating oils, we contemplate the use of up to 10% of these compounds in lubricating oils whether "highly" refined or not, for the purpose of improving the film strength thereof and to impart to lubricants improved extreme pressure characteristics. These compounds may also be used to improve the lubricity and other desirable properties of lubricating oils.

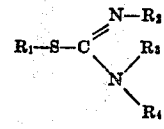
Some of the hereinbefore named compounds may not be completely soluble in the lubricant, in which case effective results are obtained by suspending the inhibitor in the lubricant by means of a small amount of a peptizing agent such as aluminum naphthenate, aluminum stearate, etc.

This application is a division of our co-pending application Serial Number 164,310 filed September 17, 1937, now U. S. Patent No. 2,209,464, issued July 30, 1940, which is a division of our then co-pending application Serial Number 108,832, filed November 2, 1936, and now United States Patent Number 2,160,880, issued June 6, 1939.

We do not limit ourselves to the specific embodiments of our invention herein described except as defined by the appended claims.

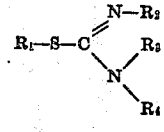
We claim:

1. A lubricant containing from about 0.05% to about 10% of an organic compound selected from the group consisting of (1) pseudo thiourea derivatives having the general formula



in which R_1, R_2, R_3 and R_4 are substituents selected from the group consisting of hydrogen and hydrocarbon radicals and (2) the condensation products of thioureas and mustard oil.

2. A corrosion inhibited lubricating oil adapted for use in the presence of hard metal alloy bearings having the corrosive susceptibility of alloys of the class consisting of cadmium-silver alloys, cadmium-nickel alloys, and copper-lead alloys, comprising a highly refined mineral lubricating oil normally corrosive to such alloys, and a small but sufficient amount to inhibit the corrosion of said alloy bearings of an organic compound selected from the group consisting of (1) pseudo thiourea derivatives having the general formula



in which R_1, R_2, R_3 and R_4 are substituents selected from the group consisting of hydrogen, and hydrocarbon radicals, and (2) the condensation products of thioureas and mustard oil.

3. A lubricant comprising a mineral lubricating oil and from about 0.05% to about 10% of a pseudo thiourea.

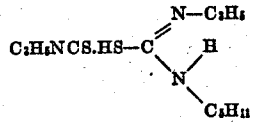
4. A lubricant comprising a mineral lubricating oil normally corrosive to alloys having the corrosive susceptibility of alloys of the class consisting of cadmium-silver alloys, cadmium-nickel alloys, and copper-lead alloys, and a pseudo thiourea added in amounts sufficient to render said mineral lubricating oil non-corrosive to said alloy.

5. A lubricant as described in claim 4 in which the pseudo thiourea is cetyl pseudo thiourea.

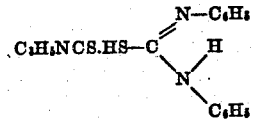
6. A lubricant comprising a mineral lubricating oil normally corrosive to alloys having the corrosive susceptibility of alloys of the class consisting of cadmium-silver alloys, cadmium-nickel alloys, and copper-lead alloys and condensation product of a thiourea and mustard oil added in amounts sufficient to render said mineral lubricating oil non-corrosive to said alloys.

7. A lubricant as described in claim 6 in which

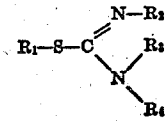
the thiourea-mustard oil condensation product has the general formula



8. A lubricant as described in claim 6 in which the thiourea-mustard oil condensation product is a condensation product of thiocarbanalide and mustard oil having the general formula



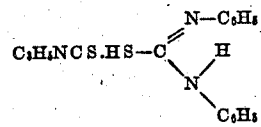
9. The method of preventing the corrosion of hard metal alloy bearings having the corrosive susceptibility of alloys of the class consisting of cadmium-silver, cadmium-nickel and copper-lead alloys by a highly refined mineral lubricating oil which comprises adding to said oil normally corrosive to said alloys a small but corrosion inhibiting amount of an organic compound selected from the group consisting of (1) pseudo thiourea derivatives having the general formula



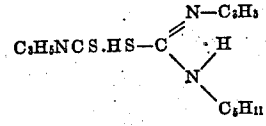
in which R_1, R_2, R_3 and R_4 are substituents selected from the group consisting of hydrogen and hydrocarbon radicals, and (2) the condensation products of thioureas and mustard oil.

10. The method described in claim 9 in which the pseudo thiourea is cetyl pseudo thiourea.

11. The method described in claim 9 in which the thiourea-mustard oil condensation product is the condensation product of thiocarbanalide and mustard oil having the general formula



12. The method described in claim 9 in which the thiourea-mustard oil condensation product has the general formula



13. A lubricant containing from about 0.05% to about 10% of the condensation product of a thiourea and mustard oil.

CLARENCE M. LOANE.
BERNARD H. SHOEMAKER.