

UNITED STATES PATENT OFFICE

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COOLING AND LUBRICATING MEANS FOR
THE WORKING OF METALSFritz Singer, Socking on the Starnberger See,
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6 Claims. (Cl. 252—33)

This invention relates to a cooling and lubricating means for the working of metals, and more particularly to the cold working of metals such as stretching and drawing in the presence of an aqueous cooling and lubricating medium.

In the working of metals and particularly in cold working processes such as stretching or drawing iron, steel, brass and the like, it is often necessary to provide a means for cooling and lubricating the metal during the working thereof. For this purpose aqueous solutions of ordinary soaps have been suggested but suffer from many disadvantages. By an ordinary soap is meant a soluble salt of a higher aliphatic carboxylic acid, for example, sodium stearate and similar compounds. When such compounds are dissolved in an aqueous medium and employed as a cooling and lubricating means in the stretching and drawing of metals such as iron, steel, brass and other heavy metals, they are objectionable because of the formation of insoluble salts with the heavy metal or with calcium, magnesium or similar salts ordinarily present in hard water. In a stretching process such as described in United States Patent No. 1,982,544, in which portions of a tube or other metal article are repeatedly and successively subjected to elongating forces to reduce the wall thickness thereof, the formation of such insoluble salts is exceedingly undesirable and may cause clogging of the apparatus. Furthermore, the presence of such salts seriously interferes with cooling and lubrication of the metal. Ordinary soap solutions are likewise difficult to work with because of the excessive foam and their lubricating action is often entirely insufficient, for instance, when they are used in a process for reducing the wall thickness of tubes, as described in the aforesaid United States patent.

It is known that a wide variety of long chain organic compounds and other types of organic compounds containing sulfonic groups show some of the properties of soaps and find use in the textile industry as wetting and dispersing agents. These materials greatly differ with different classes of compounds and while many of them possess some of the properties similar to ordinary soaps, they may possess many different properties from soaps. Hence, from the fact that they are intended to replace soaps for cer-

tain purposes in the textile industry, it does not follow that all sulfonic and sulfuric derivatives can be used for non-related purposes such as the cooling and lubricating of metals in the mechanical working thereof.

It is an object of this invention to provide certain new and useful lubricating means for the working of metals and particularly for the cold working of metals. A further object is the provision of a cooling and lubricating means which possesses excellent lubricating action in the more difficult types of metal working such as stretching. An additional object is the provision of a new and improved substantially non-corrosive cooling and lubricating means for metal working. Another object is the provision of a method for cooling and lubricating metals such as iron and brass without producing etching and permanent surface defects during the mechanical working thereof. Other objects will appear as the description proceeds.

In accordance with the invention, it has been found that aqueous solutions of the salts of the compounds obtained by the combination of higher molecular fatty acids with aliphatic, cycloaliphatic and aromatic oxy- and halogen sulfonates are particularly suitable for cooling and lubricating metals during the mechanical working thereof. Most of these compounds when dissolved in water and employed as a lubricating and cooling means are slightly corrosive and in order to avoid the corrosive effects thereof it is necessary to incorporate with said compounds a substance capable of preventing or inhibiting corrosion of the metal, preferably an alkaline salt and particularly such salts as alkali metal carbonates and alkali metal borates.

Sulfonates of the type described are excellent lubricating agents in an aqueous medium, even in the more difficult types of metal working such as the elongation and reduction of wall thickness of iron, steel, brass and other heavy metal tubes. These materials are far superior to soaps as well as to sulfates of the fatty alcohols with regard to their lubricating action to the extent that they may be used in considerably small quantities and for purposes where the lubricating action of soaps is entirely insufficient, as, for instance, with the process for reducing the wall thickness of tubes mentioned above. A fur-

ther advantage of the solutions of the above named materials over soap solutions consists in the elimination of the formation of foam which is so objectionable in soap solutions. Likewise the formation of insoluble lime salts and heavy metal salts is avoided.

Among the compounds which may be employed in accordance with the present invention are those having the following formulas:

- (1) $R.COO.R_1.SO_3.X$
- (2) $R.COO.R_2.SO_3.X$
- (3) $R.COO.R_3.SO_3.X$

In the foregoing formulas R represents an aliphatic hydrocarbon radical, saturated or unsaturated containing 8 to 18 carbon atoms, e. g., octyl, nonyl, decyl, dodecyl, tetradecyl, hexadecyl, octadecyl and 9,10-octadecenyl (oleyl); R_1 preferably represents an aliphatic hydrocarbon radical, e. g., $-CH_2-$, $-C_2H_4-$, etc.; R_2 represents phenyl, tolyl, xylyl, naphthyl, etc.; R_3 represents naphthenyl, tetrahydronaphthyl, etc.; and X represents $-Na$, $-K$.

The radicals R, R_1 , R_2 and R_3 may contain substituent groups in place of hydrogen, e. g., halogen atoms such as chlorine, bromine, fluorine, hydroxyl groups, alkoxy radicals (e. g., methoxy, ethoxy, etc.), amino and substituted amino groups (e. g., diethylamino, dimethylamino). They may contain one or more sulfonic groups. The aliphatic chain of the radicals R and R_1 need not be continuous carbon chains but may contain ether linkages ($-O-$), thioether linkages ($-S-$), or imino linkages ($-NH-$) between carbon atoms of the chain. These and other suitable compounds useful for the purpose of the invention may be prepared as described in French Patent No. 705,081 and United States Patent No. 1,881,172.

The following example is a preferred illustration of the preparation of a non-corrosive cooling and lubricating means in accordance with the invention.

Example

A solution of 200 parts of the sodium salt of the compound produced according to Example 6 of French Patent No. 705,081 having the formula $R.COOC_2H_5.SO_3Na$ in which R represents an aliphatic hydrocarbon radical of at least 6 carbon atoms, 50 parts of sodium carbonate and 100 parts of borax in 12,000 to 14,000 parts of water was prepared by dissolving the compounds in water. This medium proved to be an excellent cooling and lubricating medium in the stretching process described in United States Patent No. 1,982,544, when applied to heavy metal tubes made of iron, steel, brass and similar materials. Excellent working of the metal was obtained without etching or otherwise producing permanent surface defects.

It will be understood that the foregoing example is illustrative and that the proportions of the materials may be varied. The borax may be used alone. Instead of sodium carbonate, other alkali metal carbonates may be employed.

It has further proved to be advantageous to stir into the solutions produced as described

above small amounts of a lubricating oil, for instance, rape-seed oil or rape oil.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A cooling and lubricating medium for the mechanical working of metals consisting of an aqueous solution of a compound having the general formula: $R.COO.R_x.SO_3M$ in which R represents an aliphatic hydrocarbon radical containing eight to eighteen carbon atoms, R_x represents aliphatic, cycloaliphatic and aromatic radicals and M represents a salt forming radical.

2. A cooling and lubricating medium for the mechanical working of metals consisting of an aqueous solution of alkaline salts capable of inhibiting corrosion of the metal and a compound having the general formula: $R.COO.R_x.SO_3M$ in which R represents an aliphatic hydrocarbon radical containing eight to eighteen carbon atoms, R_x represents aliphatic, cycloaliphatic and aromatic radicals and M represents a salt forming radical.

3. A cooling and lubricating medium for the mechanical working of metals consisting of about 50 parts of sodium carbonate, about 100 parts of borax, about 12,000 to about 14,000 parts of water, and about 200 parts of a compound having the following formula: $R.COO.R_x.SO_3M$ in which R represents an aliphatic hydrocarbon radical containing eight to eighteen carbon atoms, R_x represents aliphatic, cycloaliphatic and aromatic radicals and M represents a salt forming radical.

4. In the art of cold working metals by stretching, the step which comprises carrying out the process with the portions of the metal being worked in contact with an aqueous cooling and lubricating medium consisting of a compound having the general formula: $R.COO.R_x.SO_3M$ in which R represents an aliphatic hydrocarbon radical containing eight to eighteen carbon atoms, R_x represents aliphatic, cycloaliphatic and aromatic radicals and M represents a salt forming radical, and a corrosion inhibitor.

5. In the art of cold working metals by stretching, the step which comprises carrying out the process with the portions of the metal being worked in contact with an aqueous cooling and lubricating medium consisting of a compound having the following formula: $R.COO.R_x.SO_3M$ in which R represents an aliphatic hydrocarbon radical containing eight to eighteen carbon atoms, R_x represents aliphatic, cycloaliphatic and aromatic radicals and M represents a salt forming radical, and containing an alkaline salt inhibiting corrosion of the metal.

6. In the art of cold working metals by stretching, the step which comprises carrying out the stretching process with the metal in contact with a cooling and lubricating medium consisting of an aqueous solution of an alkali metal carbonate, borax and a compound having the following formula: $R.COO.R_x.SO_3M$ in which R represents an aliphatic hydrocarbon radical containing eight to eighteen carbon atoms, R_x represents aliphatic, cycloaliphatic and aromatic radicals and M represents a salt forming radical.

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