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METAL CUTTING OIL

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Our invention relates to a novel oil product, and more particularly it relates to a metal cutting oil compound.

One object of our invention is to provide a metal cutting oil product which effectively and efficiently acts as a refrigerant and absorbs the heat generated in both the cutting tool and the metal being cut with no tendency to cause corrosion or otherwise deleteriously affect the tool or the metal.

A further object of our invention is to provide a metal cutting oil such as is employed to cool metal while it is being cut by a suitable tool and also cool the curled chip which rubs against the cutting tool, the cutting oil being capable of forming permanent and homogeneous emulsions or solutions when mixed with a diluent.

Still another object of our invention is to provide a base in concentrated form which may be easily transported and which may be mixed in the mill with the necessary amount of diluent for the particular work encountered.

Other objects will be apparent from a consideration of the specification and claims.

The metal cutting oil of the present invention may be utilized in the cooling of the metal and the tool in the same manner as other cutting oils have hitherto been used. Generally a continuous stream of cutting oil or cutting oil compound is directed against the tool and the metal, the efficiency of the oil or compound depending upon the heat-conducting properties of the oil. The metal cutting oil product of the present invention has relatively high heat-conducting properties and therefore is particularly applicable for use. The compound increase the life of the cutting tool and also tends to give more accurately machined work. The compound of the present invention utilizes as one ingredient a relatively cheap material and, therefore, an economical source of one of the raw materials is afforded.

The invention is characterized by the presence of talloil as one of the active ingredients in the metal cutting oil compound. The talloil may be utilized in anyone of the various types of metal cutting oils now known to the trade. One type of metal cutting compound comprises simply a mixture of a saponifiable oil and mineral oil which is employed directly without dilution with water or other mineral oil.

A second type of cutting compound contains saponifiable material, mineral oil, and a small amount of an emulsifying agent such as soap. If soap is employed, it is usually formed by adding to the other ingredients an amount of caustic solution corresponding to the amount of soap desired in the compound. The caustic, which may be caustic potash or soda, or sodium carbonate, reacts with a small proportion of the saponifiable matter forming the soap in the mixture. In addition to these three materials, the cutting oil may contain other materials. These mixtures may either be liquid or heavy bodied pastes at room temperature. In either event, the compounds when mixed with water form emulsions which are used in the mill as cutting oils. In the use of compounds of this type, great difficulty is encountered in maintaining the mixture in the form of an emulsion, the so-called hard water tending to break down the emulsion first formed. With the use of talloil as a saponifiable material, the compound may be mixed with water with assurance that a stable emulsion will result since the presence of lime or magnesium salts in the water fails to cause a break down of the emulsion.

There is a third type of metal cutting oil known as a sulphur-base compound in which free sulphur is employed in its manufacture. This compound also usually contains saponifiable matter and mineral oil but as opposed to the second described class, it is not used with water as a diluent but is diluted with hydrocarbon mineral oil and the like with which it forms a permanent and homogeneous solution. Hereinafter, the word "diluent" is used to include both water and oleaginous materials such as hydrocarbon mineral oil when employed with the compounds of either the second or the third type.

The talloil may make up the whole of the saponifiable material or it may be used to replace a portion of other saponifiable ma-

terial such as lard oil, castor oil, and oleic acid. Talloil, which is known in Germany as "Talloel", is at the present time produced in Europe for the most part, although it is available in this country. It may be defined as a waste material or by-product oil which is recovered from the wood of coniferous trees during the process of conversion of the wood fibre into cellulose by the so-called sulphate or Swedish process for cellulose pulp making. This process involves the treatment of chipped raw wood with a boiling solution of sodium bisulphate and sodium sulphate. The residual waste liquor obtained from the process after the separation of the cellulose therefrom separates into two layers, the top layer of which is skimmed off and represents the crude talloil. It is an oil of a strong tarry odor before purification and has chemical properties between those of a fatty and those of a resinic acid nature due to the fact that the talloil always contains both fatty acid and resinic acid as two constituents. If desired, the talloil may be purified by distillation or by many other known and practiced processes prior to its incorporation in the metal cutting oil, and either the purified or the crude talloil may be employed in the compound of the present invention.

The percentage of the talloil employed may vary widely and will be dependent upon the properties desired in the metal cutting oil product and upon the particular work for which the product is to be employed. It may constitute the only saponifiable material in the compound or it may be used to take the place of a portion of other saponifiable material, in which case the percentage of talloil employed will be reduced accordingly. In general, when the talloil is the only saponifiable material present, it will be used in proportions varying from 10% to 40%, while, if other saponifiable material is used in combination therewith, the percentage may be reduced to 2% or 3%. In either case, the proportions given are merely illustrative and are not to be considered limiting.

The following are typical formulæ for the manufacture of a metal cutting oil of the first described type which is not employed with a diluent:

Formula 1

	Percent
Talloil	25
Mineral oil	75

Formula 2

	Percent
Talloil	5
Lard oil	5
Mineral oil	90

Formula 3

	Percent
Talloil	20
Recovered wool grease (Degras)	5
Mineral oil	75

Formula 4

	Percent
Talloil	25
Recovered wool grease	10
Lard oil	15
Mineral oil	50

In the formation of a compound of the second type which is emulsified with water as a diluent prior to use, the oil product may be prepared by mixing the talloil, the other saponifiable material if any is used, the mineral oil, and caustic solution such as caustic soda, together with any other suitable materials, in the desired proportions. The mixture is then heated until the caustic saponifies the equivalent amount of saponifiable material. The method involving the formation of the soap in the presence of other ingredients is to be preferred since a more uniform mixture is obtained, but, if desired, soap itself may be added and the mixture agitated with or without heat until the homogeneous product results. Other emulsifying agents may be employed in place of soap, although this material is very effective and is cheaper than most other agents. In many instances, a more permanent emulsion and a more satisfactory product is obtained by the inclusion of a relatively small amount of a water-soluble organic solvent such as alcohol or higher boiling solvents of this type including diethyleneglycol and the alkyl ethers of dihydric alcohols such as ethyleneglycolmonoethylether and ethyleneglycolmonobutylether. In some instances, the presence of carbolic acid has been found to be desirable.

The following are typical formulæ for the manufacture of a metal cutting oil of the type which forms permanent emulsions in water:

Formula 5

	Percent
Oleic acid	6
Talloil	8
35° caustic soda solution	4
Ethyleneglycolmonoethyl- (or -monobutyl) ether	4
Mineral oil	78

Formula 6

	Percent
Rosin	5
Talloil	10
35° caustic soda solution	3.6
Ethyleneglycolmonoethyl- (or -monobutyl) ether	3.4
Mineral oil	78

Formula 7

	Percent
Talloil	13
35° caustic soda solution	3.8
Ethyleneglycolmonoethyl- (or -monobutyl) ether	3.7
Mineral oil	79.5

Formula 8

	Percent
Raw talloil	15.5
28° paraffine oil	77.3
35° Baumé caustic soda solution	3.7
Alcohol	3.5

Formula 9

	Percent
Distilled talloil	12
28° paraffine oil	81
35° Baumé caustic soda solution	3.6
Denatured alcohol	3.4

Formula 10

	Percent
Sulpho naphthenic sludge, derived from the treatment of white mineral oils	20
Distilled talloil	20
28° paraffine oil	44
35° Baumé caustic potash solution	8
Carbolic crystals	5
Diethyleneglycol	3

Formula 11

	Percent
Castor oil	10
Talloil	6
Recovered wool grease (Degras)	1.7
Mineral oil	45.4
Water	27.4
35° caustic potash solution	9.5

Formula 12

	Percent
Talloil	20
Mineral oil	45
Water	27
35° caustic soda solution	8

Formulæ 5 to 10 inclusive result in compounds which are liquid oily bodies at room temperature, while Formulæ 11 and 12 comprise white heavy bodied pastes. Any one of the Formulæ 5 to 12 inclusive may be diluted with three parts to fifteen parts of water, the exact amount depending upon the nature of the use for which the cutting oil is intended. In general, a satisfactory emulsion is obtained when the compound of the formula is diluted with ten parts of water. As previously pointed out, the emulsions formed are sufficiently stable as to be unaffected by the presence of lime and magnesium salts in hard water, which is of marked advantage. Formulæ 5 to 9 and 11 and 12 result in milky emulsions of a permanent nature when mixed with water. Formula 10, however, results in a clear, transparent emulsion when diluted with water, which is of particular advantage when the product is used as a cutting oil in the machining of steel.

As a typical example of a sulphur base, the following formula is given:

Formula 13

	Percent
Crude talloil	30
Mineral oil	30
Sulpho naphthenic sludge, from white mineral oil	20
Sulphur	15
Pine oil	5

This sulphur base cutting oil may be manufactured by heating a mixture of the compounds to a temperature at which the sulphur will be completely dissolved and combined with the other ingredients, for instance 350° F. In certain cases, it has been found advantageous to dissolve the sulphur in the saponifiable material or in a portion thereof by bringing it to a temperature in the neighborhood of 350° F., and thereafter slowly adding the sulphur during the heating. When the mixture of saponifiable material and sulphur is at the temperature given and the sulphur has thoroughly dissolved in the saponifiable material, the mineral oil, or if desired a portion of the saponifiable material and the mineral oil, which has previously been heated to a temperature in the neighborhood of 300° F. is added to the mixture of saponifiable matter and sulphur, the mass being agitated during the mixing process. Variations in the percentage of sulphur used in the above formula as well as in the percentages of the other constituents may be made. If desired, the sulpho naphthenic sludge may be replaced by other mineral oil and the pine oil may be omitted without departing from the invention. The sulphur base cutting oil of the above given formula, as before pointed out, when mixed with mineral oil as a diluent, gives a permanent homogeneous solution. The proportions of concentrated base to mineral oil may vary considerably. In general, it will be used in the proportion between four parts and twenty parts of mineral oil to one part of the sulphur base, though we do not restrict ourselves to these particular proportions.

In Formulæ 10 and 13, the use of sulpho naphthenic sludge, derived from white mineral oil, is specified. This material, as well as the paraffine oil or any other mineral oil, is included within the term "mineral oil product" used in the claims.

Considerable modification is possible in the percentages and choice of materials used and in the ratio of base to diluent employed without departing from the essential features of our invention.

We claim:

1. A metal cutting oil containing talloil as one ingredient.

2. A metal cutting oil containing talloil and a mineral oil product as two ingredients.

3. A metal cutting oil compound containing talloil and a mineral oil product as two ingredients, the talloil being present in percentages between 10% and 40%.

4. A concentrated base adapted for use after the addition of a diluent as a metal cutting oil compound, having therein talloil.

5. A concentrated base adapted for use after the addition of a diluent as a metal cutting oil compound, having therein talloil and a mineral oil product.

6. A concentrated base adapted for use after emulsification with water as a metal cutting oil compound, comprising talloil, a mineral oil product, and an emulsifying agent.

7. A concentrated base adapted for use after emulsification with water as a metal cutting oil compound, comprising talloil, a mineral oil product, and soap.

8. A concentrated base adapted for use after emulsification with water as a metal cutting oil compound, comprising as the principal ingredients talloil, a mineral oil product, and soap, the talloil being present in amounts from 10% to 40%, and the soap being present in amounts sufficient to bring about emulsification when water is added to the concentrated base.

9. A concentrated base adapted for use after emulsification with water as a metal cutting oil compound, comprising talloil, a mineral oil product, soap, and a water-soluble organic solvent.

10. A concentrated base, adapted for use after mixing with mineral oil as a metal cutting oil compound, comprising sulphur, talloil, and a mineral oil product.

11. A concentrated base, adapted for use after mixing with mineral oil as a metal cutting oil compound, comprising as the principal ingredients sulphur, talloil, and a mineral oil product, the talloil being present in amounts from 10% to 40%.

12. A metal cutting oil in the form of a water emulsion, comprising talloil, a mineral oil product, and an emulsifying agent, dispersed in water.

13. A metal cutting oil in the form of a water emulsion, comprising talloil, a mineral oil product, and soap, dispersed in water.

14. A metal cutting oil in the form of a water emulsion, comprising as the principal ingredients talloil, a mineral oil product, and soap, dispersed in water, the talloil being present in amounts from 15% to 35% of the weight of the materials exclusive of water and the soap being present in amounts sufficient to maintain the mixture in the form of an emulsion.

15. A metal cutting oil in the form of a water emulsion, comprising talloil, a mineral oil product, soap, and a water soluble organic solvent, dispersed in water.

16. A metal cutting oil in the form of a homogeneous solution, comprising a compound of sulphur, talloil, and a mineral oil product, dissolved in mineral oil.

17. A metal cutting oil in the form of a homogeneous solution, comprising a compound, the principal ingredients of which are sulphur, talloil, and a mineral oil product, the talloil being present in amounts from 15% to 35% of the total weight of the compound, dissolved in mineral oil.

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