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INHIBITED TURBINE OIL AND THE CORRO-
SIVE INHIBITOR THEREFOR

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This invention relates to lubricants and more particularly to addition agents which serve to render lubricating oils non-corrosive.

It is a matter of common experience in the art that lubricating oils in the presence of water have a tendency to corrode steel and other metal parts with which they come in contact in ordinary use, and that this phenomenon appears most pronounced with the highly and drastically refined petroleum lubricants to which agents have been added for the purpose of modifying their lubricating properties. Corrosion of this kind is particularly noticeable and troublesome in the operation of steam turbines where the lubricating oils are in continual contact with steam or water in almost all parts of the turbine system. It is readily apparent that such rusting, however slight, tends to unbalance the rotating parts of this delicate, precisely built machine, as well as to upset the operation of its governor and other critical elements.

The principal object of the invention is to provide an addition agent for lubricating oils which serves to inhibit corrosion of the metal parts over which the oil passes in normal usage and thus materially to reduce one of the most troublesome of all lubricating problems.

It is a further object of the invention to provide a steam turbine oil which retains all of its desirable and highly specialized lubricating characteristics while at the same time having no tendency to corrode the parts of the turbine in which it is used, either alone or in the presence of steam and water.

The corrosion inhibiting properties of sodium dichromate have long been well known and understood by those familiar with the art. This material has found little or no favor as a corrosion inhibitor for lubricating oils, however, because of its almost complete insolubility in these mineral lubricants. We have discovered that while the dichromate cannot be dissolved directly in refined petroleum oil, it is soluble to some extent in tributyl phosphate, and that a solution of these compounds is miscible in lubricating oils; and we have further discovered that a saturated solution of the dichromate in tributyl phosphate serves as a highly effective corrosion inhibitor for a lubricating oil to which it has been added.

In preparing our inhibitor we place a suitable quantity of sodium dichromate crystals in a container which is partially filled with tributyl phosphate, the quantity of dichromate being considerably in excess of that which can be dissolved

by the phosphate compound. This mixture is shaken or otherwise violently agitated at intervals over a period of several days, until such time as there appears to be no appreciable deepening of its color. This stabilization point indicates saturation of the tributyl, and when it is reached, we decant the liquid from the residual solids. The fresh solution has a deep orange-yellow color, which, in the presence of bright sunlight ultimately changes to a deep green. We have found it satisfactory to carry out the foregoing reaction at normal room temperatures, and with intermittent shaking or stirring of the mixture. It is recognized, however, that the speed of the reaction may be increased by heating the sodium dichromate and the tributyl phosphate, and perhaps by continuous violent agitation. Other steps may also be taken to speed the dissolution of the dichromate crystals, if that is desired.

The sodium dichromate-tributyl phosphate solution has proven highly effective as a corrosion inhibitor. In one test we took two sections of deep drawing sheet steel having bright surfaces, free of all scale and rust, as test samples. One of the samples was coated with a highly refined lubricating oil, and the other with the same oil to which had been added .75 percent, by volume, of the saturated dichromate solution. Both samples were suspended in a closed jar containing water, and placed in an oven which was held at a temperature of 100° F. After 24 hours there was an appreciable difference in the extent of corrosion of the samples, and at the conclusion of a 48-hour test it was readily evident that the first sample was severely corroded, whereas the second one exhibited no corrosion whatsoever.

In making up a turbine oil in accordance with the invention, we use as a starting product any suitable hydrocarbon oil having a viscosity and other characteristics suitable for steam turbine lubrication. Refined petroleum hydrocarbons and other mineral hydrocarbon oils are preferred, particularly the drastically and specially refined petroleum fractions to which have been added one or more modifying agents. The saturated solution of sodium dichromate in tributyl phosphate is added to these hydrocarbon oils at ordinary temperatures and in such proportion as to give a sodium dichromate content which will effectively inhibit corrosion of the turbine parts either by the oil alone or in the presence of steam and water. We have found that the addition of from 0.5 percent to about 5.0 percent by volume, of a saturated solution of the sodium dichromate and tributyl phosphate serves to render such oils com-

pletely non-corrosive in their normal uses as turbine lubricants.

The addition of our inhibitor does not affect the desirable properties of the lubricating oils in the slightest. Thus it does not reduce the pressure-resisting qualities of the lubricant, nor its chemical stability and freedom from gum-forming tendencies. Nor does it materially affect the steam emulsion number of the oil, nor the ease with which it may be separated from water. It does, however, completely inhibit corrosion tendencies.

Having described the preferred embodiment of our invention, what we claim as new is:

1. A corrosion inhibitor for mineral lubricating oils in which sodium dichromate is insoluble, consisting essentially of a saturated solution of sodium dichromate in tributyl phosphate, which solution is soluble in such lubricating oil.

2. A corrosion inhibited oil composition comprised mainly of a refined mineral lubricating oil, and a small percentage of a solution of sodium dichromate in tributyl phosphate, said sodium dichromate being present in said mineral oil in sufficient quantity to effectively prevent corrosion of steel parts.

3. A turbine oil composition comprised mainly of a refined mineral oil having a viscosity and

other properties suitable for turbine lubrication, and a small percentage of a solution of sodium dichromate in tributyl phosphate, said sodium dichromate being present in the lubricating oil in such quantities as effectively to inhibit corrosion of steam turbine parts.

4. A steam turbine oil composition comprising from 95 percent to 99.5 percent, by volume, of a refined hydrocarbon lubricating oil having a viscosity and other properties suitable to steam turbine lubrication, and from 5.0 percent to 0.5 percent by volume of a saturated solution of sodium dichromate in tributyl phosphate, said sodium dichromate being present in the composition in such proportion as effectively to inhibit corrosion of turbine parts.

5. A corrosion inhibited oil composition comprised mainly of a refined mineral oil in which sodium dichromate alone is insoluble, and from 0.5 to 5.0 per cent by volume of a saturated solution of sodium dichromate in tributyl phosphate, said sodium dichromate being present in the composition in such concentration as to inhibit corrosion of steel parts in the presence of water.

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