

UNITED STATES PATENT OFFICE

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LUBRICATING COMPOSITION

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This invention concerns an improved metal cutting oil comprising a mineral lubricating oil and a halogenated aliphatic hydrocarbon, as well as a method of using the same.

The combination of properties required in a cutting oil is not thoroughly understood, but it is known that such oil should flow toward the work from the point of contact, should flush away metal scraps or particles which would tend to clog and dull the tool and produce jagged surfaces in the metal under treatment, and should conduct heat away from the work.

An ordinary mineral lubricating oil cannot be employed satisfactorily as a cutting oil, since when such oil is used the tool usually becomes heated and tends to stick, and metal particles are not properly flushed away from the work, with the result that the metal surfaces formed by the operation are usually jagged and torn. It is known, however, that by emulsifying certain materials, e. g. soap and water, sulphur, etc., with mineral oil, a good grade of cutting oil may be produced. An emulsion of mineral oil, soap, and water is used extensively as a cutting oil.

We have now found that a superior cutting oil which, when applied in the usual manner, will permit exceptionally severe use of a tool before dulling, overheating, or sticking occurs, is provided by adding a halogenated saturated aliphatic hydrocarbon to a mineral lubricating oil. We have also found that ordinary cutting oils which contain mineral oil, e. g. emulsions of mineral oil with soap and water, sulphur, sulphur compounds, etc., may be improved in quality by incorporating therewith a halogenated saturated aliphatic hydrocarbon. When any such cutting oil, containing a halogenated aliphatic hydrocarbon, is employed in a metal cutting operation, the halogenated aliphatic hydrocarbon in the body of cutting oil in contact with the cutting tool and the metal under treatment reacts chemically with the latter to form a minute quantity of a metal halide.

The invention, accordingly, consists in the cutting oils and method of using same hereinafter fully described and particularly pointed out in the claims.

Our cutting oils are prepared by incorporating a halogenated saturated aliphatic hydrocarbon in a mineral lubricating oil or mixture containing such lubricating oil. A cutting oil of excellent quality can be prepared by partially brominating or chlorinating the lubricating oil and removing the acid generated by the reaction from the resultant mixture. However, due to the relatively

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high viscosity of the product and the difficulty involved in removing last traces of the acid therefrom, we prefer to prepare our cutting oils by dissolving or emulsifying a halogenated saturated aliphatic hydrocarbon, e. g. chlorinated gasoline or kerosene, in the lubricating oil.

Any grade or quality of mineral lubricating oil may be employed in our cutting oils, but for ordinary use we prefer an oil of light or medium grade. The halogenated aliphatic hydrocarbon should have a boiling point above about 140° C. at atmospheric pressure, i. e. sufficiently high so that it will remain unvolatilized and be retained in the cutting oil during use. Such halogenated hydrocarbon may contain either chlorine or bromine substituents or both, but a chlorinated compound is preferable over a corresponding brominated compound due to its greater stability against hydrolysis and decomposition. The halogenated compound may contain any desired proportion of combined halogen, but polyhalogenated compounds are somewhat superior to corresponding monohalogenated compounds for the present purpose. Among the various halogenated aliphatic hydrocarbons which may be employed are acetylene tetrachloride, acetylene tetrabromide, dichloro-tribromo-ethane, hexachloro-ethane, glyceryl-trichloro-hydrin, tetrabromo-propane, chlorinated gasoline, chlorinated kerosene, etc.

The cutting oil may contain any desired proportion of the halogenated hydrocarbon, since the latter improves the quality of the lubricating oil for metal cutting purposes regardless of the proportion used. In practice, however, we prefer to employ the halogenated hydrocarbon in such proportion that 100 kilograms of the cutting oil will contain between about 0.06 and 8.45 gram atomic weights of combined halogen. For instance, when a chlorinated hydrocarbon is used in the cutting oil, the latter will preferably contain between 0.02 and 3 per cent by weight of combined chlorine.

The following table sets forth data collected during two series of drilling tests using various oil mixtures as cutting oils. In each test, 3/4 inch holes were drilled through a sheet of boiler plate, 1 1/8 inch thick, using a drill which revolved 332 times per minute and which was mechanically advanced through the metal at a rate of 0.016 inch per revolution regardless of the cutting properties of the drill or oil employed. The drilling was continued, using a single drill and continuously directing on the work a stream of cutting oil having the composition stated in the table, until it become necessary to discontinue the drill-

ing for the reason stated under "Remarks" in the table. The linear inches of bore with a single drill before it became necessary to discontinue drilling was carefully measured and is stated in the table. The drills employed in the various runs were new drills from standard stock and were, as nearly as could be judged, of the same quality and sharpness.

In the first series of tests, a commercial emulsified cutting oil containing a mineral lubricating oil, soap, and water, was first tested, then various chlorinated aliphatic hydrocarbons were added to other samples of the same emulsified cutting oil and the resultant mixtures were tested as cutting oils. The results of these tests are found in the table under the caption "Series I."

In the second series of tests, a mineral lubricating oil of medium grade was first tested as a cutting oil, then various chlorinated aliphatic hydrocarbons were mixed with other samples of the same mineral oil and the resultant mixtures were tested as cutting oils. The results of these tests are listed under the caption "Series II" in the table.

The percentage composition of the cutting oil (or of a chlorinated aliphatic hydrocarbon contained in such oil) stated in the table is in each instance the per cent by weight.

the mineral oil, the latter is converted into an exceptionally good cutting oil.

In the claims the expressions "halogenated saturated aliphatic hydrocarbons" and "chlorinated saturated aliphatic hydrocarbon" are employed in the usual sense as referring to saturated aliphatic compounds which consist only of carbon, hydrogen, and halogen.

Other modes of applying the principle of our invention may be employed instead of those explained, change being made as regards the method or compositions herein disclosed, provided the steps or compositions stated by any of the following claims or the equivalent of such stated steps or compositions be employed.

We therefore particularly point out and distinctly claim as our invention:

1. A composition of matter comprising a mineral lubricating oil and a relatively small portion of a substantially non-volatile chlorinated paraffin hydrocarbon as essential ingredients.

2. A composition of matter comprising a mineral lubricating oil and a relatively small portion of a substantially non-volatile compound consisting of chlorine in chemical combination with a normally gaseous paraffin hydrocarbon.

3. A composition of matter comprising a min-

Table

Series	Run No.	Composition of Cutting Oil					Inches of Bore Before Stopping	Remarks
		Lubricating Oil Percent	Chlorinated Hydrocarbon—		Soap Percent	Water Percent		
			Kind	Percent				
I	1	7.9	-----	0	2.4	89.7	632	Tool became dulled to such extent that drilling could not be continued.
	2	7.1	Hexachloro-ethane-----	2.2	2.2	88.5	1,105	Tool became dulled.
	3	7.1	Acetylene Tetrachloride-----	1.8	2.2	88.9	1,165	Do.
	4	7.2	Chlorinated gasoline containing 39.8% chlorine.	1.1	2.2	89.5	1,060	Do.
	5	7.2	Chlorinated kerosene containing 32.2% chlorine.	1.1	2.2	89.5	1,172	Do.
	6	7.2	Chlorinated lubricating oil containing 21.6% chlorine.	1.1	2.2	89.5	1,087	Do.
II	1	100	-----	0	0	0	(1)	Drill became clogged with metal shavings, tool jerked rather than cutting evenly, and overheating occurred.
	2	98.83	Hexachloro-ethane-----	1.17	0	0	3,307	Tool became dulled.
	3	98.25	Chlorinated gasoline containing 39.8% chlorine.	1.75	0	0	2,423	Do.
	4	98.25	Chlorinated kerosene containing 32.3% chlorine.	1.75	0	0	4,336	Tool was quite sharp and still cutting smoothly at end of test.

¹ About 10.

In Series I of the foregoing table, a comparison of run 1 with runs 2—6 shows that the utility of an emulsified cutting oil which contains mineral oil can be increased considerably by adding thereto a small proportion of a chlorinated saturated aliphatic hydrocarbon. The soap present in the emulsified cutting oils was largely sodium oleate. However, other soaps, e. g. sodium stearate, potassium palmitate, triethanolamine-oleate, etc., may be employed instead, as well as other emulsifying agents such as are commonly used in preparing emulsified cutting oil compositions.

In Series II of the table, run 1 shows that a mineral lubricating oil has little if any value as a cutting oil. However, runs 2—4 of the same series show that by adding only a small proportion of a chlorinated aliphatic hydrocarbon to

eral lubricating oil and a relatively small portion of a substantially non-volatile chlorinated propane as essential ingredients.

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