

9 Claims

Example 1.—A water-base lubricating composition, designated Composition A, was prepared in the following manner. A solution, designated solution No. 1, was

formed by mixing 105 kilograms of water, 7 kilograms of glycerine and 350 grams of sodium carboxymethyl cellulose—CMC 1050. A second solution, designated solution No. 2, was formed by mixing 35 kilograms of water, 31.5 kilograms of triethanol amine and 31.5 kilograms of a mixture of sulfonated petroleum oils—Petromix No. 9—a mixture of petroleum sulfonates, oleates, potassium abietate, sulfonated oils, and coupling agents (the alcohols of higher paraffins). A third solution, designated solution No. 3, was prepared by the use of 31.5 kilograms of a rust preventative (X-0027), 6.0 grams of a fungicide (Vancide BN), and 12 kilograms of an anti-foam agent. The X-0027 rust preventative is comprised of 55 percent water and minor amounts of phenylmercuries, morpholines, nitrogen compounds, coupling agents and an anti-foam agent. The Vancide BN fungicide contains as active agents orthosilicate esters and hydroxyquinoline. The anti-foam agent had been previously prepared by mixing into 10 kilograms of water 1 kilogram of triethanol amine and 1 kilogram of chromium oleate.

Solution No. 2 was carefully mixed into solution No. 1, the solution being continuously agitated by a propeller mixer. Solution No. 3 was then added to the mixture of solutions 1 and 2 as mixing was continued. 0.3 gram of Jaune Ariable coloring agent was added for marketing purposes.

Composition A, prepared in the manner described above, was compared with a commercially available cooling composition, Ultralin. The Ultralin cooling composition is comprised of 83 percent water and minor amounts of polyethylene glycol, a mixture of ethers, a rust preventative, an anti-foam agent and a bactericide. Both Composition A and the Ultralin composition were diluted with water in a ratio of 20 to 1 and were used to lubricate a tungsten carbide cutting tool which was used to finish a 2-inch diameter 20-40 steel rod rotating on a metal lathe at s.f.p.m. 165. The temperature of the cutting tool near the cutting edge was measured by a thermocouple. The temperature of the cutting tool with the Ultralin cooling composition was measured to be 265° C. In contrast, the temperature of the cutting tool with Composition A was measured to be 75° C.

Two finished rods, the first finished with the use of Ultralin and the second finished with Composition A, were microscopically studied. The scorings on the finish of the second rod were found to be approximately three times closer than that on the finish of the first rod. This difference indicates that the vibration of the cutting tool used with Composition A was considerably less than with Ultralin, due to the improved high speed lubricity of Composition A. The same two finished rods were measured for roughness by the use of an ASA standard surface analysis machine. The average distance between the peaks and valleys of the rod finished with the Ultralin composition was found to be .006 inch, whereas that of the rod finished with Composition A was found to be .002 inch.

Example 2.—A second water-base lubricating composition designated Composition B was produced in the following manner. A solution, designated solution No. 1, was formed by mixing into 210 kilograms of water 3.50 kilograms of glycerine, and 0.75 kilograms of sodium hydroxyethyl cellulose—Cello-size. A second solution, designated solution No. 2, was produced by mixing into 70 kilograms of water, 3.15 kilograms of Petromix 9 and 31.5 kilograms of triethanol amine. Solution No. 3 was produced by mixing together, as in Example 1 above, 31.5 kilograms of rust preventative X-0027, 6.0 kilograms of fungicide (Vancide BN) and 12 kilograms of an anti-foam agent. As in Example 1, the anti-foam agent had been previously prepared by mixing together 10 kilograms of water with one kilogram of triethanol amine and one kilogram of chromium oleate.

Both Composition B and Cimcool, a high speed cooling composition, were diluted with water in a ratio of 20 to 1 and compared as cooling compositions for a

Bachler Screw Machine for machining Inconel X-750, a hard-cobalt-nickel alloy. The Cimcool cooling composition is comprised of about 50 percent water, and minor amounts of polyethylene glycol, propylene oxide, nitrogen compounds, a rust preventative and an anti-foam agent. It was found that through the use of Composition B the machining speed could be increased 75 percent, while still providing an excellent finish to the work, and tool wear was decreased more than 500 percent (with Cimcool it was necessary to replace tools once an hour, whereas with Composition B tools required sharpening or replacement once every five hours or more).

For an additional comparison Composition B and Cimcool were utilized to machine cast aluminium in a 6 turret metal lathe. It was found that through the use of Composition B machining speed could be increased 30 percent due to the lower friction provided by Composition B. It was also discovered that a new tap was required every seventy-two hours with Composition B, in contrast to once every three hours with Cimcool composition.

Cimcool and Composition B were tested for evaporation rates, and the evaporation rate of Composition B was approximately 2 percent by weight over a twenty-four-hour period, as opposed to 6 to 8 percent by weight loss over a twenty-four-hour period for Cimcool.

Example 3.—Composition A, Composition B, the Ultralin and Cimcool cooling compositions and a commercially available cutting oil were tested in a Falex test machine in dilutions of one part of lubricating composition to twenty parts water. In the Falex test machine the shaft was rotated at a speed of 295 r.p.m., and pressure was applied at the rate of 500 lbs./minute. The results of these tests are summarized below in Table I:

TABLE I

Lubricating composition:	Falex test pressure, lbs.
Composition A -----	>4000
Composition B -----	>4000
Cimcool -----	2600
Ultralin -----	2950
Straight cutting oil -----	2600

The above test clearly demonstrates the lubricity and anti-bind properties of the cooling composition provided by this invention.

Example 4.—The corrosion resistance of Ultralin, a commercially available lubricating and cooling composition, and Composition B were compared at dilutions of one part lubricating agent to one hundred parts of water by means of a Herbert Corrosion Test. Chips of cast iron were placed on the polished and degreased surface of two cast iron Herbert Corrosion Test blocks. The first test block was coated with the dilute solution of Composition B, and the second was coated with the dilute solution of Ultralin. The two test blocks were allowed to stand at room temperature for twenty-four hours, during which time the cooling composition completely evaporated. The cast iron chips on the two blocks were then microscopically examined for rust. The chips coated with the dilute Ultralin solution were found to show evidence of rust, whereas there was no evidence of rust on the chips coated with Composition B. This example demonstrates that the lubricating and cooling compositions provided by this agent provide a thin rust preventative coating to a workpiece even at low concentrations.

Example 5.—A water-base lubricating composition was prepared by thoroughly dispersing 0.76 part by weight of carboxymethyl cellulose marketed under the mark CMC 7 HF, and approximately 61 parts of water. A second solution was then formed by mixing approximately 21 parts of water with 3.22 parts of triethanolamine and 13.75 parts of a mixture of sulfonated petroleum oils—Petromix 9. A third solution was then prepared by mixing approximately 0.8 percent of a bactericide—Preveniol GDC—and approximately 0.45 percent of an anti-foam-

ing agent—Colloid 581B—using an appropriate amount of water to obtain a good dispersion. The second solution containing the amine and the sulfonated oils was then carefully mixed into the carboxymethyl cellulose solution and continuously agitated by a propeller mixer.

The third solution was then added to the mixture of the first two solutions as the mixing continued. During the mixing a small amount of coloring agent was added for marketing purposes. The total composition contained 81.75 percent water, 13.75 percent sulfonated oils, 3.22 percent of triethanolamine, 0.76 percent carboxymethyl cellulose, 0.08 percent bactericide, 0.45 percent anti-foaming agent, and a small amount of coloring agent.

This composition was then used in both rough face milling finish and pocket milling applications on titanium metal. Upon examination of the wear lands on the cutting tool edges, this composition was found to be equal or superior to CO₂ and can be used to replace CO₂ in all known applications. This is particularly advantageous from an economical standpoint since it eliminates CO₂ container rentals, storage for the CO₂ tanks, obtaining tank refills, and also the high production cost of CO₂. This composition was also used in face milling operations and end milling operations on steel. The resultant use of the lubricant of this invention in face milling operations showed a noticeable improvement in the finish and the one-half-inch diameter end mill tool life was increased by 30 percent over any other known fluid lubricating and cooling compositions. Tests on aluminum were also excellent.

The lubricating compositions of this invention also have other advantages. For example, foam tests showed that compositions of this invention settled within 15 seconds, while all others of which the applicant has knowledge take in excess of 15 minutes to settle. Heat thaw, rust tests and separation tests were also found to be excellent. The product is also odor free, clean, and will not stain garments. It leaves no scummy residue on the machine or production parts. It has surfactant or detergent action and will flush and clean the machine pump. It is anti-bacterial and will dry leaving a rust resistant film.

The sulfonated oils used in the compositions of this invention have a number of functions including the reduction of friction, although it is possible to use other oils for this purpose. Quite superior results were obtained by using the sulfonated oils, particularly in combination with the alkanolamines and carboxymethyl cellulose.

The same is true with respect to the alkanolamines which serve a corrosion inhibitor function. Other corrosion inhibitors could be used, but the alkanolamines, particularly triethanolamine, are quite superior, particularly in combination with the sulfonated oils and the carboxymethyl cellulose.

The amounts of the various materials which can be used can be varied quite widely, as will be apparent to those skilled in the art. The optimum amounts of carboxymethyl cellulose, sulfonated oils, and alkanolamines can readily be determined by routine experimentation.

The majority of the lubricating or cooling fluids of this invention is composed of course of water. The amount of carboxymethyl cellulose is advantageously in the range of 0.1 to 1.5% by weight of the total composition, and preferably about 0.75 percent. As low as 0.1 percent could also be used if desired.

The amount of sulfonated oils used will of course depend upon the amount of friction reduction desired, which will in turn depend upon the particular metal being worked and the speed at which it is being worked. Generally, anywhere from about 3 to 15 percent by weight of the total composition would be acceptable, and it is

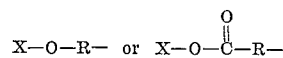
preferred in most instances to operate at the upper percentage level of between 13 and 15 percent.

Similarly, the amount of alkanolamines used will depend upon the particular alkanolamine selected for use and the amount of corrosion resistance desired, which will again depend upon the particular metal being worked. Generally, anywhere from about 3 to 15 percent by weight of the total composition would be acceptable, and it is advantageous in most instances to use an amount between about 3 to 5 percent.

The amounts of the other materials can also be varied and used in sufficient amount to prevent bacteria or fungus activity and to prevent foaming. The particular bactericide or fungicide or foaming agent used can be selected quite readily by those skilled in the art.

I claim:

1. A water-base fluid lubricating and cooling composition comprising a major amount of water and a minor amount of a boundary lubricant consisting essentially of 3 to 15% of a sulfonated oil, 3 to 15% of alkanol amine and 0.1 to 1.5% of a cellulose substituted with a member consisting of



wherein R is an alkyl group of 1 to 2 carbon atoms and X and an alkali metal, said percentages based on the total weight of the composition.

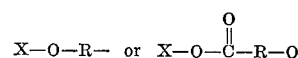
2. The composition of claim 1 wherein the alkanol amine is triethanolamine.

3. The composition of claim 1 wherein the cellulose is an alkali metal carboxy methyl cellulose.

4. The composition of claim 1 containing as an additional ingredient a small amount of glycerine effective to facilitate the mixing of the various ingredients.

5. The composition of claim 1 containing as an additional ingredient an anti-foam agent.

6. In the process of metal machining, the step of cooling the work with a composition comprising a major amount of water and a minor amount of a boundary lubricant consisting essentially of 3 to 15% of a sulfonated oil, 3 to 15% of an alkanolamine and 0.1 to 1.5% of a cellulose substituted with a member selected from the group consisting of



wherein R is an alkyl group of 1 to 2 carbon atoms and X is an alkali metal, said percentages being based on the total weight of the composition.

7. The process of claim 6 wherein the alkanol amine is triethanolamine.

8. The process of claim 6 wherein the cellulose is an alkali metal carboxy methyl cellulose.

9. The process of claim 6 wherein the composition contains as an additional ingredient an anti-foam agent.

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U.S. Cl. X.R.

252—33, 33.2, 33.4, 42.1, 42.7, 49.3, 49.5