Patented Aug. 13, 1940 2,211,250

UNITED STATES PATENT OFFICE

2,211,250

SOLUBLE CUTTING OIL AND METHOD OF PREPARING THE SAME

Paul T. Anderson, Park Ridge, and Harry L. Moir, Chicago, Ill., assignors to The Pure Oil Company, Chicago, Ill., a corporation of Ohio

No Drawing. Application July 17, 1936, Serial No. 91,098

12 Claims. (Cl. 252—48)

This invention relates to cutting oils and lubricants and to the method of making the same. The invention is more particularly concerned with soluble cutting oils and lubricants.

It is common practice to employ oils in grinding, polishing and cutting metallic bodies of various kinds. The oil serves a dual function as a coolant and as a lubricant. It is important that the oil used have a high film strength under the high pressures to which it is subjected during the cutting, grinding or polishing operation. When the film strength of the oil is insufficient, frequent dressing of the abrasive grinding, cutting or polishing wheel is necessary, with the result that the operation is time consuming.

This invention resides in a novel cutting oil which not only enables cutting operations to be performed in considerably less time than heretofore but also enables grinding and polishing to be done in one operation in less time than is required with present known cutting oils to perform the grinding operation alone. Furthermore, with present types of cutting oils, separate grinding and polishing operations are necessary, whereas grinding and polishing may be accomplished in one operation when oil prepared in accordance with this invention is used. On certain types of metal, as for example, aluminum, it is possible to obtain a higher polish than heretofore.

The composition to which this invention relates may be prepared by sulfurizing and then phosphorizing a vegetable, animal or marine fat or oil and preparing a homogeneous mixture or solution of the sulfurized and phosphorized body with a major portion of a mineral lubricating oil and a sufficient amount of emulsifying agent to allow the material to emulsify when mixed with water. As an emulsifying agent, various sulfonated fatty oils, sulfo-aromatic compounds of fatty oils, such as Twitchell reagent, and naphthenic or sulfo-naphthenic acid soaps, may be used. This composition may be mixed with water in various proportions depending upon the consistency of the material desired for the cutting, grinding or polishing operation.

When using naphthenic acid or sulfo-naphthenic acid soaps and other emulsifying agents, it may be necessary to add a small percent of an homogenizing agent to the composition to prevent separation into layers. For this purpose, poly-hydroxy alcohols such as diethylene glycol, glycerine and the higher mono-hydroxy alcohols such as butyl and amyl alcohols, may be used.

The composition prepared in accordance with the invention is highly sensitive to small amounts of reagents normally found in water. In certain instances the composition may readily emulsify with the water, whereas in other instances a satisfactory emulsification cannot be obtained. It may therefore be necessary in some cases to treat the water to remove therefrom the emulsifying inhibitors. For best results the water should have a pH value of approximately 7 and should not vary therefrom more than 0.5. Generally, the addition of either caustic alkali or of fatty acid, such as oleic acid, in amounts of 0.1% or less by weight, based on the quantity of water, assists emusification. In such cases where the composition does not readily emulsify, the water may be tested empirically by adding small amounts of caustic soda or oleic acid to different samples of the water and determining whether or not the composition will emulsify in the presence of one or the other reagent. After the proper amount of caustic soda or oleic acid to produce emulsification has been determined, this amount can be used in preparing the emulsion for commercial use.

The sulfurized and phosphorized material used in the composition may be prepared in the following manner:

A lubricating oil, preferably obtained from Gulf Coast crude, may be mixed with sulfur chloride in the proportions of 5 parts of the former to 0.5 of a part by weight of the latter. This mixture may then be incorporated with approximately 87 parts by weight of prime lard oil and the mixture slowly heated to approximately 270° F. At this temperature 7.4 parts by weight of finely ground flowers of sulfur may be added over a period of about 10 minutes. After the addition of sulfur the temperature of the mixture may be raised to approximately 330° F. and held at this temperature until the mixture shows no corrosion when a copper strip is dipped into it. The period of heating may require approximately 7 hours. During the heating the mixture should be continuously agitated. The resulting composition is then cooled rapidly to approximately 150° F. and then may be permitted to cool slowly to room temperature. The sulfurized material thus prepared may be used in that state as a constituent of the cutting oil base, or this material may be phosphorized by mixing with 99.6 parts of the sulfurized lard oil, 0.4 of a part of finely divided phosphorus sesquisulfide and the mixture heated to a temperature of approximately 220°–230° F. for a period of 5 hours with constant agitation. The resulting material may then be cooled to form the final sulfurized and phosphorized base. Although the method outlined is the preferable method for preparing the sulfurized and phosphorized bases, it will be understood that the preparation is not limited to the specific procedure outlined, nor to the specific quantities of ingredients.

The sulfurized and phosphorized base made in the aforesaid manner may be blended with a

Gulf Coast lubricating oil having the following characteristics:

Table I

A. P. I. gravity	21.2
Flash °F	350/360
Fire °F	385/395
Viscosity @ 100° F	200/210
Viscosity @ 210° F	42/45
Pour °F	−20/−25

and with an emulsifying agent. In some cases diethylene glycol or other homogenizing agent may be added. Twitchell reagent may be used as the emulsifying agent. Sodium sulfonaphthenate may also be used for this purpose, either alone or mixed with Twitchell reagent.

The sodium naphthenates or sodium sulfonaphthenates used in the composition may be obtained from the treatment of Gulf Coast oils. For example, where it is desired to obtain sodium naphthenate, an oil fraction containing naphthenic acids may be mixed with a 5–6° Baumé caustic soda solution and the resulting soap solution skimmed from the oil. To the soap solution sufficient sulfuric acid may be added to produce a neutral solution when tested with methyl orange. The solution is preferably agitated with air during the adding of acid. The naphthenic acids are liberated and separate as a top layer.

In certain instances it may be desirable to distill the resulting naphthenic acids in order to separate a fraction of the desired properties. In the distillation the temperature should not exceed 600° F. and distillation should be carried out in the presence of steam.

The sulfo-naphthenic acids may be obtained from Gulf Coast oils which have been treated with sulfuric acid. The acid treated oil may be neutralized with caustic soda solution and the water layer which contains in solution or suspension the sulfo-naphthenic acid soaps, may be withdrawn and acidified. The sulfo-naphthenic acids will separate as a top layer and can be skimmed.

A composition was made by blending together the following materials in the proportions stated:

Table II

	Percent
Emulsifier (consisting of 75% naphthenic acid soap—25% Twitchell reagent)	15
Sulfurized and phosphorized base	10
Lubricating oil (Table I)	74
Diethylene glycol	1

When this composition was blended with 10 parts of water to 1 of the composition, an emulsion was formed from which substantially no separation took place. The proportions above given are all by weight.

Another composition was prepared by mixing the following:

Table III

	Percent
Sulfurized-phosphorized base	10
Sulfo-naphthenic acid soap	10
Lubricating oil (Table I)	78
Diethylene glycol	2

This composition was likewise emulsified with 20 parts of water to 1 part of the composition and produced an emulsion which resulted in very little separation.

A third emulsion was produced by mixing a composition containing the following:

Table IV

	Percent
Twitchell reagent	25
Sulfurized-phosphorized base	10
Lubricating oil (Table I)	65

with 10 parts of water to 1 part of the composition. This emulsion like the preceding two, was very stable.

Although the specific examples given show blends of 1 part of composition to 10 to 20 parts of water, the composition may be blended with water in any proportion from 1 part of composition to 1 part of water up to approximately 50 parts of water to 1 part of the composition. 1 part of composition to 40 parts of water has been found to give excellent results for cutting and grinding purposes.

The soluble base prepared in accordance with the invention is in a liquid form, and in those cases where naphthenates or sulfo-naphthenates are used as emulsifying agents, it is desirable to add a small amount of homogenizing agent, such as diethylene glycol, to keep the material from separating into layers, since the material after separation emulsifies with the water only with great difficulty.

In the specific examples given, a sulfurized and phosphorized base was used, but excellent cutting oils may be made from sulfurized material which has not been phosphorized.

It is to be understood that although in the examples, specific quantities of various constituents have been given and specific constituents have been named, the examples are given only for purpose of illustration and the invention is not intended to be limited to either the specific amounts of materials or the specific materials, but broadly include other materials falling within the same general class or exhibiting the same functions as the materials specifically named.

Wherever used in the specification or claims the term "sulfurized" shall mean the chemical combination of sulfur and/or sulfur chloride with fatty material and the term "phosphorized" shall mean the chemical combination of phosphorus either elemental or in combination with other elements, with fatty material.

What is claimed is:

1. A soluble cutting oil base comprising a major portion of mineral lubricating oil and minor portions of fatty material which has been sulfurized and then phosphorized, an emulsifying agent, and an homogenizing agent.

2. A cutting oil base in accordance with claim 1 in which the homogenizing agent is a material selected from the group consisting of butyl alcohol, amyl alcohol, glycerine and diethylene glycol.

3. A cutting oil base in accordance with claim 1 in which the emulsifying agent comprises saponified sulfonated mineral oil acids.

4. A cutting oil base in accordance with claim 1 in which the emulsifying agent comprises saponified sulfonated mineral oil acids, and the homogenizing agent comprises compounds selected from the class consisting of mono-hydroxy alcohols of four or more carbon atoms and polyhydroxy alcohols.

5. Method of preparing a soluble cutting oil base which comprises sulfurizing fatty oil at elevated temperatures, phosphorizing the sulfurized oil, and compounding the sulfurized and phosphorized oil with mineral lubricating oil and an emulsifying agent.

6. Method in accordance with claim 5 in which

the sulfurized and phosphorized fatty oil is compounded with a major portion of mineral lubricating oil, a minor portion of saponified sulfonated mineral oil acid and sulfo-aromatic fatty acid and a still smaller portion of diethylene glycol.

7. The method of preparing an emulsion of a cutting oil which comprises agitating with water until emulsification takes place, an emulsifying agent, an homogenizing agent and a composition prepared by mixing 5 parts by weight of a lubricating oil, 0.5 of a part of sulfur chloride and 87 parts by weight of lard oil, slowly heating the mixture to 270° F.. then slowly adding 7.4 parts by weight of flowers of sulfur, raising the temperature to approximately 330° F. and holding the mixture at this temperature until it shows no corrosion to a copper strip, cooling to about 225° F. and adding 0.4 of a part of phosphorus sulfide to 99.6 parts of the sulfurized oil, holding the mixture at this temperature for approximately 5 hours and then cooling.

8. A soluble cutting oil comprising a major portion of a mineral lubricating oil and minor portions of an emulsifying agent and a material prepared by chemically reacting sulfur chloride and sulfur with a fatty oil at elevated temperatures and then reacting the sulfurized oil with a sulfide of phosphorus at elevated temperatures, and cooling the reaction product.

9. A soluble cutting oil in accordance with claim 8 in which the fatty oil is lard oil.

10. Method of preparing a soluble cutting oil base which comprises compounding with mineral lubricating oil and an emulsifying agent, a material prepared by mixing 5 parts by weight of a lubricating oil, 0.5 of a part of sulfur chloride and 87 parts by weight of fatty oil, slowly heating the mixture to 270° F., then slowly adding 7.4 parts by weight of flowers of sulfur, raising the temperature to about 330° F. and holding the mixture at this temperature until it shows no corrosion to a copper strip, cooling to about 225° F. and adding 0.4 of a part of a sulfide of phosphorus, holding the mixture at this temperature for approximately 5 hours, and then cooling.

11. Method in accordance with claim 10 in which the fatty oil is lard oil.

12. A soluble cutting oil comprising a major portion of a mineral lubricating oil, minor portions of an emulsifying agent and a material prepared by chemically reacting .5 part by weight of sulfur chloride and 7.4 parts by weight of sulfur with 87 parts by weight of lard oil at elevated temperatures and then reacting 99.6 parts of the sulfurized lard oil with .4 part by weight of phosphorus sesquisulfide at elevated temperatures and cooling the reaction product.

PAUL T. ANDERSON.
HARRY L. MOIR.