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3,180,829

PENETRATING OIL

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The present invention is directed to a penetrating oil.
More particularly, the invention is concerned with a pen-
etrating oil for loosening threaded connections. In its
more specific aspects, the invention is concerned with a
composition suitable for use as a penetrating oil.

The present invention may be briefly described as a
penetrating oil comprising a solution in an aromatic
naphtha boiling within the range from about 345° to 560°
F. of a lubricating diluent oil, an alkaline earth metal
sulfonate, an alkaline earth metal alkyl phenol sulfide
and a fatty acid ester.

The present invention suitably involves a penetrating
oil containing about 60 to about 90% by volume of the
aromatic naphtha, about 4 to about 21% by volume of
the lubricating diluent oil, about 3 to about 0.6% by
volume of calcium sulfonate, about 6 to about 1.4% by
volume of calcium-barium nonyl phenol sulfide and about
10.0 to about 2.0% by volume of isopropyl oleate.

The composition of the present invention may suitably
be made up within the ranges shown in Table I.

Table I

	Percent by volume
Heavy aromatic naphtha (345-560° F.)	60.0-92.0
Calcium sulfonate	2.8-0.6
Diluent oil	20.6-4.1
Calcium-barium nonyl phenol sulfide	6.6-1.3
Isopropyl oleate	10.0-2.0

The aromatic naphtha employed in the present inven-
tion suitably boils within the range from about 345° to
about 560° F. This aromatic naphtha may be obtained
by fractionating crude petroleum or it may be a solvent
extract of a crude petroleum fraction. The aromatic
naphtha may have an aromatic content from about 70.0
to about 95.0% by volume.

The lubricating diluent oil may be a treated lubricating
oil and suitably may be a blend of various lubricating oil
fractions. The lubricating oil used as a diluent suitably
may have the characteristics as shown in Table II which
follows:

Table II

	(1)	(2) ¹	(3) ¹
Boiling range, ° F.	700-950	650-825	700-850.
Gravity, ° A.P.I.	31 Min.	28 Min.	27 Min.
Viscosity S.S.U./100° F.	145-155	95-105	200-210.
Pour, ° F.	+15 Max.	-25 Min.	-20 Max.
Flash, ° F., COC.	410	330 Min.	375 Min.
Neutralization No.	0.05	0.10 Max.	
VI	102 Min.		
Aniline Point, ° F.			195 Min.

¹ Used as a 60%-40% blend of (2) and (3).

The lubricating diluent oil may be the lubricating oil
shown in column (1), Table II, or may be a 60%-40%
blend of the oils shown in columns (2) and (3) of Table
II.

The calcium-barium nonyl phenol sulfide is a com-
pound in which the phenolic groups are linked by the
sulfur atoms. This compound may contain from about
3 to 5 phenol radicals and the connecting sulfur atoms
may vary from 1 to 5 sulfur atoms between two phenol

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units. A method of making the phenol sulfide is de-
scribed in the Mikeska et al. U.S. Patent 2,488,134. It
is contemplated that other phenol sulfides may be used
such as the alkaline earth metal sulfides, for example, cal-
cium, barium, and strontium sulfides. Similarly, alkyl
sulfides may be used in which the alkyl radical has 4
to 10 carbon atoms.

Likewise, other compounds and other phenol sulfides
disclosed in the Mikeska et al. patent, supra, may be used
in the present invention, which compounds are incor-
porated by reference herein.

The fatty acid ester employed in the present invention
is preferably isopropyl oleate which imparts ash-free
properties to the composition of the present invention,
but other film-strength improvers may be used such as
the esters of the fatty acids as illustrated by oleates,
stearates, wax acid esters, and the like.

The alkaline earth metal sulfonate is preferably cal-
cium alkylated aromatic hydrocarbon sulfonate but other
alkaline earth metal sulfonates may be used. The alka-
line earth metal sulfonate is prepared from alkylated
benzene alkylate bottoms such as a C₆ to C₁₅ alkyl ben-
zene; preferably tertiary olefin is employed as the alkylat-
ing olefin.

In order to illustrate the invention further, three com-
positions of the improved mineral oil were made up in
accordance with the components shown in the following
Table III.

Table III

	Improved Penetrating Oil		
	1	2	3
	Percent by Volume		
Heavy aromatic naphtha	70.0	85.0	92.0
Calcium sulfonate	2.0	1.0	0.5
Diluent oil	15.2	7.6	4.2
Calcium-barium nonyl phenol sulfide	4.8	2.4	1.3
Isopropyl oleate	8.0	4.0	2.0

These compositions were tested by determining the
reduction in torque in freezing rusted nuts from bolts.
In this technique, specimens of ½ by 4 inch bolts having
2 inch minimum thread length had ½ inch hexagon nuts
threaded thereon. In preparing for the test, all threads
were chased using the same tap and die. All specimens
were cleaned of oil, grease and foreign material using
acetone and a stiff brush. The specimen was then dried
thoroughly and one nut was threaded on each bolt to a
distance sufficient to leave sufficient threads for placing
a second nut thereon. The bolthead and nut were
clamped in a vise and the second nut was then placed on
a bolt and the nuts were tightened with a torque of 180
inch-pounds. The several specimens were exposed to
rusting conditions in five gallons of water which was
blown with air until the desired rusting condition prevails,
which is a minimum of 400 inch-pounds torque required
to break the nuts free after air drying overnight when the
bolt and the first nut are held in a vise. After the rust-
ing criterion is met, the specimens are drained and dried
in air overnight. The torque required to unlock five
specimens is measured without employing any oil. There-
after, the composition of the present invention is placed
in a container having an oil depth sufficient to cover both
nuts on each bolt specimen. Five rusted bolt specimens
are dipped in each oil for a 15 second-interval and the
oil allowed to drain for 5 minutes. Then, holding the
bolthead and the first nut in a vise, the second nut is un-
locked recording the torque required to accomplish same.

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The total time from the dipping of the first specimen to the time of applying torque should be five minutes and 15 seconds. The procedure is then repeated allowing the specimen to drain or penetrate for 30 minutes with the total time from dipping to application of torque being 30 minutes and 15 seconds.

As a result of this procedure on testing several specimens, composition No. 2 in Table III for a 5-minute soak period showed an average reduction in torque of 21.6%, composition No. 1 for this same period of soaking showed an 18.6% torque reduction, while composition No. 3 showed a 17.0% reduction in torque.

For the 30-minute soak period, composition No. 2 showed an average reduction in torque of 34.6%, composition No. 3 showed an average reduction in torque of 24.8%, and composition No. 1 showed an average reduction in torque of 17.3%.

These data show that the improved penetrating oil is quite valuable and useful in freeing threaded connections. When comparing the improved penetrating oil to other penetrating oils available on the market, improved results are shown for the present invention. The invention is therefore quite desirable and useful.

The nature and objects of the present invention having been fully described and illustrated and the best mode thereof set forth, what we wish to claim as new and useful and secure by Letters Patent is:

A penetrating oil comprising a solution of about 60%

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to about 92% by volume of an aromatic naphtha boiling within the range from about 345° to about 560° F. and containing about 70% to about 95% by volume of aromatics, about 4% to about 21% by volume of a lubricating diluent oil boiling within the range from about 650° to about 950° F. and having a minimum A.P.I. gravity of about 27°, a viscosity SSU at 100° F. from about 95 to about 210, a minimum pour point of about -25° F., and a flash point of 330° F. minimum, about 3.0% to about 0.6% by volume of calcium alkylated aromatic hydrocarbon sulfonate having 6 to 15 carbon atoms in the alkyl group, about 6.0% to about 1.4% by volume of calcium-barium nonyl phenol sulfide wherein two phenolic groups are attached by a sulfur atom and about 10.0% to about 2.0% by volume of isopropyl oleate.

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