

SOLUBLE METALWORKING OIL

Laurence F. King and Lorne W. Sproule, Sarnia, Ontario, Canada, assignors to Standard Oil Development Company, a corporation of Delaware

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The present invention relates to soluble metal working oil compositions or emulsifiable lubricants such as are used in cutting steels and other metals in turning lathes, milling machines, shapers, planers, grinders, etc. The invention pertains particularly to an improved soluble oil of superior properties employing a combination of ingredients which are more readily available and less expensive than those hitherto considered essential for satisfactory products.

In the prior art the advantages of the so-called soluble or emulsifiable cutting oils have been widely recognized. Since these oils are emulsifiable with water they can be combined with various proportions of water to simultaneously lubricate and cool the tools and the metal parts which are being operated upon. The prior art has considered it essential to use certain types of emulsifying ingredients in relatively large proportions in order to secure good solubility or emulsifiability in various proportions of water. In general it is desired that soluble cutting oils be compatible with proportions of 1 to 10 or 20 parts of water for each part of the oil composition. Hence, it is essential that the emulsifying agents be highly effective.

Most successful prior art compositions have employed substantial proportions of oil soluble petroleum sulfonates as the primary emulsifying or solubilizing agent. For example, sodium sulfonates obtained by treating mineral oils with concentrated or fuming sulfuric acid and neutralizing with sodium hydroxide or the like have been widely used in soluble oils. These oil soluble sodium petroleum sulfonates are in general demand for various purposes including detergents, lubricating oil additives and the like. They are relatively expensive and often in short supply. Commercial cutting oils employ as much as 10 to 15% by weight of these sulfonates on a dry basis, proportions of 12 to 15% being particularly common. Compositions of this type consume large quantities of the relatively scarce and expensive sulfonate and an object of the present invention is to replace a major part of such sulfonates with other ingredients which give comparable or even superior results.

According to the present invention it has been found that a suitable combination of alkanolamine salts, especially trialkanol amine salts, e. g. a triethanolamine naphthenate and the corresponding amine salt of tall oil or tall oil acids can replace the major proportion of sodium sulfonate with actual improvement in quality. For example, a soluble oil containing 13.4% by weight of sodium sulfonate on a dry basis has been widely sold as a suitable soluble oil for machining metals. A composition containing only 4.7% of sodium petroleum sulfonate in combination with the reaction products of 2.25% triethanolamine, a similar quantity of naphthenic acid, and 4.5% of refined tall oil gave results that were equally as good and in some respects superior to the commercial product. A lubricating oil of moderate grade may be used as the principal ingredient. For example, a mineral base oil of relatively low viscosity index may be used very satisfactorily. Synthetic oils may be used with or in lieu of mineral oil.

A product made according to the present invention is actually superior to the prior art product in foaming properties and in emulsion characteristics in both dissolved and hard water. It should be noted that the prior product requires an additive to prevent foaming (andelilla wax) whereas the product of the present invention requires none. It is just as good as the prior art

product in its gelling and rusting tendencies. Field experience has been shown that it can be used satisfactorily in a variety of cutting and grinding operations. The new product gives satisfactory results with regard to tool life, surface finish of the machined product and protection of both against rust.

In its broader aspects, therefore, the invention contemplates the production of a soluble metal working oil composition consisting primarily of a lubricating oil, mineral base lubricating oils being preferred ordinarily for reasons of economy, containing about 2 to 7% by weight, based on the total composition of oil soluble sodium sulfonate, 1 to 5% of an alkylolamine salt of naphthenic acid and 3 to 8% of an alkylolamine salt (or soap) of tall oil. More specifically a preferred composition contains between 4 and 5% of the sulfonate, and 2 to 4% of triethanolamine salt of naphthenic acids, and 5 to 7% of a similar salt of refined tall oil. The latter may be referred to as a "tallate."

It is preferable to employ a small amount of alcohol, from 0.5 to 1% usually, as a coupling agent. Ethyl alcohol is preferred, though isopropanol may also be used. It is desirable to add a similar small quantity of water. The latter feature is not new per se, having been used in prior art compositions of the conventional type, but it does assist in ready emulsification.

The following table shows comparative properties of a successful commercial product containing over 13% of sodium sulfonate and requiring a base oil of high viscosity index and a product made according to the present invention containing only 4.7% of sodium sulfonate and the salts of reaction products obtained by combining about 2.25% each of naphthenic acids and triethanolamine with 4.5% tall oil, preferably a refined tall oil, using a much less expensive base oil. The properties of the respective compositions are also tabulated and it will be noted that the product of the invention, which costs considerably less than the prior commercial product, is equal or superior in every important respect. It will be noted, furthermore, that the present invention makes it possible to employ a mineral oil of higher initial viscosity as well as lower viscosity index than was considered feasible prior to this invention. It is undesirable to have a cutting oil that is too viscous because emulsification is difficult and low temperature lubrication is not too satisfactory. Sodium sulfonate increases the viscosity of mineral oils considerably in the proportions ordinarily used. By reducing sodium sulfonate content very substantially and substituting the other materials named above a more viscous oil at the outset, and one having a lower viscosity index, gives no higher resulting viscosity.

Table

Formula, Percent by Wt.	Commercial Product	Product of Invention
Sodium Sulphonate (dry basis).....	13.4.....	4.7.
Sodium Naphthenate.....	3.50.....	
Triethanolamine Naphthenate.....		3.0.
Triethanolamine "Tallate".....		6.0.
Water.....	2.15.....	0.9.
Alcohol.....	0.50.....	0.9.
Mineral Oil (V/100=110; V. I. 70).....	80.4.....	
Mineral Oil (V/100=130; V. I. 35).....		84.5.
Candelilla Wax.....	0.05.....	
Inspections:		
Visc. @ 100° F. S. S. U.....	550.....	550.
Free Acid, percent.....	0.4.....	0.4.
Emulsion Characteristics (10:1 Emulsion):		
(a) Distilled Water.....		
After 1 hr., cc. separated.....	1 (cream).....	0.5 (cream).
After 24 hrs., cc. separated.....	3 (cream).....	1 (cream).
(b) Hard Water.....		
After 1 hr., cc. separated.....	2 (oil).....	0.5 (oil).
After 24 hrs., cc. separated.....	3 (oil).....	1 (oil).
Foaming, Increase in Vol. cc.....	100.....	20.
Gelling Tendencies (after 7 days at 32° F.).....	pass.....	pass.

¹ Contains 1,000 p. p. m. of both magnesium chloride and calcium chloride.
² 500 cc. of 10:1 emulsion stirred at 500 r. p. m. in Mixmaster pan for 15 minutes.

It will be understood that other conventional modifiers may be added to the product of this invention as will be

3 obvious to those skilled in the art. Thus, other conventional soaps, antioxidants, anti-foamants, load bearing agents (extreme pressure or oiliness additives) and the like may be included.

What is claimed is:

1. A soluble metal working lubricant composition comprising a mineral base lubricating oil, 2 to 7% by weight, based on the total composition, of oil soluble sodium sulphonate, and supplementary soaps including 1 to 5% of an alkylolamine salt of naphthenic acid and 3 to 8% of an alkylol amine soap of tall oil.

2. A soluble cutting oil composition comprising a mineral base lubricating oil, about 4 to 5% by weight, based on the total composition of oil soluble sodium sulphonate, and supplementary amine soaps comprising 2 to 4% of triethanolamine naphthenate and 5 to 7% of the triethanolamine soap of refined tall oil.

3. Composition according to claim 2 wherein the mineral oil has a viscosity index below 60.

4. Composition according to claim 2 to which is added 0.5 to 1% of alcohol as a coupling agent.

5. An emulsifiable cutting oil composition having approximately the following formula:

	Percent by weight
Mineral oil of 130 S. S. U. viscosity at 100° F. and 35 viscosity index	84.5
Oil soluble sodium petroleum sulfonate-dry basis	4.7
Triethanolamine soap of refined tall oil	6.0
Triethanolamine naphthenate	3.0
Water	0.9
Ethyl alcohol	0.9

6. A composition consisting essentially of 80 to 88% by weight of mineral lubricating oil of low viscosity index, 4 to 5% of oil soluble sodium petroleum sulphonate, 2 to 4% of triethanolamine naphthenate, 5 to 7% of the triethanolamine soap of refined tall oil, and 0.5 to 1% each of ethyl alcohol and water.

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