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MINERAL OIL LUBRICATING COMPOSITIONS

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The present invention relates to improved mineral oil compositions and, particularly, to novel liquid compounded lubricating oil compositions possessing rust-preventive properties. More particularly, the invention relates to such compositions suitable for lubrication of steam turbines and containing components that markedly improve the compositions with respect to preventing rusting of metal components of the turbine.

The compositions embodied herein comprise a mineral oil in major amount, based on the weight of the composition, and a small but rust-inhibiting amount of an oil-soluble combination additive comprising a half amide-ester of an aliphatic dicarboxylic acid and an oil-soluble heterocyclic carbon compound containing a hetero-N-atom. With reference to the mineral oil component of the compositions embodied herein, use is contemplated of mineral oil fractions of lubricating grade, derived from any of a variety of crudes, and which fractions should desirably be improved with respect to rust-preventive characteristics. In particular, however, the invention relates to use, as the mineral oil fraction, of highly refined lubricating oil fractions produced by solvent extracting, acid treating or other methods known to those skilled in the art for removal of more-aromatic components from mineral oil lubricating fractions to provide highly refined lubricating oils of more paraffinic nature than the fraction subjected to the refining treatment. Although it is not intended that the invention be limited thereto, a preferred embodiment relates to compositions comprising, as the mineral oil component, a highly refined solvent extracted oil of lubricating grade produced by furfural extraction of a lubricating oil distillate fraction and an illustration of which is an oil such as the turbine oil used in preparation of the compositions set forth hereinafter in further description of the invention.

As set forth hereinbefore, one of the additive components of the compositions embodied herein is an oil-soluble half amide-ester of an aliphatic dicarboxylic acid, i. e. aliphatic dicarboxylic acids in which one carboxyl group has been esterified with an aliphatic alcohol and the other carboxyl group has been converted to an amide grouping in which at least one of the two hydrogen atoms linked to the amide nitrogen atom is substituted by an

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aliphatic radical. Illustrative of such a component are half amide-esters of acids such as succinic acid, glutaric acid, adipic acid, suberic acid, and the like, as well as alkylated derivatives of other acids such as aforesaid. As to the esterified portion of the half amide-ester compounds, contemplated herein are such compounds that contain, as an aliphatic residue of an esterifying alcohol, an aliphatic group of from about four to about 20 carbon atoms and, more preferably, from about 8 to 20 carbon atoms. As to the amide portion of the half amide-ester compounds, contemplated herein are such compounds wherein at least one of the hydrogen atoms linked to the nitrogen atom has been substituted by an aliphatic group, preferably an alkyl group of about four to about twenty carbon atoms. With reference thereto, and as the half amide-esters contemplated are those soluble in mineral oil lubricating fractions in amounts which, though small, are sufficient to provide the desired rust preventive properties when used in combination with the aforesaid heterocyclic compound, the number of carbon atoms present in either or both the ester grouping and substituted amide grouping should be sufficient to impart such solubility characteristics to the half amide-esters. For purposes of illustration and not limitation, such half amide-esters include the lauryl ester of N-hexyl succinamic acid, the octadecyl ester of N-hexyl succinamic acid, the dodecyl ester of N-hexadecyl adipamic acid, the lauryl ester of N,N-dihexyl succinamic or adipamic acid, the octadecyl ester of N-hexyl alkenylated succinamic acid, and others.

The other additive component is an oil-soluble heterocyclic carbon compound containing a hetero-N-atom and hydrocarbon substituted derivatives thereof. In particular, the invention embodies such compounds of the type wherein the ring atoms are saturated as illustrated by compounds such as pyrrolidines and piperidines and hydrocarbon-substituted derivatives thereof, e. g., 2-methyl piperidine, 1-ethyl piperidine, 1-amyl piperidine, 1-dodecyl piperidine, 3-ethyl piperidine, 1-phenyl piperidine, 1,2-dimethyl pyrrolidine, 1,3-dimethyl pyrrolidine, and the like.

In order to further describe the invention by way of illustration and not limitation, the following tabulation sets forth compositions prepared by dissolving, in a turbine lubricating oil (150 SUS at 100° F.) prepared by furfural extraction of a petroleum lubricating oil distillate, the amounts shown (weight percent) of the half amide-esters and heterocyclic compounds as embodied herein. The tabulation also sets forth the results obtained by subjecting the compositions to the test, known as ASTM D-665-52T, for determining rust-preventive characteristics. Briefly, the test provides that polished cylindrical steel specimens be partially immersed in a bath maintained at 140° F., and composed of 300 ml. of lubricant and 30 ml. of distilled water, and observing the time required for rusting, if any, to occur on the immersed portion of the steel specimens. Compositions that inhibited rusting for twenty-four hours under the test conditions were considered as satisfactorily passing the rusting test.

COMPOSITION					
No.	Half Amide-Ester		Heterocyclic Nitrogen Compound		
	Octadecyl ester of N-hexyl succinamic acid	Lauryl ester of N-hexyl succinamic acid	Pyrrolidine	1-ethyl piperidine	Piperidine
1			0.0033		
2	0.05				
3	0.05		0.0033		
4				0.0033	
5	0.05			0.0033	
6		0.1			
7					0.0033
8		0.1			0.0033
9		0.05			0.0033
10	0.05				0.0033
11		0.1	0.0033		

ASTM
D-665-52T
Rusting
test (dis-
tilled water)

As is apparent from the foregoing tabulation, the oil compositions containing the half amide-esters per se (compositions Nos. 2 and 6) or the compositions containing the heterocyclic nitrogen compounds per se (compositions Nos. 1, 4 and 7), but not a combination thereof, imparted little, if any, rust-preventive characteristics whereas use of the additive components in combination provided highly effective protection against rusting (compositions Nos. 3, 5, 8, 9, 10 and 11) and the results shown evidence the substantial more than additive protection obtained by practice of this invention.

As is further apparent from the foregoing tabulation, a marked improvement in rust-preventive characteristics is imparted to the mineral oil composition by dissolving therein a small amount of the combination additive. In setting forth compositions containing the half amide-ester and heterocyclic compounds in the specific amounts shown, such amounts have been used as illustrations of concentrations suitable for practice of the invention. It should be understood, however, that amounts other than those specifically set forth are contemplated as, for example, a combination in amounts of from about 0.02 to about 1.0% by weight of the composition. The relative proportion of the half amide-esters to heterocyclic compounds in the combination additive may also be varied, depending upon particular requirements with the actual proportion employed being such that, for a particular mineral oil composition, the combination additive comprises a proportional amount of the half amide-esters to heterocyclic compound such that a more-than-additive degree of rust preventive characteristics is obtained by use of the combination additive. Although, as aforesaid the relative proportion of the half amide-esters to heterocyclic compound may be varied to meet particular requirements, the ingredients are usually employed in amounts of one part of the heterocyclic compound to from about one to about forty parts of the half amide-ester and, preferably, one part of the heterocyclic compound to from about five to thirty parts of the half amide-ester.

Although the present invention has been described in conjunction with certain preferred embodiments thereof, those skilled in the art will recognize that variations and modifications can be made. Such modifications and variations are to be considered to be within the purview of the specification and scope of the appended claims. Moreover, it should be understood that compositions as embodied herein may also contain additional ingredients for imparting other desired properties to the compositions. In illustration, the compositions may contain anti-foam agents, e. g. of the silicone type, viscosity index improvers such as the polyisobutylenes, pour point de-

pressants such as the wax alkylated naphthylenes, and others.

I claim:

1. A lubricating oil composition comprising a mineral oil of lubricating grade in major amount based on the weight of the composition, a small amount of an oil-soluble half amide-aliphatic hydrocarbon ester of an aliphatic hydrocarbon dicarboxylic acid, said half amide-ester being characterized in that its amide portion contains an aliphatic hydrocarbon group as a substituent for at least one of the hydrogen atoms linked to the amide nitrogen atom, and a small amount of an oil-soluble heterocyclic carbon compound in which nitrogen is the hetero-atom, said composition being characterized by containing from about 0.02 to about 1.0% as the combined weight of said half amide-ester and heterocyclic compound in a weight ratio of said half amide-ester to heterocyclic compound to impart to said composition rust-preventive characteristics in excess of the individual effectiveness of said half amide-ester and heterocyclic compound, said half-amide ester being a compound in which one carboxyl group of an aliphatic dicarboxylic acid from the group consisting of succinic, glutaric, adipic and suberic acids is esterified with an aliphatic radical containing about 4 to about 20 carbon atoms and in which the amide portion of the ester contains an alkyl group of about 4 to about 20 carbon atoms substituted for at least one of the nitrogen-linked hydrogen atoms, and said heterocyclic compound being selected from the group consisting of piperidine, pyrrolidine and 1-ethyl piperidine.

2. A lubricating oil composition comprising a mineral oil of lubricating grade in major amount based on the weight of the composition and a small amount, sufficient to impart rust-preventive characteristics to said composition, of an oil-soluble rust-inhibiting additive, said additive comprising a half amide-aliphatic hydrocarbon ester of an aliphatic hydrocarbon dicarboxylic acid, said half amide-ester being characterized in that its amide portion contains an aliphatic hydrocarbon group as a substituent for at least one of the hydrogen atoms linked to the amide nitrogen atom, and an oil-soluble saturated heterocyclic compound in which nitrogen is the hetero-atom and characterized by containing said half amide-ester in a weight ratio relative to said heterocyclic compound of one part of the heterocyclic compound to from about one to about forty parts of the half amide-ester, said half-amide ester being a compound in which one carboxyl group of an aliphatic dicarboxylic acid from the group consisting of succinic, glutaric, adipic and suberic acids is esterified with an aliphatic radical containing about 4 to about 20 carbon atoms and in which the amide por-

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tion of the ester contains an alkyl group of about 4 to about 20 carbon atoms substituted for at least one of the nitrogen-linked hydrogen atoms, and said heterocyclic compound being selected from the group consisting of piperidene, pyrrolidine and 1-ethyl piperidine.

3. A lubricating composition comprising a mineral oil of lubricating grade in major amount based on the weight of the composition and from about 0.02 to about 1.0% by weight of an oil-soluble additive consisting essentially of a half amide-alkyl ester of an aliphatic hydrocarbon dicarboxylic acid, said amide-ester being characterized in that its amide portion contains an alkyl substituent for at least one of the hydrogen atoms linked to the amide nitrogen atom, and an oil-soluble saturated heterocyclic compound in which the hetero atom is nitrogen in a weight ratio of one part of said heterocyclic compound to from about one to about forty parts of said half amide-ester, said half-amide ester being a compound in which one carboxyl group of an aliphatic dicarboxylic acid from the group consisting of succinic, glutaric, adipic and suberic acids is esterified with an ali-

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phatic radical containing about 4 to about 2.0 carbon atoms and in which the amide portion of the ester contains an alkyl group of about 4 to about 20 carbon atoms substituted for at least one of the nitrogen-linked hydrogen atoms, and said heterocyclic compound being selected from the group consisting of piperidene, pyrrolidine and 1-ethyl piperidine.

4. A composition, as defined in claim 1, in which said half-amide ester is the octadecyl ester of N-hexyl succinamic acid.

5. A composition, as defined in claim 1, in which said half-amide ester is the lauryl ester of N-hexyl succinamic acid.

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