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METHOD OF LUBRICATING BEARING SURFACES

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4 Claims. (Cl. 87—9)

This invention relates to methods of lubricating bearing surfaces; and it comprises a method of lubricating bearing surfaces by means of a lubricating oil of the petroleum type containing a minor amount, usually less than one per cent, of tributyl phosphite serving to prevent decomposition of the oil in storage and in use; as more fully hereinafter set forth and as claimed.

This application is a division of my copending application Serial No. 49,442, filed November 12, 1935.

In use and in storage all petroleum lubricating oils tend toward deterioration with various chemical and physical changes; formation of acids, increase in carbon residue and increase in viscosity. At high temperatures these changes are more rapid and far going. I find that metals, in general, accelerate the deterioration of petroleum lubricating oils and that conversely, as the oils deteriorate they attack metal surfaces and particularly bearing surfaces. This is more noticeable when the bearing metals are of the sensitive type, as for instance certain modern alloys of cadmium with other metals.

I have found that the presence of a small amount of tributyl phosphite, usually less than one per cent, serves to prevent decomposition of petroleum lubricating oils in storage and use and stabilizes the oil against oxidation in the presence or absence of metals. The reason for this action is not evident and I content myself with noting the results. While tributyl phosphite is exceptionally suitable, other esters of aliphatic alcohols are also good addition agents.

I have found that a lubricating oil containing tributyl phosphite is stabilized effectively in storage and in use irrespective of the previous conditions in refining and of the presence or absence of metals. Since high refining is desirable for other reasons, I regard my invention as most advantageous with the highly refined oils.

Tributyl phosphite is a liquid, sufficiently soluble in oil for my purposes, and its addition to lubricating oil is a simple mixing operation. Usually one per cent by volume or less of tributyl phosphite added to lubricating oil achieves my purpose. Good grades of Pennsylvania and Mid-Continent lubricating oils refined by sulfuric acid, by solvent extraction, or by aluminum chloride, with an addition of one per cent or less by volume of tributyl phosphite give a lubricating composition not rapidly developing acidity, not corroding bearings and not developing undue viscosity when used in automotive bearings. Desirable characteristics gained by refining to a high degree of paraffinicity are not impaired.

Lubricating oils containing tributyl phosphite as a stabilizing agent evince great permanence both under conditions of use and when subjected to accelerated laboratory tests. One accelerated laboratory test was made on a Pennsylvania type lubricating oil containing 0.1 per cent by volume of tributyl phosphite. This particular oil had been refined by the aluminum chloride process and had the following characteristics:

Gravity °A. P I.	31.2
Viscosity in seconds by the Saybolt Universal viscometer at 100°	371.0
S. U. V. at 210° F.	56.8
Viscosity index (as determined by Dean and Davis Chem. & Met. 36, 618 (1929)	100.0
Carbon residue (%)	0.06
Neutralization No. (mgm. KOH required to neutralize 1 gm. sample)	0.1

For comparative purposes this oil was treated with and without the addition of the tributyl phosphite. Calling the untreated oil "A" and the treated oil "X", in one test 10 cc. samples each of A and X were placed in 15 cc. glass tubes open at the top. The tubes were then suspended in an oil bath in such a manner as to bring the surface of the bath near the top of each tube. The bath was maintained thermostatically at a temperature of 350° F. The samples were given time to reach the bath temperature, after which oxygen was bubbled through each sample at a controlled rate of 470 cc. per hour by means of glass capillaries projecting downwardly to a point near the bottom of the sample tube. In each instance a 5 gram strip of cadmium-silver alloy was suspended in the sample by means of a fine copper wire.

The testing conditions were maintained for 20 hours after which the sample tubes were removed from the bath, allowed to cool and each sample tested by identical standard methods with the following results:

In the presence of 5 gm. strip of Cd-Ag alloy

	Oil A	Composition X
Viscosity at 210° F. seconds	Not viscous	58.9
Neutralization No.	5.7	0.55
Loss in weight (gms.) of Cd-Ag strip	0.1956	0.0000

The presence of the cadmium-silver alloy accelerated the deterioration of the oil "A" to such

an extent that the viscosity became too high to measure. On the other hand, the composition "X" containing only 0.1 per cent of tributyl phosphite increased only slightly in viscosity when subjected to the same conditions.

An increase in the neutralization number may be taken as an index of the formation of acid, and the loss in weight of the metal strip as an index of corrosion. With this in view, the results of the tests show that the addition of tributyl phosphite greatly improved the lubricating oil as regards stability.

While I have spoken more particularly of cadmium-silver alloys in bearing metals, inhibition of corrosion is also evidenced as regards other sensitive metal alloys used in bearings; cadmium-nickel, copper-lead, etc. My inhibition agent is also useful in alloys used with more common and less sensitive bearing metals such as steel, brass, babbitt, etc.

For the present purposes a lubricating oil may be taken to be one having a viscosity greater than 35 seconds S. U. V. at 100° F. and while I contemplate mainly stabilization of oils to be used as lubricants, stabilization is also useful when they are used for other purposes, as in transformers, and as quenching oils used after heat treatments as in cooling optical glass. Quenching oils are subjected to temperature extremes under conditions even more favorable to oxidation than those occurring in lubrication.

What I claim is:—

1. A method of lubricating bearing surfaces in internal combustion engines when subjected to conditions of operation which comprises maintaining between bearing surfaces, one of which is an alloy formed chiefly of a metal selected from the class consisting of cadmium and copper, a film of lubricating oil which initially produces an effective lubricating action but which would normally tend to corrode the aforesaid alloy, and maintaining the effectiveness of the lubricating oil by incorporating therein tributyl phosphite in a small but sufficient proportion substantially to retard the corrosion.

2. A method of lubricating bearing surfaces in internal combustion engines when subjected to conditions of operation, which comprises maintaining between bearing surfaces, one of which is an alloy formed chiefly of a metal selected from the class consisting of cadmium and copper, a film of lubricating oil which initially produces an effective lubricating action but which would normally tend to corrode the aforesaid alloy, and maintaining the effectiveness of the lubricating oil by incorporating therein up to 1.0 per cent of tributyl phosphite sufficient substantially to retard the corrosion.

3. A method of lubricating bearing surfaces which comprises maintaining between bearing surfaces, one of which is an alloy selected from the class consisting of cadmium-silver, cadmium-nickel, and copper-lead alloys, a film of lubricating oil which initially produces an effective lubricating action but which would normally tend to corrode the aforesaid alloy and maintaining the effectiveness of the lubricating oil by incorporating therein tributyl phosphite in a small but sufficient proportion substantially to retard the corrosion.

4. A method of lubricating bearing surfaces which comprises maintaining between the bearing surfaces, one of which contains a characterizing proportion of cadmium, silver, nickel, copper or lead, a film of lubricating oil which initially produces an effective lubricating action but which would normally tend to corrode the aforesaid surface and maintaining the effectiveness of the lubricating oil by incorporating therein tributyl phosphite in a small but sufficient proportion to substantially retard the corrosion.

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