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TURBINE OIL

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This invention relates to the art of lubrication and is more particularly concerned with the lubrication of steam turbines employing conventional circulatory pressure systems of lubrication. The provision of new and novel lubricants and lubricating compositions having particular utility in turbine lubrication is likewise to be considered as encompassed within the broad scope and confines of the invention.

Mineral lubricating oil when employed in circulatory turbine lubricating systems, is subject to, and almost invariably undergoes, serious deterioration caused by heat and aeration, resulting in excessive sludge formation in the oil and eventually requiring shut-down of the turbine. Degradation of the oil per se in the manner aforesaid has now been substantially obviated through the use of small amounts of added inhibitors having the desired power of successfully retarding or mitigating oxidation and/or acid formation and consequent sludge formation in the oil.

Due to recent changes in design of steam turbines another difficulty in turbine operation, to which little attention heretofore had been paid, has become a serious problem. In circulating through the turbine the lubricating medium, whether it be mineral oil or deterioration-inhibited mineral oil of the type referred to, becomes unavoidably mixed with, or wetted by, steam condensate from the system. This entrained condensate in the course of lubricant circulation comes in contact with various metal parts of the turbine and occasions or tends to occasion rusting or corrosion thereof to greater or lesser degree. While generally objectionable such rusting is particularly serious in its effect upon steel parts of the governor control mechanism since an undue accumulation of rust may cause serious interference with its proper operation. In the older turbines of relatively low capacity and operated at relatively low temperatures, the speed at which the governor control mechanism operated frequently was sufficient to prevent much accumulation of rust; and consequently the water corrosion problem while present was usually ignored. In many new steam turbine installations of much higher capacity and operating at relatively high temperatures a new type of governor control mechanism is employed. The movement of this newer mechanism is extremely slow and this provides an opportunity for excessive accumulation of rust due to corrosion by the steam condensate entrained in the lubricant. The natural result of such rust accumulation is to cause the governor control mechanism to stick, and the turbine then has to be shut down for repair or replacement of parts.

It is an important objective of the present invention, therefore, to provide adequate means for solving the aforesaid problem of rust and corrosion of turbine parts. A further and more specific objective is the provision of new and novel lubricating compositions and their application to turbine parts to retard and inhibit corrosive action of entrained steam condensate. Included also within the broad objectives of the invention is the production of steam turbine lubricating oil compositions treated with and containing addition agents which exhibit inhibiting action in respect of corrosive or rusting tendencies of steam condensate entrained in the lubricant, but which do not deleteriously affect the lubricating and other qualities of the oil.

These and other objectives are attained through the addition to turbine lubricating oil of a small amount of a saturated long chain fatty acid, or of mixtures thereof. Preferably, although not necessarily, the saturated fatty acid addition agents coming within the scope of the present invention are substantially water-insoluble, have from about 10 to about 20 carbon atoms in the chain and are exemplified by, but not limited to, the following illustrative compounds:

Lauric acid	$C_{11}H_{23}COOH$
Myristic acid	$C_{13}H_{27}COOH$
Palmitic acid	$C_{15}H_{31}COOH$
Stearic acid	$C_{17}H_{35}COOH$

It is a prerequisite of turbine oil addition agents that the action thereof does not deleteriously affect in any way the good demulsibility value of refined turbine oil. Long chain fatty acids employed as corrosion inhibitors in turbine oils in accordance with the present invention do not impair the demulsibility of the oil. This has been confirmed by actual tests using varying small amounts of stearic acid in a moderately refined, solvent treated oil. In all instances the demulsibility value at 130° F. was the same for the treated oil as for the untreated oil.

In the practice of the present invention any suitable turbine oil base may be employed, the invention being in no wise limited in this respect since the long chain fatty acids exhibit corrosion inhibiting function regardless of the type of turbine oil employed. Preferably, the oil is a light, moderately refined, solvent treated petroleum distillate having a 150–160 vis. at 100° F. As

pointed out hereinbefore, it is within the scope of the present invention to employ turbine oils previously inhibited in respect of oxidation or other oil deterioration. In this latter instance, addition of acids for the purpose of corrosion inhibition in no way influences or affects the action of the oxidation inhibitor in the oil composition. The long chain fatty acids added for anti-rusting purposes likewise are unaffected in the performance of their intended function by the coincident presence of an oxidation inhibitor. Comparative stability tests (the conventional Funk test) showed a turbine oil containing an oxidation inhibitor and a corrosion inhibitor to be fully as stable as a turbine oil containing the same oxidation inhibitor but uninhibited against corrosion.

The long chain saturated fatty acids may be added to the turbine oil in any suitable corrosion inhibiting proportions. Ordinarily, concentrations of inhibitor as low as 0.02% are effective and recommended proportions range from 0.02% to 0.1%. In some instances larger or smaller amounts may be employed, but in no case should the neutralization number of the treated turbine oil be raised sufficiently to cause acid corrosion of the metal parts. The particular proportions employed depend upon the particular saturated fatty acid and the turbine oil compounded therewith, as well as the particular type of lubricant desired. It should be clearly understood, therefore, that the invention is not specifically limited with respect to proportions.

The saturated fatty acid addition agents may be incorporated into turbine oil in any suitable manner. The acid may be dissolved in the oil simply by mixing the acid with the oil and agitating the mixture until a uniform solution is obtained. In the amounts here employed, the acids are readily and completely soluble in turbine oils. In some instances a slight warming of the oil mixture during agitation facilitates solution. Warming to temperatures between 100° F. and 180° F. is usually sufficient.

It is also within the scope of the present invention to dissolve the acid in a part of the turbine oil to form a master batch, which may be subsequently blended with additional turbine oil to give the concentration of acid desired in a particular turbine lubricating system. These master batches are useful in improving the lubricant of a turbine which has previously been operated with ordinary turbine oil.

The efficacy of the saturated fatty acid corrosion inhibitors in turbine oils has been established through test. For example, a light turbine oil of 150–160 vis. at 100° F. containing 0.05% stearic acid was found to be 100% effective in preventing corrosion in the presence of water. The test method employed consisted in adding a small polished cold rolled steel bar or rod to the oil composition and stirring the oil for ten minutes after which 1% water was added. Stirring was continued for eight hours daily for five days and then the steel specimen was withdrawn and examined visually for corrosion. No rust spots were discerned. This is in contradistinction to the results of the same experiment carried out without the fatty acid addition, in which case rust spots formed within thirty minutes of the immersion of the steel specimen.

I claim:

1. Turbine oil composition comprising a hydrocarbon mineral oil, an oxidation inhibitor and an inhibitor effective to retard corrosion of turbine parts by entrained water.

2. Turbine oil composition comprising a hydrocarbon mineral oil, an oxidation inhibitor and a monocarboxylic saturated long chain fatty acid in an amount sufficient to retard corrosion of turbine parts by entrained water.

3. Turbine oil composition comprising a hydrocarbon mineral oil, an oxidation inhibitor and stearic acid.

4. Turbine oil composition comprising a hydrocarbon mineral oil, an oxidation inhibitor and myristic acid.

5. Turbine oil composition comprising a hydrocarbon mineral oil, an oxidation inhibitor and lauric acid.

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