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NON-FERROUS METAL DRAWING LUBRICANT

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This invention relates to improved lubricants and more particularly to mineral lubricating oil compositions for use in metal drawing of non-ferrous metals such as aluminum and alloys thereof.

It is known from the prior art that straight mineral oils or soluble-oil emulsions are generally unsatisfactory as drawing lubricants for non-ferrous metals such as aluminum. Mineral oils lack the required cooling properties encountered during the drawing and reducing of aluminum in which extremely high temperatures are encountered. Emulsions, although they are good coolants, lack desired lubricity properties and cause staining. In both cases the problems of metal "pick-up," staining, scoring and tearing of the metal surface result in spoilage and waste of metal as well as loss of time and money.

It is an object of the present invention to provide improved lubricants for drawing of non-ferrous metals. It is also an object of the invention to provide an improved aluminum drawing lubricant having good cooling, lubricating and surface-finishing properties and which is resistant to staining and metal pick-up.

These and other objects are accomplished in accordance with this invention, which provides a lubricant consisting essentially of a highly refined essentially non-aromatic mineral lubricating oil having a viscosity of at least 50 SUS at 210° F., preferably between 60 and 150 SUS at 210° F., containing a minor, critical amount, at least from 5% to about 15%, preferably from 5% to 8% of an oil-soluble polycyclic monohydric alcohol having a phenanthrene structure in which the hydroxyl group is attached directly or indirectly through an aliphatic hydrocarbon to a non-aromatic carbocyclic ring of the phenanthrene structure, and from about 0.05% to about 1%, preferably from about 0.1% to about 0.5% of an oil-soluble trialkyl phenol.

The combination of this complex monohydric alcohol with the trialkyl phenol imparts unexpected and superior properties to such mineral oil compositions as shown hereinafter not reproducible when other well known anti-oxidants, such as arylamines, e.g., phenyl-alpha-naphthylamine or phenyl-beta-naphthylamine are substituted for the trialkyl phenols in compositions of this invention.

The complex monohydric alcohols are available materials derived from animals and plants by means well known in the art. Alcohols of this type include those derived from the reduction resin acids such as abietic acid, pimaric acid or sapinic acid to give alcohols in which the hydroxy group is indirectly attached to the non-aromatic carbocyclic ring, such as abietyl alcohol, hydroabietyl alcohol, e.g., dihydro or tetrahydroabietyl alcohol and mixtures thereof as well as the corresponding alcohols derived from other acids mentioned above, such as sapinyl alcohol as well as ferruginol, totarol, dihydroclareol and various sterols, such as cholesterol, dihydrochlolesterol, cerelrosterol, lanosterol, dehydrolanosterol, agnosterol, dihydroagnosterol, etc. in which the hydroxyl group is attached directly to a ring of the phenanthrene structure. The alcohols containing the hydroxy group indirectly attached to a saturated alicyclic ring of the phenanthrene structure through an alkylene radical, such as methylene such as hydroabietyl alcohol or hydrosapinyl alcohol are preferred.

The oil-soluble trialkyl mono or bisphenols which are used contain alkyl, i.e., acyclic or cyclic alkyl, groups

which can be the same or different while at least one of them is preferably a tertiary alkyl radical. Trialkyl phenols of this type include 2,4,6-triethyl-, tributyl-, trioctyl-, 2,4-ditert-butyl-6-methyl-, 2,6-ditert-butyl-4-methyl-, 2,4,6-tritert-butyl-, 2,6-dicyclohexyl-4-methyl-, 2,6-dimethyl-4-cyclohexyl-phenols. The alkyl bisphenols include bis(2-hydroxy-3-t-butyl-5-methylphenyl)methane; bis(2-hydroxy-3-t-butyl-5-methylphenyl)ethane; 1,1-bis-(2-hydroxy-3-t-butyl-5-methylphenyl)propane; bis(2-hydroxy-3-t-butyl-5-methylphenyl)butane; bis(2-hydroxy-3-t-butyl-5-methylphenyl)isobutane; bis(2-hydroxy-5-t-butyl-3-methylphenyl)methane; bis(2-hydroxy-5-t-butyl-3-methylphenyl)ethane; 1,1-bis(2-hydroxy-5-t-butyl-3-methylphenyl)propane; 1,1-bis(2-hydroxy-5-t-amyl-3-methylphenyl)butane; 1,1-bis(2-hydroxy-5-t-amyl-3-methylphenyl)isobutane; etc. The 2,4,6-trialkyl phenols containing two tertiary alkyl groups in the 2,4-, or 2,6-positions are preferred, such as 2,4-ditert-butyl-6-methyl-, 2,6-ditert-butyl-4-methylphenol.

The mineral lubricating oils useful in the formulation of compositions of this invention are highly refined viscous lubricating oils having a viscosity of at least 50 SUS at 210° F., preferably from about 60 to about 120 SUS at 210° F. and having an aromatic content of less than 20%, preferably between 1 and 5%. Petroleum fractions of this type can be derived from asphaltic, naphthenic or paraffinic crudes. It is preferred to use a refined viscous mineral lubricating oil, such as a selective solvent (phenol) refined lube oil raffinate from a West Texas Ellenburger (WTE) base stock having a viscosity of about 60 SUS at 210° F. and an aromatic content of less than 5% and the balance being paraffinic and isoparaffinic fractions (X).

The following are illustrative of compositions of the invention:

Composition I

	Percent
Hydroabiethyl alcohol	5
2,6-ditert-butyl-4-methylphenol	0.1
Mineral lubricating oil (60/210° F., X)	Balance

Composition II

Dihydroabietyl alcohol (40%), tetrahydroabietyl alcohol (45%), abietyl alcohol (15%)	6
2,6-ditert-butyl-4-methylphenol	0.1
Mineral lubricating oil (60/210° F., X)	Balance

Composition III

Dihydroabietyl alcohol (40%), tetrahydroabietyl alcohol (45%), abietyl alcohol (15%)	6
2,4-dimethyl-6-tert-butylphenol	0.1
Mineral lubricating oil (60/210° F., X)	Balance

Composition IV

Dihydroabietyl alcohol	5
Bis(2-hydroxy-3-t-butyl-5-methylphenyl)methane	0.1
Mineral lubricating oil (60/210° F., X)	Balance

Composition V

Cholesterol	4
Bis(2-hydroxy-3-t-butyl-5-methylphenyl)methane	1
Mineral lubricating oil (75/210° F.)	Balance

Compositions I, II and III were used in an aluminum plant where aluminum alloy tubings were reduced. Each of these compositions was 80–90% effective in reducing the tubings from 4.250" by 0.445" to 2.900" by 0.110" without mandrel pickup, scratching, or scoring of the surface and staining of the metal surface. Compositions IV and V were about 50–75% effective and gave desired surface finishes. However, when oil composition X (mineral oil 40/100° F., aromatic about 25%+5% abietyl alcohol+0.1% phenyl-alpha-napthylamine) or

composition Y (mineral oil 40/100° F.+5% tallow) or composition Z (mineral oil 40/100° F.+1% stearic acid+0.1% 2,6-ditert-butyl-4-methylphenol) or composition XX (mineral oil 50/210° F.+5% abietyl alcohol) was used in place of compositions I–V of the present invention for drawing the same aluminum tubes under same conditions, considerable staining, particularly with compositions X and Y was noted, surface finish was poor and mandrel pickup occurred with all of these conditions.

I claim as my invention:

1. A non-ferrous metal drawing lubricant consisting essentially of a highly refined non-aromatic mineral lubricating oil having a viscosity of from about 50 to about 150 SUS at 210° F. and from about 5% to about 15% of an oil-soluble polycyclic monohydric alcohol selected from the group consisting of abietyl alcohol, hydroabietyl alcohol and chloesterol, and from about 0.05% to about 1% of an oil-soluble trialkyl phenol at least one of the alkyl groups being a tertiary alkyl group.

2. An aluminum drawing lubricant consisting essentially of a highly refined non-aromatic mineral lubricating oil having a viscosity of from about 50 to about 150 SUS at 210° F. and from about 5% to about 8% of hydroabietyl alcohol and from about 0.1% to 0.5% of 2,6-ditert-butyl-4-methylphenol.

3. An aluminum drawing lubricant consisting essentially of a highly refined non-aromatic mineral lubricating oil having a viscosity of from about 50 to about 150 SUS at 210° F. and from about 5% to about 8% of a mixture of abietyl alcohol and hydroabietyl alcohol and from about 0.1% to about 0.5% of 2,6-ditert-butyl-4-methylphenol.

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