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CUTTING OIL CONTAINING CALCIUM STEARATE

Harrison M. Stine, Lyndhurst, and Everett C. Hughes, Shaker Heights, Ohio, assignors to The Standard Oil Company, Cleveland, Ohio, a corporation of Ohio

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The present invention relates to a cutting oil containing calcium stearate.

Cutting oils are employed wherever metal is used to cut another metal, as in drilling, thread cutting, and lathe machine work. The function of the cutting oil is usually twofold, in that it serves as a cooling agent to keep the drilling or cutting tool from overheating and it alleviates friction between the contacting parts. The cutting oil must therefore provide a certain degree of cooling and have sufficient oiliness to adhere to the working parts and reduce friction to a minimum.

The machining of abrasive steels requires the use of heavy-duty cutting oils. Those which have been employed heretofore for this purpose contain large amounts of sulfur and of expensive fatty animal oils, such as lard oil, which because of their oiliness have been blended with mineral oil to give greater efficiency to the lubricant.

Greases are prepared by mixing a small amount of a fatty acid soap with a mineral lubricating oil. Greases are well known lubricants which are characterized by a gel structure which inhibits flow. Lime-base greases contain from about 4 to 25% lime soap. They are not true solutions of soap in the oil; they are suspensions of soap and water in the oil, and depend upon their 0.5 to 2% water content to maintain the grease body. It is because of the tendency of the fatty acid soaps to form gel structures that they are not used in combination with mineral oils, including the sulfurized oils, to form a cutting oil, which of necessity is a liquid material under the working conditions.

It is the object of the present invention to provide a sulfurized heavy-duty cutting oil which is both inexpensive and highly efficient.

In accordance with the present invention, a cutting oil is provided consisting essentially of about 5% calcium stearate and a sulfurized, anhydrous, mineral oil. The cutting oil is anhydrous because in the presence of water there is a tendency to form a grease gel due to the calcium stearate. A sulfurized oil is used because of its desirable cutting properties. The sulfur content of the oils is corrosive because it is in an active form.

Only calcium stearate among the fatty acid soaps has the properties required to make the heavy-duty cutting oil of the invention equivalent to the more expensive cutting oils which employ fatty oils such as lard oil. The near homologues of stearic acid, for example, calcium palmitate, are not nearly as effective, nor are other metal salts of stearic acid, such as nickel and sodium stearates.

The amount of the calcium stearate used also is critical. Lesser amounts appreciably reduce the effectiveness of the cutting oil. When larger amounts are used, the cutting oil will gel.

Any suitable mineral oil of cutting oil viscosity may be employed as base oil. In general, hydrocarbon oils, e.g., acid-treated oils, having a viscosity within the range from 75 to 300 S.S.U. at 100° F. are preferred. Diamond paraffin oil is used in the examples as illustrative.

In general, the sulfur should be in an active form, i.e., not bound to a carbon atom, so that it can react with a metal being machined under the conditions exist-

ing at the point of contact between the tool and the machined metal. The active form of the sulfur explains the corrosive nature of the oil. The active corrosive sulfur content may be furnished by the addition of a polysulfide, such as benzyl polysulfide, diamyltetrasulfide, diallyltetrasulfide, phenyl polysulfide, tallow polysulfide, xylyl polysulfide, naphthyl polysulfide, and anthracenyl polysulfide (see U.S. Patents Nos. 2,186,271 and 2,205,858), or sulfur in other forms. Pure sulfur may be added, if desired, and can be simply dissolved in or reacted with the oil at an elevated temperature.

The amount of the polysulfide which may be present in the oil will be enough to produce an active corrosive sulfur content of from about 0.1 to about 5%, preferably from about 0.5% to about 2%.

The cutting oil of the invention is a solution of the calcium stearate in the oil. This can be prepared by any convenient method, such as by mixing the components together with agitation, with heating, if necessary, to dissolve the calcium stearate.

The cutting oil is employed in the cutting of metals, such as abrasive steels, by cutting the metal while lubricating the metal and tool with the cutting oil.

Comparisons of the effectiveness of the cutting oil of the present invention with that of other cutting oils in the cutting of metal, such as Momax abrasive steel, are set forth in the following examples.

Example 1

A cutting oil was prepared by mixing together 92.4% anhydrous diamond paraffin oil (100 S.S.U. at 100° F.), 2.6% benzyl polysulfide to give a cutting oil containing about 0.8% active corrosive sulfur, and 5% calcium stearate, each on a total weight basis. This oil was compared with a cutting oil composed of 20% lard oil in a sulfurized (0.8% active sulfur) base oil (160 S.S.U. at 100° F.) in the production of one-half inch twist drills on an automatic milling machine. The work piece was one-half inch drill stock of regular Momax high-speed steel. Both flutes (22° Spiral, 0.128 inch depth) were milled simultaneously, then indexed to a second position where both margins were clearance milled. Operation was at 1.625 inches per minute, 176 s.f.m. Finish life was the criterion of tool life and out-of-dimension tool failure follows finish life by three or four drills. Separate work pieces were drilled while lubricating them, respectively, with each of the two cutting oils. In this operation 47 tool grinds gave an average of 36 drills per grind for both of these cutting oils before there was failure of the tool dimensions. It will thus be seen that the cutting oil of the present invention is equally effective as the more expensive cutting oil containing lard oil.

Example 2

A cutting oil was prepared by mixing together 92.4% anhydrous diamond paraffin oil (100 S.S.U. at 100° F.), 2.6% benzyl polysulfide, and calcium palmitate in amounts to give a cutting oil containing about 0.8% corrosive active sulfur and 5% calcium palmitate, each on a total weight basis. This cutting oil was tested following the procedure given in Example 1 and was found to average only 21 drills per grind for each five grinds. Accordingly a cutting oil containing anhydrous corrosive sulfurized mineral oil and calcium stearate soap is markedly superior to one containing the near lower homologue of calcium stearate, namely, calcium palmitate.

Example 3

A cutting oil comprising 10% lead naphthenate, 88% straw paraffin oil (75 S.S.U. at 100° F.) and 2% benzyl polysulfide (0.6% corrosive active sulfur) was tested in accordance with the procedure given in Example 1. It gave an average of 33 drills per grind for 6 grinds. This cutting oil containing a heavy metal soap was inferior in effectiveness compared to one containing calcium stearate even though this cutting oil contained twice as much soap as that contained in the cutting oil of the present invention.

Example 4

A cutting oil containing 7.5% lead linoleate, 90% diamond paraffin oil (100 S.S.U. at 100° F.) and 2.5% benzyl polysulfide (0.8% corrosive active sulfur) was tested in accordance with the procedure given in Example 1. It gave only 31 drills per grind for 5 grinds. This cutting oil containing another heavy metal soap was inferior to the cutting oil of the present invention even though this cutting oil contained 50% more heavy metal soap than that contained in the cutting oil of the present invention.

Various modifications and changes may be made in the cutting oil of this invention without departing from the spirit thereof or sacrificing any of the advantages thereof and hence it will be understood that this invention is to be limited only within the scope of the appended claim.

All percentages are by weight of the cutting oil composition.

We claim:

A liquid cutting oil consisting essentially of an anhydrous mineral oil of cutting oil viscosity, benzyl polysulfide in an amount to produce a corrosive active sulfur content of about 0.8% and about 5% calcium stearate.

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