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**CUTTING OIL CONTAINING CALCIUM
STEARATE**

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The present invention relates to a cutting oil contain-
ing 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 cut-
ting oil must therefore provide a certain degree of cool-
ing 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 em-
ployed 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 lubri-
cant.

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 cut-
ting 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 inexpen-
sive 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 cal-
cium 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, cal-
cium 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 criti-
cal. Lesser amounts appreciably reduce the effective-
ness 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. Dia-
mond 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-

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ing at the point of contact between the tool and the ma-
chined metal. The active form of the sulfur explains
the corrosive nature of the oil. The active corrosive sul-
fur content may be furnished by the addition of a poly-
sulfide, such as benzyl polysulfide, diamyltetrasulfide, di-
allyltetrasulfide, 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 pres-
ent in the oil will be enough to produce an active cor-
rosive 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 cal-
cium 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 dis-
solve the calcium stearate.

The cutting oil is employed in the cutting of metals,
such as abrasive steels, by cutting the metal while lubri-
cating 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 com-
pared 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. Sep-
arate 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 effec-
tive 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 fol-
lowing 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 mark-
edly 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

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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 inven-

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tion 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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