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SOLUBLE CUTTING OIL

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This invention relates to an improved soluble cutting oil and more particularly to a soluble cutting oil which when in an emulsified form will provide a high load-carrying film of lubricant between the cutting tool and the work being machined.

Cutting fluids are generally produced from soluble cutting oils by emulsifying one part of the oil in from 10 to 40 parts of water. The emulsion so formed is poured over the tool and the work in a steady stream and functions to dissipate the heat from both the tool and the work; improve the quality of the surface produced; lubricate the surfaces in contact between the tool and work; prevent "build up" on the tool or the welding of the work to the tool; to wash away the chips and to provide lubrication between the chip and the tool, thus reducing the pressure of the chip on the tool. Oil emulsions are used principally where roughing cuts are being made. In roughing cuts the primary object is to remove material, and the quality of the surface produced is secondary. However, since in the following finishing cut only a very small amount of material is removed, the preceding rough cut should not leave the work in such a condition that the finishing cut will not remove the scars left by the rough cut. Therefore a superior cutting fluid should help to improve the quality of the surface produced during the roughing cut. There is normally an enormous pressure between the cutting edge of the tool and the metal being machined, and in addition, due to the inherent resiliency of the metal, heavy pressures are maintained between the work and the surface of the tool just under the cutting edge and between the chips and the surface of the tool just back of the cutting edge. Therefore, it is requisite that lubricant be provided which is capable of providing lubrication even under heavy loads.

It has heretofore been recognized that the presence of sulfur and sulfur compounds improves the load bearing characteristics of an oil and the load bearing characteristics of the oil are increased by raising the normal quantity of sulfur found in the oil by the addition of elemental sulfur or organic oil-soluble sulfides or polysulfides, such as phenol polysulfides or alkylated phenol polysulfides, such as t-amyl phenol disulfide or diiso-octyl phenol disulfide. Elemental sulfur is

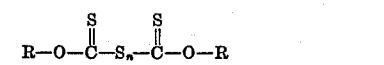
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relatively ineffective for the reason that it is not sufficiently soluble in the oil. Therefore, direct sulfurization of the oil with sulfur or sulfur chloride, which discolors the oil is often resorted to. The oil-soluble organic polysulfides have, where the sulfur content obtained in the soluble cutting oil is above about 0.5%, a distinct de-emulsification effect and while this does not deleteriously effect the E. P. it is still not desirable in soluble cutting oils.

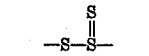
It is an object of the present invention to increase the sulfur content of a soluble cutting oil and thus raise its E. P. without impairing the capacity of the oil to readily emulsify in water and to form a stable emulsion. Other and further objects will be apparent to those skilled in the art upon reading the following detailed description.

It has now been discovered that xanthogen polysulfides and their homologous derivatives or dibenzyl disulfide may be used to increase the sulfur content of a soluble cutting oil without impairing the emulsibility of that oil. Xanthogen polysulfides are oil-soluble and since they contain a relatively large amount of sulfur in proportion to the remainder of the molecule, have the effect of carrying into solution in the oil a disproportionately large percentage of sulfur. In addition, xanthogen polysulfides have a high solvency power for elementary sulfur which can be utilized to further increase the sulfur content of the oil if desired. Heretofore the addition of sufficient sulfur, either elemental or combined to yield the requisite load bearing characteristics, has resulted in a dark colored to almost black composition. Compositions made in accordance with the present invention are clear, transparent, and of a light yellow to straw color.

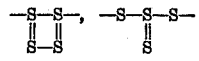
Xanthogen polysulfides have the general formula—



where n is an integer; S_n is either —S—S—,

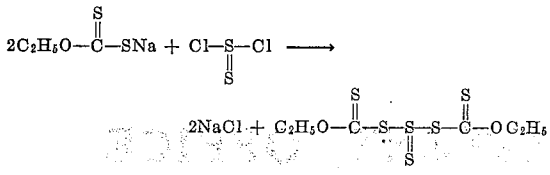


or



etc., and R is an alkyl radical such as methyl,

ethyl, ispropyl, and butyl, etc. A suitable xanthogen polysulfide may be prepared by dispersing sodium ethyl xanthate in benzol and adding a benzol solution of sulfur monochloride with stirring:



(Ethyl xanthogen tetrasulfide)

The sodium chloride may be removed either by filtration or by water washing and the benzol is then evaporated from the product.

Although a wide range of lubricating oils may be employed as the base for the soluble cutting oil, in general the base oil comprises an oil having a viscosity at 100° F. in the range of from about 90 to 500 seconds, an A. P. I. gravity of 23° to 33°, and a flash point above 300° F. However, in preparing compositions of this character, we prefer to use a light oil as the base, that is, one having a gravity in the range of from 25° A. P. I. to 31° A. P. I. and a viscosity at 100° F. of from 100 to 300 seconds.

Although improved load bearing or lubricating characteristics are apparent from the addition of widely varying amounts of the xanthogen polysulfides to the oil, it is preferred to add from 1% to 10% by weight of the xanthogen polysulfides based upon the oil, and more preferably, about 3.5%. The xanthogen polysulfides are incorporated in the mineral oil content of the soluble oil by ordinary agitation and the emulsifier is then added by the usual method such as stirring or warming and stirring. The xanthogen sulfide is non-corrosive in action whereas the polysulfides are corrosive but appear to lose their corrosive properties when incorporated in a soluble cutting oil.

Due to the structural non-uniformity between metal test pieces and other factors, a cutting test upon soluble cutting oils is difficult of reproduction. However, the Almen machine test is easily reproducible and furnishes an accurate comparison of the load bearing characteristics of the oil tested. This test is conducted as described in J. O. Almen, U. S. Patent 2,001,861.

The following table shows a comparison of the load bearing characteristics of an emulsion of an oil consisting of approximately 9.5% sodium petroleum sulfonates, 2.9% sodium naphthenate, 1.6% water, 0.9% alcohol and 85.1% 100 vis. at 100° F., pale oil, and an emulsion of the same oil plus various amounts of xanthogen polysulfide:

Table

Emulsion of water and Oil		Type of Oil	Loading Weights
Water	Oil		
Per cent	*Per cent*		
90	10	Above soluble oil	2-3
90	10	Above soluble oil+2% Xanthogen Tetrasulfide	4-5
90	10	Above soluble oil+3.5% Xanthogen Tetrasulfide	11
85	15	Above soluble oil+3.5% Xanthogen Tetrasulfide	12
90	10	Above soluble oil+3.5% Xanthogen Tetrasulfide [1]	15
90	10	Above soluble oil+3.5% Dibenzyl Disulfide	7

[1] Xanthogen tetrasulfide containing 15% excess sulfur.

The above emulsions were all entirely stable. It should be noted that, while having no deleterious effect on emulsibility, dibenzyl disulfide and the like are much less potent extreme pressure agents. The soluble oil containing 3½% of phenol disulfides, e. g., tertiary-amyl phenol disulfide and di-isobutyl phenol disulfide, showed no tendency to emulsify.

What is claimed is:

1. Soluble cutting oil comprising a mineral lubricating oil, an emulsifier capable of emulsifying water and oil and an alkyl xanthogen polysulfide having from 1 to 4 carbon atoms in the alkyl group having dissolved therein excess elemental sulfur.

2. Composition according to claim 1 in which the alkyl xanthogen polysulfide is alkyl xanthogen tetrasulfide.

3. A soluble cutting oil comprising a light mineral lubricating oil, an emulsifier capable of emulsifying oil and water and from 1% to 10% of alkyl xanthogen polysulfide having from 1 to 4 carbon atoms in the alkyl group having excess sulfur dissolved therein.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,307,307	Shoemaker	Jan. 15, 1943
2,079,803	Holtzclan	May 11, 1937
2,062,652	Herrmann	Dec. 1, 1936
2,060,425	Nerrkom	Nov. 10, 1936
2,250,545	Mikeska	July 29, 1941
2,154,628	Lincoln	Apr. 18, 1939