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(54) **LUBRICATING OIL COMPOSITION.**

(57) A lubricating oil-composition which is obtained by compounding a base oil with a specific amine and at least one compound selected from among sulfonates, phenates and salicylates is disclosed. This composition is excellent in stain resistance and is favorably used for, particularly, working of bearings or super-finish working.

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DESCRIPTION

Lubricating Oil Composition

TECHNICAL FIELD

This invention relates to a novel lubricating oil composition, more particularly to a lubricating oil composition for metal working which is suitable as a processing oil for super finishing processing or bearing processing and has excellent stain resistance so that stain will not be generated not only in the absence of sulfur type extreme pressure agents but also in the presence of such agents.

BACKGROUND ART

Generally in metal working such as cutting or grinding of metal, load applied on frictional surfaces increases, and extrusions between metals break the adsorption oil film and come into contact with each other. As a result, surface temperature rises, and the adsorbed oil film is destroyed and causes seizure or scuffing. Thus, an extreme pressure agent has been conventionally incorporated in a lubricating oil for metal working to decrease friction to ensure that the lubricating oil will not lose lubricating properties under such a condition.

Cutting or grinding of metal is characterized in that temperature rises greatly and a fresh surface always appears upon cutting or grinding. Therefore, such an extreme pressure agent is required to have sufficient durability against the rise in temperature on friction surfaces and to

react rapidly with the friction surfaces so that fresh metal surfaces which will be generated successively can be covered quickly with the lubricating film of the extreme pressure agent. For that reason, a sulfur type or chlorine type agent having high activity is generally used under very high temperature conditions.

As the sulfur type extreme pressure agent, there are used, for example, sulfur simple substance, a sulfide, a sulfurized fat and oil, a sulfurized mineral oil or the like. However, while a lubricating oil containing the active sulfur is excellent in processability, it has a defect that stains are generated in the processed metal product after processing and causes inevitably the lowering of the product value. Even if a lubricating oil which does not contain the aforementioned active sulfur is used, it is apprehended that stains will be generated by using a working tool (grinder) containing sulfur as an ingredient.

This invention has been done for the purpose of overcoming the defects in conventional lubricating oils for metal working and providing a lubricating oil composition for metal working which is excellent in stain resistance so that stains will not be generated not only in the absence of a sulfur type extreme pressure agent, but also in the presence of such an agent.

The present inventors have conducted earnest researches for developing a lubricating oil composition for metal working which is excellent in stain resistance. As a result,

it has been found that the aforementioned object can be reached by incorporating a specific compound with a base oil. This invention has been accomplished on the basis of this knowledge.

DISCLOSURE OF INVENTION

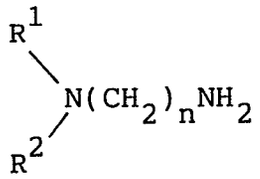
That is, this invention provides a lubricating oil composition, characterized in that (B) an amine represented by the formula (I) or (II) and (C) at least one compound selected from the group consisting of a sulfonate, a phenate and a salicylate are incorporated into (A) a base oil and, if necessary, (D) an extreme pressure agent and/or an oiliness agent are further incorporated into the base oil.

This invention is now described in detail below.

In the composition of this invention, the base oil used as the component (A) has no limitation except that the viscosity at the temperature of 40°C is in the range of 1 to 300 cSt, and any one of the base oils which have been conventionally used in lubricating oil compositions for metal working such as a mineral oil, a synthetic oil, a sulfurized mineral oil or a sulfurized fat and oil can be used. Particularly, in bearing processing or super finishing processing, the use of a sulfur type base oil such as a sulfurized mineral oil, a sulfurized fat and oil or a sulfurized olefin advantageously gives excellent processability.

The aforementioned base oil may be used alone or in combination of the two or more.

The amine, which is the component (B) in the composition of this invention, is the compound represented by the formula (I) or the formula (II):

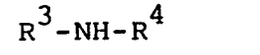


(I)

wherein n denotes 2 to 6, preferably 3; R^1 and R^2 represent respectively a hydrogen atom or an alkyl group, an alkenyl group, a cycloalkyl group, an alkylaryl group, an aralkyl group or an aryl group having 5 to 30 carbon atoms, preferably 10 to 24 carbon atoms and may be the same or different provided that both of the two do not represent hydrogen atoms simultaneously.

If n in the above-mentioned formula (I) is less than 2, the amine has a problem of odor; and the amine in which n exceeds 6 is less available. If R^1 or R^2 has carbon atoms less than 5, the amine has the problems of odor or poor solubility; and the amine in which R^1 or R^2 has carbon atoms exceeding 30 is less available.

The diamines include for example N-laurylpropylenediamine, N-myristylpropylenediamine, N-palmitylpropylenediamine, N-stearylpropylenediamine, N-eicosylpropylenediamine, N-oleylpropylenediamine, N,N-dilaurylpropylenediamine, tallow propylenediamine or the like.



(II)

wherein R^3 and R^4 represent respectively an alkyl group, an

alkenyl group, a cycloalkyl group, an alkylaryl group, an aralkyl group or an aryl group having 4 to 30 carbon atoms, preferably 5 to 20 carbon atoms and may be the same or different from each other.

If R^3 or R^4 has carbon atoms less than 4, the amine has the problems of odor or solubility. The aforementioned secondary amines include, for example, di(methylcyclohexyl)-amine, di(ethylcyclohexyl)amine, di(propylcyclohexyl)amine, dicyclohexylamine, cyclohexyldodecylamine, cyclohexyllauryl-amine, cyclohexylstearylamine, dioctylamine, dilaurylamine, distearylamine and the like, particularly di(methylcyclohexyl)amine and dicyclohexylamine are preferred.

These amines may be used alone or in combination of the two or more. The amount to be incorporated is generally selected in the range of 0.1 to 5% by weight, preferably 0.2 to 2% by weight on the basis of the weight of the composition. If the amount is less than 0.1% by weight, the effect of this invention cannot be exhibited satisfactorily. If the amount exceeds 5% by weight, the improvement of the effect corresponding to that amount cannot be expected.

In the composition of this invention, one or more kinds of the compounds selected from a sulfonate, a phenate and a salicylate are used as the component (C). The base numbers of the sulfonate, phenate and salicylate are not limited specifically and are preferably in the range of 10 to 500 mg KOH/g, more preferably 150 to 500 mg KOH/g, particularly a

high base number in the range of 150 to 450 mg KOH/g being preferred. The component having such a high base number has good durability of the effect (particularly stain resistance).

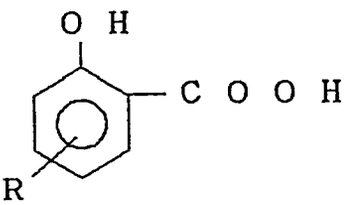
As the sulfonate, either a petroleum sulfonate or a synthetic sulfonate can be used, and as the salt form, there are mentioned an alkali metal salt, an alkaline earth metal salt, a diamine salt, an ammonium salt or the like. Among these salts, the alkaline earth metal salt, particularly a calcium salt and a barium salt are preferred.

As the petroleum sulfonate, a sulfonate which is obtained by recovering as a sulfonate a petroleum sulfonic acid which is a by-product during the purification of liquid paraffin with sulfuric acid or by sulfonating a mineral oil having a suitable molecular weight with a sulfonating agent such as concentrated sulfuric acid, fuming sulfuric acid or sulfuric acid anhydride and further converting into a sulfonate is used. Also, as the synthetic sulfonate, there is used a sulfonate obtained by sulfonating bottoms containing as the main component didodecylbenzene as a by-product during the production of dodecylbenzene as a raw material of a synthetic detergent by alkylating, for example, benzene with a propylene tetramer, or by sulfonating dinonylnaphthalene which is obtained by the alkylation of naphthalene with nonene and further converting the sulfonic acid into a salt. The sulfonate having a high base number is obtained by contacting the sulfonate thus obtained with

carbon dioxide gas in the presence of an excessive amount of an alkali compound such as an hydroxide, for example calcium hydroxide or barium hydroxide, or an oxide. The sulfonate may be used alone or in combination of the two or more.

The phenate can be prepared, for example, by reacting an alkylphenol with elementary sulfur and a metal hydroxide in an alcohol as a solvent. As the form of the salt, there are mentioned a variety of salts in the same manner as in the sulfonate, among others a calcium salt being preferred.

On the other hand, as the salicylate, an alkali metal salt, an alkaline earth metal salt, a diamine salt or an ammonium salt of the alkylsalicylic acid represented by the general formula (III) are used:



. . . (Ⅲ)

wherein R represents an alkyl group. Among these salts, alkaline earth metal salts, especially the calcium salt and the magnesium salt are preferably used. The alkylsalicylic acid can be generally prepared by alkylating phenol with an -olefin having 14 to 18 carbon atoms and subjecting the resultant alkylphenol to Kolbe-Schmidt reaction. The salicylate having a high base number is prepared in the same manner as the aforementioned sulfonate.

The alkylsalicylic acid in which the alkyl group is placed at the para-position to the hydroxyl group is

advantageous because of its excellent dispersibility in high temperatures.

The salicylate may be used alone or in combination of the two or more, and it may also be combined with the aforementioned sulfonate or phenate.

In the composition of this invention, the sulfonate, the phenate or the salicylate as the component (C) is generally used in an amount of 0.1 to 10% by weight, preferably 0.2 to 5% by weight on the basis of the weight of the composition. If the amount is less than 0.1% by weight, the effect of this invention will not be exhibited satisfactorily; if it exceeds 10% by weight, the improvement of the effect corresponding to that amount cannot be expected. The optimum amount is about 1% by weight to the weight of the composition.

In the composition of this invention, an extreme pressure agent and/or an oiliness agent can be incorporated as the component (D), if necessary. The extreme pressure agent or the oiliness agent has no particular limitation, and those which is conventionally used in a lubricating oil for the processing of machines can be used. The extreme pressure agent reacts in a satisfactory speed with the friction surfaces under the extreme pressure condition of the loading on the friction surfaces, covers quickly the fresh metal surfaces which will generate in succession with the lubricating film, so that the extrusions on the surfaces are protected from fusion or breakage. As the extreme pressure agent, there are mentioned a sulfur type extreme pressure

agent such as sulfur as simple substance, a sulfide, a sulfurized olefin, a sulfurized mineral oil, a sulfurized fat and oil or the like; a chlorine type extreme pressure agent such as a chlorinated paraffin, a chlorinated fat and oil, a chlorinated naphthalene, a chlorinated polyphenyl, a chlorinated alkylbenzene, methyl trichlorostearate, pentachloropentadienic acid, dibutyl chlorendate or the like; a phosphorus type extreme pressure agent such as tributyl phosphate, tricresyl phosphate, trioctyl phosphate, triphenyl phosphate, lauryl acid phosphate, oleyl acid phosphate, a tallow amine salt of octyl phosphate, an oleylamine salt of oleyl acid phosphate, tributylphosphite, dilauryl phosphite or the like; an organic metal compound type extreme pressure agent such as lead naphthenate, lead oleate, a metal salt of an organic dithiophosphate, a metal salt of an organic dithiocarbamate, amine hexafluorotitanate, titanium tetra(dialkyl orthophosphate), a reaction product of tetrabutyl titanate and an polyamine or the like. The extreme pressure agent may be used alone or in combination of the two or more.

On the other hand, the oiliness agent has the effect of adsorbing on metal surfaces and forming a strong adsorption film to decrease friction. As the oiliness agent, there are mentioned, for example, a higher fatty acid such as oleic acid, stearic acid or the like; a higher alcohol such as stearyl alcohol, oleyl alcohol or the like; an amine or an ester. The oiliness agent may be used alone or in

combination of the two or more, and it may also be combined with the aforementioned extreme pressure agent.

In the composition of this invention, the extreme pressure agent or the oiliness agent as the component (D) is generally incorporated in an amount of 0.01 to 40% by weight, preferably 0.1 to 20% by weight on the basis of the weight of the composition.

Moreover, in the lubricating oil composition of this invention, other additives which have been conventionally used in a lubricating oil such as a pour point depressant, a viscosity index improver, an anti-oxidant, an anti-corrosion agent, a detergent dispersant, a rust inhibitor, an antifoamer or the like can be incorporated, if necessary.

This invention is further described in detail with reference to Examples, which should not be construed to limit the invention.

Stain resistance of the lubricating oil composition was evaluated as follows:

Stain resistance (1)

The processed bearings were coated with the composition, stacked and left standing for 3 days under the conditions of 30°C and a humidity of 95%; then the stacked bearings were observed according to the following criteria:

O: no stain

X: stain

Stain resistance (2)

The composition was boiled together with active sulfur

in an amount of 0.5% by weight, and the composition was evaluated in the same manner as the method (1) according to the following criteria:

O: no stain

X: stain

Stain resistance (3)

The samples in which no stain had been generated on the aforementioned method (1) was left standing under the conditions of a temperature of 40°C and a humidity of 95% for 1 month, and thereafter the samples were evaluated according to the following criteria:

O: no stain

△: small stains in parts

X: large amount of stains

The components set forth below were used.

Base oil A:

light mineral oil (kinematic viscosity at 40°C: 4 cSt),

Base oil B:

sulfurized mineral oil (sulfur content: 0.5% by weight),

Diamine A:

laurylpropylenediamine,

Diamine B:

oleylpropylenediamine,

Secondary amine:

dicyclohexylamine,

Sulfonate (Ba):

Ba salt of petroleum sulfonate

Sulfonate (Ca):

Ca salt of petroleum sulfonate

Sulfonate having high base number (Ca):

Ca salt of petroleum sulfonate having a base number of 300 mg KOH/g

Sulfonate having high base number (Mg):

Mg salt of petroleum sulfonate having a base number of 400 mg KOH/g

Sulfonate(Na);

Na salt of petroleum sulfonate

Sulfonate(diamine);

ethylenediamine salt of petroleum sulfonate

Sulfonate(ammonium);

ammonium salt of petroleum sulfonate

Phenate having high base number (Ca)

Ca salt of phenate having a base number of 200 mg KOH/g

Salicylate (Ca):

Ca salt of salicylate which has an alkyl group with 14 to 18 carbon atoms

Salicylate having high base number (Ca):

Ca salt of salicylate having a base number of 300 mg KOH/g

Amine: Oleylamine

Extreme pressure agent:

active sulfurized lard (sulfur content: 10% by weight)

Oiliness agent:

lard

Examples 1 to 28 and Comparative Examples 1 to 22

Lubricating oil compositions, each having a formulation shown in Table 1 were prepared, and their stain resistances were evaluated. The results are shown in Table 1.

The extreme pressure agent and the oiliness agent were used as a mixture of the ratio 2 : 1 by weight.

Table 1

No.	Components of lubricating oil composition (% by weight)							
	Base oil A	Base oil B	Diamine A	Diamine B	Secondary amine	Sulfonate (Ba)*1	Sulfonate (Ca)*1	High base number sulfonate (Ca)*2
Example 1	balance	-	0.1	-	-	10	-	-
Example 2	balance	-	0.5	-	-	5.0	-	-
Example 3	balance	-	1.0	-	-	1.0	-	-
Example 4	-	balance	1.0	-	-	1.0	-	-
Example 5	balance	-	5.0	-	-	0.1	-	-
Example 6	balance	-	-	1.0	-	1.0	-	-
Example 7	balance	-	-	1.0	-	-	1.0	-
Example 8	balance	-	1.0	-	-	-	-	1.0
Example 9	balance	-	-	1.0	-	-	-	1.0
Example 10	balance	-	-	-	0.5	-	-	1.0
Example 11	balance	-	-	1.0	-	-	-	-
Example 12	balance	-	1.0	-	-	-	-	-
Example 13	balance	-	-	-	0.5	-	-	-
Example 14	balance	-	-	1.0	-	-	-	-
Example 15	balance	-	-	1.0	-	-	-	-
Example 16	balance	1.0	1.0	-	-	-	-	-
Example 17	balance	-	-	-	0.5	-	-	-
Example 18	balance	-	-	1.0	-	-	-	-

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Table 1 (continued)

No.	Components of lubricating oil composition (% by weight)					
	High base number sulfonate (Mg) *3	Sulfonate (Na) *1	Sulfonate (diamine) *4	Sulfonate (ammonium) *4	High base number phenate (Ca) *5	Salicylate (Ca) *1
Example 1	-	-	-	-	-	-
Example 2	-	-	-	-	-	-
Example 3	-	-	-	-	-	-
Example 4	-	-	-	-	-	-
Example 5	-	-	-	-	-	-
Example 6	-	-	-	-	-	-
Example 7	-	-	-	-	-	-
Example 8	-	-	-	-	-	-
Example 9	-	-	-	-	-	-
Example 10	-	-	-	-	-	-
Example 11	-	1.0	-	-	-	-
Example 12	1.0	-	-	-	-	-
Example 13	1.0	-	-	-	-	-
Example 14	-	-	1.0	-	-	-
Example 15	-	-	-	1.0	-	-
Example 16	-	-	-	-	1.0	-
Example 17	-	-	-	-	1.0	-
Example 18	-	-	-	-	-	1.0

Table 1 (continued)

No.	Components of lubricating oil composition (% by weight)			Evaluation		
	High base number salicylate (Ca)*2	Amine	Extreme pressure agent, Oiliness agent	Stain resistance (1)	(2)	(3)
Example 1	-	-	10	○	○	△
Example 2	-	-	10	○	○	△
Example 3	-	-	10	○	○	△
Example 4	-	-	10	○	○	△
Example 5	-	-	10	○	○	△
Example 6	-	-	10	○	○	△
Example 7	-	-	10	○	○	△
Example 8	-	-	10	○	○	○
Example 9	-	-	10	○	○	○
Example 10	-	-	10	○	○	○
Example 11	-	-	10	○	○	△
Example 12	-	-	10	○	○	○
Example 13	-	-	10	○	○	○
Example 14	-	-	10	○	○	△
Example 15	-	-	10	○	○	△
Example 16	-	-	10	○	○	○
Example 17	-	-	10	○	○	○
Example 18	-	-	10	○	○	△

Table 1 (continued)

No.	Components of lubricating oil composition (% by weight)							
	Base oil A	Base oil B	Diamine A	Diamine B	Secondary amine	Sulfonate*1 (Ba)	Sulfonate*1 (Ca)	High base number sulfonate*2 (Ca)
Example 19	balance	-	-	1.0	-	-	-	-
Example 20	-	balance	-	1.0	-	1.0	-	-
Example 21	balance	-	1.0	-	-	1.0	-	-
Example 22	balance	-	1.0	-	-	-	-	-
Example 23	balance	-	-	1.0	-	-	-	-
Example 24	balance	-	-	-	0.5	-	-	-
Example 25	balance	-	-	1.0	-	-	-	1.0
Example 26	balance	-	-	1.0	-	-	-	-
Example 27	balance	-	1.0	-	-	-	-	1.0
Example 28	balance	-	-	-	0.5	-	-	1.0
Comparative Example 1	balance	-	5.0	-	-	-	-	-
Comparative Example 2	balance	-	-	5.0	-	-	-	-
Comparative Example 3	balance	-	-	-	5.0	-	-	-
Comparative Example 4	balance	-	-	-	-	10	-	-
Comparative Example 5	balance	-	-	-	-	-	10	-
Comparative Example 6	balance	-	-	-	-	-	-	5.0
Comparative Example 7	balance	-	-	-	-	-	-	-

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Table 1 (continued)

No.	Components of lubricating oil composition (% by weight)					
	High base number sulfonate (Mg)*3	Sulfonate (Na)*1	Sulfonate (diamine)*4	Sulfonate (ammonium)*4	High base number phenate (Ca)*5	Salicylate (Ca)*1
Example 19	-	-	-	-	-	5.0
Example 20	-	-	-	-	-	1.0
Example 21	-	-	-	-	-	1.0
Example 22	-	-	-	-	-	-
Example 23	-	-	-	-	-	-
Example 24	-	-	-	-	-	-
Example 25	-	-	-	-	-	-
Example 26	1.0	-	-	-	-	-
Example 27	-	-	-	-	1.0	-
Example 28	-	-	-	-	1.0	-
Comparative Example 1	-	-	-	-	-	-
Comparative Example 2	-	-	-	-	-	-
Comparative Example 3	-	-	-	-	-	-
Comparative Example 4	-	-	-	-	-	-
Comparative Example 5	-	-	-	-	-	-
Comparative Example 6	-	-	-	-	-	-
Comparative Example 7	5.0	-	-	-	-	-

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Table 1 (continued)

No.	Components of lubricating oil composition (% by weight)			Evaluation		
	High base number salicylate (Ca)*2	Amine	Extreme pressure agent, Oiliness agent	Stain resistance (1)	(2)	(3)
Example 19	-	-	10	○	○	△
Example 20	-	-	10	○	○	△
Example 21	-	-	10	○	○	△
Example 22	1.0	-	10	○	○	○
Example 23	1.0	-	10	○	○	○
Example 24	1.0	-	10	○	○	○
Example 25	1.0	-	10	○	○	○
Example 26	1.0	-	10	○	○	○
Example 27	1.0	-	10	○	○	○
Example 28	1.0	-	10	○	○	○
Comparative Example 1	-	-	10	X	X	-
Comparative Example 2	-	-	10	X	X	-
Comparative Example 3	-	-	10	X	X	-
Comparative Example 4	-	-	10	X	X	-
Comparative Example 5	-	-	10	X	X	-
Comparative Example 6	-	-	10	X	X	-
Comparative Example 7	-	-	10	X	X	-

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Table 1 (continued)

No.	Components of lubricating oil composition (% by weight)							
	Base oil A	Base oil B	Diamine A	Diamine B	Secondary amine	Sulfonate (Ba)*1	Sulfonate (Ca)*1	High base number sulfonate (Ca)*2
Comparative Example 8	balance	-	-	-	-	-	-	-
Comparative Example 9	balance	-	-	-	-	-	-	-
Comparative Example 10	balance	-	-	-	-	-	-	-
Comparative Example 11	balance	-	-	-	-	-	-	-
Comparative Example 12	balance	-	-	-	-	-	-	-
Comparative Example 13	balance	-	-	-	-	-	-	-
Comparative Example 14	balance	-	-	-	-	-	-	5.0
Comparative Example 15	balance	-	-	-	-	-	-	-
Comparative Example 16	balance	-	-	-	-	10	-	-
Comparative Example 17	balance	-	-	-	-	-	-	-
Comparative Example 18	balance	-	-	-	-	10	-	-
Comparative Example 19	balance	-	-	-	-	-	-	5.0
Comparative Example 20	balance	-	5.0	-	-	-	-	-
Comparative Example 21	-	balance	5.0	-	-	-	-	-
Comparative Example 22	balance	-	-	-	-	-	-	-

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Table 1 (continued)

No.	Components of lubricating oil composition (% by weight)					
	High base number sulfonate (Mg)*3	Sulfonate (Na)*1	Sulfonate (diamine)*4	Sulfonate (ammonium)*4	High base number phenate (Ca)*5	Salicylate (Ca)*1
Comparative Example 8	-	10	-	-	-	-
Comparative Example 9	-	-	10	-	-	-
Comparative Example 10	-	-	-	10	-	-
Comparative Example 11	-	-	-	-	5.0	-
Comparative Example 12	-	-	-	-	-	10
Comparative Example 13	-	-	-	-	-	-
Comparative Example 14	-	-	-	-	-	-
Comparative Example 15	5.0	-	-	-	-	-
Comparative Example 16	-	-	-	-	-	10
Comparative Example 17	-	-	-	-	-	-
Comparative Example 18	-	-	-	-	-	-
Comparative Example 19	-	-	-	-	5.0	-
Comparative Example 20	-	-	-	-	-	-
Comparative Example 21	-	-	-	-	-	-
Comparative Example 22	-	-	-	-	-	-

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Table 1 (continued)

No.	Components of lubricating oil composition (% by weight)			Evaluation		
	High base number salicylate (Ca) *2	Amine	Extreme pressure agent, Oiliness agent	Stain resistance (1)	(2)	(3)
Comparative Example 8	-	-	10	X	X	-
Comparative Example 9	-	-	10	X	X	-
Comparative Example 10	-	-	10	X	X	-
Comparative Example 11	-	-	10	X	X	-
Comparative Example 12	-	-	10	X	X	-
Comparative Example 13	5.0	-	10	X	X	-
Comparative Example 14	5.0	-	10	X	X	-
Comparative Example 15	5.0	-	10	X	X	-
Comparative Example 16	-	-	10	X	X	-
Comparative Example 17	-	5.0	10	X	X	-
Comparative Example 18	-	5.0	10	X	X	-
Comparative Example 19	5.0	-	10	X	X	-
Comparative Example 20	-	-	-	○	X	△
Comparative Example 21	-	-	-	X	X	-
Comparative Example 22	-	5.0	-	○	X	△

*1 Basicity, 30 mg KOH/g; *2 Basicity, 300 mg KOH/g; *3 Basicity, 400 mg KOH/g;
*4 Basicity, 25 mg KOH/g; *5 Basicity, 200 mg KOH/g;

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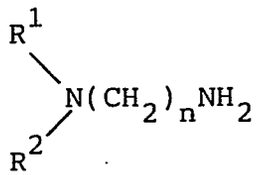
INDUSTRIAL APPLICABILITY

As described above, the lubricating oil composition of this invention is a lubricating oil composition for metal working which is excellent in stain resistance so that stain will not be generated not only in the absence of a sulfur type extreme pressure agent but also in the presence of such an agent. Thus, the lubricating oil composition of this invention is preferably used particularly for bearing processing or super finishing processing.

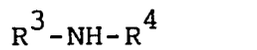
CLAIMS

1. A lubricating oil composition, characterized in that in (A) a base oil are incorporated (B) an amine represented by the formula (I) or (II) and (C) at least one compound selected from the group consisting of a sulfonate, a phenate and a salicylate:



(I)

wherein n denotes 2 to 6; R^1 and R^2 represent respectively a hydrogen atom or an alkyl group, an alkenyl group, a cycloalkyl group, an alkylaryl group, an aralkyl group or an aryl group having 5 to 30 carbon atoms and may be the same or different provided that both of the two do not represent hydrogen atoms simultaneously, or



(II)

wherein R^3 and R^4 represent respectively an alkyl group, an alkenyl group, a cycloalkyl group, an alkylaryl group, an aralkyl group or an aryl group having 4 to 30 carbon atoms and may be the same or different from each other.

2. A composition according to Claim 1, wherein the amine represented by the formula (I) or (II) is in an amount of 0.1 to 5% by weight to the total weight of the composition, and the at least one compound selected from a sulfonate, a phenate and a salicylate is in an amount of 0.1 to 10% by weight to the total weight of the composition.

3. The composition according to Claim 1 or 2, wherein the base oil is sulfur type base oil.

4. A lubricating oil composition, characterized in that in (A) a base oil are incorporated (B) an amine represented by the formula (I) or (II), (C) at least one compound selected from the group consisting of a sulfonate, a phenate and a salicylate, and (D) at least one additive of an extreme pressure agent and an oiliness agent.

5. A composition according to Claim 4, wherein (B) the amine represented by the formula (I) or (II) is in an amount of 0.1 to 5% by weight to the total weight of the composition, (C) at least one compound selected from the group consisting of a sulfonate, a phenate and a salicylate is in an amount of 0.1 to 10% by weight to the total weight of the composition, and (D) at least one additive of an extreme pressure agent and an oiliness agent is in an amount of 0.01 to 40% by weight to the total weight of the composition.

6. A composition according to Claim 4 or 5, wherein the base oil is a sulfur type base oil.

7. A composition according to Claim 1 or 4, wherein the basicity of at least one compound selected from the group consisting of a sulfonate, a phenate and a salicylate is in

the range of 150 to 500 mg KOH/g.

INTERNATIONAL SEARCH REPORT

International Application No PCT/JP89/00934

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl[4] C10M141/08, 141/06, //(C10M141/08, C10M133:06, 133:54, 135:10, 129:50, 129:54)

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	C10M141/06 - 141/08, C10M133/06 - 133/10, C10M135/10, C10M129/48 - 129/54

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	JP, B1, 44-10649 (The Lion Fat & Oil Co., Ltd.) 17 May 1969 (17. 05. 69) Claim and column 2, lines 24 to 36 (Family : none)	1 - 7
Y	JP, A, 54-94446 (NKK Corporation) 26 July 1979 (26. 07. 79) Claim, page 2, lower right column, line 19 to pate 3, upper left column, line 11 and page 3, upper right column, lines 3 to 17 (Family : none)	1 - 7
Y	JP, A, 59-232185 (NKK Corporation, Nihon Parkerizing Co., Ltd.) 26 December 1984 (26. 12. 84) Claim (Family : none)	1 - 7
A	JP, A, 61-254698 (S.C. Johnson & Son Inc.) 12 November 1986 (12. 11. 86) Claim and page 6, upper right column, line 6 to lower left column, line 6 & US, A, 4787995	1 - 7

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
November 16, 1989 (16. 11. 89)	December 4, 1989 (04. 12. 89)

International Searching Authority	Signature of Authorized Officer
Japanese Patent Office	

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

A	JP, A, 62-100596 (Daido Chemical Industry Co., Ltd., NTN Toyo Bearing Co., Ltd.) 11 May 1987 (11. 05. 87) Claim and page 3, upper right column, line 20, lower left column, line 12 (Family : none)	1 - 7

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers ..... , because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers ....., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim numbers ...., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [2]

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest

☐ No protest accompanied the payment of additional search fees