

1

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WIRE-DRAWING LUBRICATING COMPOSITION

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The present invention relates to an improved wire-drawing lubricating emulsion which is particularly useful in connection with the drawing of copper wire and to the composition from which this emulsion is prepared.

Wire is usually manufactured by pulling a rod or heavy wire through a series of dies of successively smaller diameter until the desired size and finish of wire are obtained. In many cases, the dies are made from either Carboloy or diamond and such dies have a long life when not abused in use. In the case of copper wire, the drawing may be, and frequently is, a continuous operation and the wire is drawn through the apparatus at a high speed. The wire is threaded through a number of dies of successively smaller size which have capstans, around which the wire is wrapped, located between each of the dies in a series. These capstans provide the necessary tension to pull the wire through the series of dies. Depending upon the ultimate size of wire desired, 3, 4, 5 or even more die blocks may be arranged so as to continuously reduce the size of the wire as it passes through the wire-drawing machine.

In a wire-drawing operation it is customary to cool and lubricate the area of contact between the die and the wire and between the wire and the capstan. This is necessary in order to protect the die and thereby prevent it from becoming distorted due to the intense heat engendered by the wire-drawing operation and also to protect the surface of the wire from distortion. One of the methods employed in a wire-drawing operation for cooling and lubricating wire-drawing apparatus involves continuously spraying a liquid lubricant on the wire at its various points of contact with the apparatus. Many types of liquid lubricants capable of accomplishing this end with varying success are known to the art. One of the preferred types of liquid lubricant is an aqueous emulsion containing certain ingredients that are known to have good lubricating and protective properties.

However, it has been difficult to manufacture aqueous emulsions which, in addition to possessing the requisite lubricating and cooling properties, possess satisfactory stability, i.e., a stability of the emulsion against separation into an aqueous and a non-aqueous layer between the time of preparation and the time of use. While the emulsions are usually prepared in the plant where they are to be used, frequently, because of the size of the batches prepared, the emulsion is allowed to stand for several days or even weeks before it is used. It may also stand over the week-end when the plant is not operating. It is therefore highly desirable to the wire-drawing industry that an emulsion of a wire-drawing lubricant have good stability during storage.

The drawing of copper wire imposes limitations on the composition of the wire-drawing lubricant that are not required of lubricants employed in wire-drawing operations on other metals. For example, one of the common ingredients of compounds used in the preparation of wire-drawing emulsions are the fatty acid soaps. However, compounds which are employed in the preparation

2

of emulsions for copper wire-drawing operations may not have a free fatty acid content above 1.0% by weight. If the free fatty acids in the composition exceed this limit, amounts of copper soap will be formed which are known to have an adverse effect on die life, thereby diminishing the profitability of such operations. Likewise, compounds containing "active" sulfur must be avoided as they will produce a stain on the copper wire.

It is the particular object of this invention to provide a composition that will readily emulsify with water and thereby provide a solution which will be particularly advantageous for the lubrication and cooling of the dies and wire during a copper wire-drawing operation.

It is another object of this invention to provide a lubricating composition capable of being emulsified with water for use in a copper wire-drawing operation which will possess an unusual degree of stability between the time of manufacture and the time of use.

Accordingly, we have formulated a lubricating composition which, when emulsified with water, will produce an improved lubricant for use in drawing of copper wire. In brief, the emulsion-forming compound of this invention consists of a mixture of a mineral oil, lard oil, a partial glyceride of a fatty acid, an oil soluble alkali metal petroleum sulfonate, and a glycol monoether.

The mineral oil of this invention may be any oil derived from petroleum falling within a viscosity range of 50 to 500 SSU measured at 100° F. The mineral oil may be unrefined, or refined such as by solvent extraction or acid treatment, as the economies of the particular situation may dictate. The mineral oil serves principally as a vehicle for the other ingredients of this composition and may be present in amounts ranging from about 23.0 to about 77.5% by weight.

The lard oil of this invention should be of a prime commercial variety and should not have free fatty acids in excess of 1.0% by weight. The cheaper industrial grades of lard oil will contain amounts of fatty acid well in excess of this limit. The lard oil may be present in amounts ranging from 10 to 30% by weight of the composition.

The preferred partial fatty acid glyceride, which may be present in amounts ranging from 5 to 15% by weight of the composition, may possess one or two fatty acid radicals of 12 to 18 carbon atoms esterified on the hydroxyl group of glycerol. The fatty acids may be saturated such as myristic acid or unsaturated such as oleic acid. Glycerol monolaurate is a preferred example. However, other partial glycerides such as glycerol dimyristate or glycerol mono-oleate may be employed.

The oil soluble petroleum sulfonates useful in the composition of this invention are oil-soluble alkali metal petroleum sulfonates having a molecular weight range of 350-650. The alkali metal contained in these sulfonates is preferably sodium, but lithium or potassium may also be employed. Sulfonates of the type contemplated herein are known in the art as "mahogany acid" sulfonates and may be present in amounts ranging from 5 to 25% by weight of the composition. Compositions sold under the trade-names Hardesty 19 and Carlisle 11T are illustrative.

Because of the fact that the lard oil and glyceride of the fatty acid are not compatible and tend to separate in a hydrocarbon vehicle and also when emulsified with water, an amount of a glycol monoether, varying from 2.5 to 7% by weight of the total composition, is added to the mixture. The glycol monoether provides a homogeneous solution of the ingredients of this composition prior to emulsification and thereafter. The mode of action of the glycol monoether is not known but is unimportant for the purposes of this invention. A number of glycol monoethers may be employed as stabilizers for

this composition, and the preferred glycol may have from 2 to 4 carbon atoms and the alkyl radical of the ether may have 3 to 6 carbon atoms. Two examples of preferred glycol monoethers are ethylene glycol monobutyl ether and diethylene glycol monobutyl ether.

A minor part of the above composition may be emulsified with a major amount of water such as in the range of 1 part of the composition to 8 to 20 parts of water. Such emulsions are stable over a period of several weeks.

As the best mode of practicing of our invention, a composition was prepared containing the following ingredients:

- 56.9 parts by weight of an acid treated mineral oil having a viscosity of 100 SSU at 100° F.,
- 21.8 parts by weight prime lard oil containing less than 1% free fatty acids,
- 9.1 parts by weight glycerol monolaurate,
- 7.4 parts by weight of oil soluble sodium petroleum sulfonate having a molecular weight of about 350-450 (Hardesty 19),
- 4.8 parts by weight of ethylene glycol monobutyl ether.

The composition resulting from this mixture of ingredients provided a greatly improved wire-drawing lubricant upon emulsification with water as shown in the test described below.

The test apparatus consisted of a cast iron sheave driven by an electric motor. A strand of copper wire was wrapped around the cast iron sheave and suitably anchored so as to maintain contact between the copper wire and the sheave as the sheave was rotated by the electric motor. In the absence of a satisfactory lubricant, rotation of the sheave is accompanied by singing and excessive vibration of the copper wire. Comparison of this test with commercial operations indicated that a composition which passes this test is suitable for commercial wire-drawing.

An emulsion prepared by conventional emulsion techniques from 1 part by weight of the preferred embodiment of this invention and 9 parts by weight of water was applied continuously to the areas of contact between the sheave and the wire in this apparatus. The instant emulsion proved to be entirely satisfactory in this test and eliminated the singing and vibration of the copper wire as the sheave was rotated.

This composition has also proven entirely satisfactory in commercial operations to persons engaged in the manufacture of copper wire. The emulsion was stable for several weeks.

Two emulsions were also prepared in accordance with

the teachings of the preferred embodiment of this invention except that the lard oil was left out of one of the compositions while the glycerol monolaurate was excluded from the other. Neither of these compositions proved satisfactory when tested in the test apparatus described above. Excessive singing and vibration of the copper wire occurred when the sheave was rotated in the presence of these emulsions. Since the composition of this invention eliminated all singing and vibration of the copper wire, it is believed that there are certain synergistic effects resulting from the combination of the lard oil and the partial fatty acid glyceride so that an effective lubricant is obtained only when they are combined.

However, the exact theory which explains the effectiveness of the composition of this invention is unimportant to the invention. This application is intended to cover all reasonable modifications of this invention falling within the scope of the appended claims.

We claim:

1. A composition consisting of an amount of mineral oil having a viscosity of 100 SSU at 100° F. in the range of about 23 to about 77.5% by weight of the composition, an amount of lard oil in the range of about 10 to 30% by weight of the composition, an amount of glycerol monolaurate in the range of about 5 to about 15% by weight of the composition, an amount of an oil soluble alkali metal petroleum sulfonate in the range from about 5 to about 25% by weight of the composition, and an amount of ethylene glycol monobutyl ether in the range from about 2.5 to about 7% by weight of the composition.

2. An emulsion consisting of a major amount of water and a minor amount of the composition of claim 1.

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