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CUTTING COMPOUND

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My invention relates to cutting oils of the type sometimes referred to in the industry as "cutting oils", "straight cutting oils", or "non-soluble oils", that is, oils which do not depend upon a water content for their cooling action on cutting tools. I shall employ the term "straight cutting oils", or a term of like import, where I wish to identify this type of composition.

Cutting oils are usually considered to be of two general types, namely, straight cutting oils wherein water, if present at all, is found in only relatively small amounts and then only incidentally and in the form of dispersed, dissolved or discrete particles contained within the body of the oil; and soluble cutting oils wherein an oleaginous constituent is combined with water to produce an emulsion wherein water is present in substantial amounts and is the continuous phase, and wherein the water acts as a coolant while the oil acts as a lubricant. It is only to the former type of cutting oil that my present invention is directed.

The principal object of my present invention is the provision of an improved straight cutting oil.

Another object is the provision of an improved cutting oil having included as an ingredient thereof a material or a mixture of materials which function concomitantly to improve the cutting and cooling action of the oil as well as impart other improved properties thereto.

Still another object of my invention is the production of a base for use in straight cutting oils to improve the utility thereof.

Other objects and advantages will become apparent as the description of my invention proceeds.

It has previously been proposed to improve cutting oils of the so-called soluble type and also of the straight type by the addition thereto of ammonium oleate, this being disclosed in the patent to Dahlberg, No. 1,881,173. In what way or exactly how or why ammonium oleate functions, so far as the use thereof in straight oils is concerned, is not fully understood or appreciated. Soaps, as a general class, do not function in a manner to produce results comparable to those resulting from the use of ammonium oleate.

After careful investigation, I have made the surprising finding that certain specific soaps or classes of soaps possess very useful properties so far as improving the cutting and cooling action of straight cutting oils is concerned. These are the ammonium soaps of higher organic acids such as the higher fatty acids and the substituted ammonium soaps of said acids. Among the higher organic acids, containing at least six and preferably at least eight carbon atoms, employed in the making of said soaps are abietic acid, naphthenic acids, paraffinic and cyclo-paraffinic acids, saturated higher fatty acids such as lauric acid, myristic acid, mixed coconut oil fatty acids, stearic acid, palmitic acid; unsaturated fatty acids such as ricinoleic acid, mixed palm oil fatty acids, mixed castor oil fatty acids, and other fatty acids or mixtures thereof derived from natural oils, fats and waxes. In each case, the fatty acids which I employ are free of oleic acid or the oleic acid is present in such relatively small amounts as to be of negligible effect so far as the function of any ammonium soap formed therefrom is concerned. In many instances, I can hydrogenate an unsaturated oil such as corn oil or cottonseed oil so that the mixed fatty acids produced therefrom by catalytic reduction or by saponification are relatively free of oleic acid.

As I have stated above, the soaps are formed from the higher organic acids, such as those mentioned above, and ammonia or substituted ammonia. By the term "substituted ammonia" I mean to cover amines such as ethyl amine, propyl amine, butyl amine, dimethyl amine; diamines such as ethylene diamine, mono-methyl ethylene diamine; other amines such as diethylene triamine, pyridine and the like; alkylolamines such as monoethanolamine, diethanolamine, triethanolamine and mixtures thereof as, for example, are present in commercial triethanolamine, diethylethanolamine, butanolamine, pentanolamine, and other alkylolamines; and quaternary ammonium bases such as tetra-methyl ammonium hydroxide, tetra-ethyl ammonium hydroxide, trimethyl benzyl ammonium hydroxide and the like. Specifically, I have obtained unusually satisfactory results using ammonium laurate or the ammonium soaps of mixed coconut oil fatty acids. Triethanolamine soaps of said latter fatty acids are also very useful. I may also use triethanolamine oleate although not quite so satisfactorily as ammonium laurate.

I may proceed in various ways to produce my straight cutting oil compounds. For example, I may take mixed coconut oil fatty acids, in proper proportions, and disperse or dissolve the same in a portion of mineral oil, the proportion of mineral oil generally being somewhat less in amount than the weight or volume or mixed acids employed. I then react the said mixed acids with ammonia or a substituted ammonia in a suitable way, for example, by introducing a concentrated solution of ammonia, preferably commercial aqua

ammonia (28% NH_3). Stoichiometric amounts of the mixed coconut oil fatty acids and ammonia may be employed so that substantially all of the mixed acids are saponified. If desired, however, I may use somewhat less ammonia than sufficient to saponify all of the mixed acids. In some cases, an excess of the mixed acids is advantageous in that the resulting product disperses more readily in the body of the straight cutting oil in which it is subsequently incorporated. In addition to, or in place of, excess mixed coconut oil fatty acids, I find that I also improve the properties of the cutting oil by incorporating in the base, as just described, a relatively large proportion of oleic acid, other higher fatty acids such as castor oil fatty acids, pine oil, hexalin and/or other blending agents. These agents promote better cooling action of the cutting oil, increased tool life, and, in addition, have a general all-around function in improving the product. The base, prepared as described, is then incorporated in a straight cutting oil, usually in proportions of from about ½% to 10% by weight of the completed straight cutting oil. Alternatively, the base may be made by adding preformed ammonium laurate or the like, with or without addition agents, to a suitable oil and the resulting base dispersed or dissolved in a larger body of oil.

The following examples are given by way of illustration to point out even more fully my invention. It will be understood, however, that said examples are not to be taken as limitative in any way of the full scope of my invention, the latter being limited only by the claims.

Example I

Five gallons of commercial mixed coconut oil fatty acids, three and one-half gallons of a light paraffin oil and two gallons of pine oil are mixed together thoroughly at room temperature or slightly above and then seventy fluid ounces of commercial aqua ammonia (28% NH_3) are gradually stirred into said mixture. The ammonium soaps of the mixed coconut oil fatty acids form when the aqua ammonia is introduced and, after all of it has been stirred in, stirring may be continued for a few minutes and the product is then ready for use as a cutting oil base, the exact manner of use being described hereinbelow.

Example II

One hundred and eighty-three (183) parts of commercial ammonium laurate in paste form are dissolved in three hundred and sixty-six (366) parts of a mineral oil and one hundred and eighty-three (183) parts of pine oil, all parts being by weight, and the mixture is warmed slightly until the ammonium laurate dissolves. Approximately one and one-half (1½) pounds of the resulting base are incorporated into fifteen gallons of a sulphurized cutting oil to produce a finished cutting oil ready for use.

Example III

Two hundred (200) parts of a mineral oil are mixed with one hundred (100) parts each of mixed coconut oil fatty acids and pine oil and warmed slightly to aid in effecting solution of the fatty acids. Fifteen (15) parts of aqua ammonia (24.3% NH_3) are then stirred into the oleaginous mixture until a homogeneous mass results. All parts, as above described, are by weight. The resulting cutting oil base is then dispersed in lard in amounts of 2% to 4%, by weight, of the completed product.

It is by no means necessary, as my examples show, that the mixed coconut oil fatty acids and ammonia be introduced separately. For convenience and ease of compounding, however, the formation of the soap in situ is preferred. Other mixing procedures may be resorted to, it being necessary only to obtain a substantially uniform distribution of the soap through the oleaginous material.

In each of the examples given above, I have employed a proportion of an oil, specifically, a mineral oil in the cutting oil base and this is done primarily for the purpose of facilitating the introduction of the base into a larger body of oil as employed in contact with a tool. It should be borne in mind that, in general, I may produce the base itself without a content of free oleic acid or pine oil or other similar agent, in each case, however, retaining the oleaginous material in amount and character to facilitate the introduction of the cutting oil base into a larger body of lubricant. For all practical purposes, however, the base is found to be improved by incorporating therein both pine oil and a mineral oil as described in the illustrative examples given hereinabove.

My cutting oil base is adapted for use with any of the usual straight cutting oils now employed in the industry, such as oils of mineral, plant or animal origin, such as lard oil, kerosene and other mineral oils, sulfurized or unsulfurized, and treated with such other addition or reaction products as may be desired. The proportion of base with respect to straight oleaginous substance may vary, but I have found that, based upon the proportions given hereinabove, about two to four per cent of the base added to the standard, straight cutting oil greatly improves the action of that oil, whatever its constitution and function was prior to the introduction of my improved base.

For example, in a particular steel drilling operation, fifteen drills were required to be used in a twelve hour period using a standard sulphurized cutting oil as a coolant. By adding one and one-half pounds of the cutting oil base of Example II to fifteen gallons of the same sulphurized cutting oil, only six drills were required for the same job during the same period of time. Moreover, prior to the addition of my cutting oil base to the standard sulphurized cutting oil which was being employed, operation of the press had to be discontinued at least once an hour in order to allow the tool holders to cool. After the addition of the cutting oil base of my invention, no stoppage of operation of the press was necessary except that necessitated by a change of drills. In this particular case, the practice of my invention resulted in approximately 20% increase in production.

In another case, on a machine used for tapping hexagonal nuts, the life of the taps was increased from five hours, when using a standard cutting oil, to sixteen hours after the addition to said cutting oil of approximately 1%, by weight, of commercial ammonium laurate. Moreover, after the addition of the ammonium laurate, the work remained a great deal cooler than previously.

The cutting oil base of my invention may be added to mineral oil, sulfurized or unsulfurized oils, to lard oils and other oils derived from mineral, plant, animal or fish sources, or in fact to any straight cutting oil however it may have been prepared; and in each case, whatever the treat-

ment or constitution of that oil has been, I have found that distinct and remarkable improvements are obtained by the addition of a proportion of my cutting oil base.

It is, of course, obvious that I am not limited in the proportions of materials employed in the cutting oil as employed on a machine. In other words, in place of two to four per cent of the base, I may add to the cutting oil somewhat less than two per cent or considerably in excess of four per cent without departing from the spirit and scope of my invention. In general, I have found however, that the use of a proportion of the base materially less than two per cent begins to cut down the function of the ammonium or substituted ammonium soaps and other ingredients too greatly, and that the use of proportions greatly above four per cent in general does not improve the functions of the added ingredients sufficiently to warrant the added expense. Obviously, however, instances may and do arise where greatly increased proportions may be used while still operating within the teaching of my invention. I may say also that there may be times when it will be advisable to increase the proportion of mineral oil or other similar oleaginous material in the base, both for the purpose of improving the character of the base itself under certain circumstances and also facilitating the introduction of the base into certain types of straight cutting oils. Proportions of mineral oil with respect to ammonium or substituted ammonium soaps employed in the base, while generally not critical, may, under certain circumstances, be of importance. In general, therefore, while the percentage of cutting oil base is not critical, not more than about 10% should be used, primarily for reasons of economy. The proportion of the ammonium laurate or the like in itself should be correspondingly lower than that of the base of which it forms only a part.

In the use of the cutting oil of my invention, a final feature may be noted as important from a practical, commercial point of view. While certain features are fundamental and may apply in all instances, it nevertheless is known that each instance where a cutting oil is used is in a sense associated with specific conditions and problems. For example, in one case, two per cent of a base product made in accordance with my invention may be adequate to secure the best results possible; while in another instance three per cent of the base product may function somewhat better than two per cent. In still another instance, a sulfurized oil used conjointly with my cutting oil base may give better results than for example the use of lard oil with my cutting oil base; while in still another instance a lard oil or simple mineral oil or other oil may be more than adequately improved by the mere addition of a relatively small proportion of the base of my invention. My invention, therefore, may be practiced in such a way that a complete straight cutting oil ready to be used on, for example, an automatic screw machine may be given to the user. The sale of the base product, however, has the advantage that it can be combined in various proportions with various types of commonly employed straight cutting oils and, in this way, better results may be obtained in meeting specific problems as they arise.

I wish to distinguish my invention sharply from the well-known "soluble" cutting oils. The present invention is not concerned with said latter type of oils and is, therefore, not to be confused therewith.

What I claim as new and desire to protect by Letters Patent of the United States is:

1. A straight cutting oil comprising a substantially non-aqueous mixture containing a major proportion of an oil and a minor proportion, of the order of about ½% or more, of a substance selected from the group consisting of ammonium and substituted ammonium soaps of a higher organic carboxylic acid, substantially free of oleic acid.

2. A straight cutting oil comprising a substantially non-aqueous mixture containing a major proportion of an oil and a minor proportion, of the order of about ½% or more, of a substance selected from the group consisting of ammonium and substituted ammonium soaps of a higher fatty acid substantially free of oleic acid.

3. A straight cutting oil comprising a substantially non-aqueous mixture containing a major proportion of an oil and a minor proportion of a substance selected from the group consisting of ammonium and substituted ammonium soaps of a higher saturated fatty acid.

4. A composition in accordance with claim 3, wherein the oil is a mineral oil.

5. A straight cutting oil comprising a substantially non-aqueous mixture containing mineral oil and a relatively small proportion, based on the weight of said mineral oil, of a substance selected from the group consisting of ammonium and substituted ammonium soaps of mixed coconut oil fatty acids.

6. A composition in accordance with claim 3, wherein the fatty acid is essentially lauric acid.

7. A cutting compound in accordance with claim 5 wherein the straight cutting oil contains between about ½% and 10% by weight of the ammonium soap of mixed coconut oil fatty acids.

8. A substantially non-aqueous base for straight cutting oil compositions containing a higher fatty acid, a substance selected from the group consisting of ammonium and substituted ammonium soaps of a higher fatty acid substantially free of oleic acid, and an oil selected from the group consisting of animal, vegetable and mineral oils.

9. A substantially non-aqueous base for straight cutting oil compositions in accordance with claim 8 wherein the soap comprises an ammonium soap of mixed coconut oil fatty acids.

10. A substantially non-aqueous base for straight cutting oil compositions in accordance with claim 8 wherein the soap comprises essentially ammonium laurate.

11. A straight cutting oil comprising a substantially non-aqueous mixture which contains a largely predominant amount of a readily mobile oil, the remainder comprising oleic acid and an ammonium soap of mixed coconut oil fatty acids.

12. A substantially non-aqueous base for straight cutting oil compositions containing an oil and a relatively large proportion of an ammonium soap of saturated higher fatty acids, said base being adapted to be dispersed through a large volume of a readily mobile oil to produce a straight cutting oil composition.

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