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METHOD OF DRAWING WIRE AND A LUBRICANT THEREFOR

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This invention relates to a method of drawing wire and a lubricant therefor and is a continuation-in-part of my copending application Serial No. 477,417, filed December 23, 1954, now abandoned. In the drawing of wire, particularly steel wire, the wire is coated with a lubricant and then drawn through a plurality of dies to reduce the diameter thereof. When the wire is to be subsequently plated it is very important that its surface be perfectly clean prior to entering the plating bath. The lubricants most commonly used are such that they are difficult to remove from the wire and it is necessary to bake the coated and drawn wire at high temperatures or to pass it through a bath of molten lead to remove the coating.

Some types of material are also extremely difficult to draw, this being particularly true of stainless steel. Commonly, the stainless steel may be prepared for drawing by coating it with wet lubricant or with a dry lime lubricant mixture. In either case it is necessary to draw the wire at a low speed through expensive diamond dies. Even so the die life and the finish on the drawn wire is poor and breakage of the wire during the drawing operation is high.

It is therefore an object of my invention to provide a method of drawing wire in which the coating of wire drawing lubricant is readily removed therefrom by water, either in liquid or vapor form.

Another object is to provide a method of drawing stainless steel wire without the use of diamond dies in which the drawn wire has an improved surface finish.

Another object is to provide a wire drawing lubricant which is particularly adapted for drawing stainless steel wire or wire which is to be subsequently coated.

These and other objects will be more apparent after referring to the following specification.

The wire drawing lubricant of my invention must include an organic compound of the group consisting of $ROSO_3X$, RSO_3X and RR^1SO_3X where R is a saturated alkyl hydrocarbon chain containing between 8 and 18 carbon atoms, R^1 is an aromatic hydrocarbon ring and X is one of the alkali metals such as lithium, sodium or potassium. Particular compounds of the alkyl sulfate group ($ROSO_3X$) suitable for this purpose include sodium octyl sulphate—$C_8H_{17}OSO_3Na$, sodium decyl sulphate—$C_{10}H_{31}OSO_3Na$, sodium lauryl sulphate—

$$C_{12}H_{31}OSO_3Na$$

sodium palmityl sulphate—$C_{16}H_{31}OSO_3Na$ and sodium stearyl sulphate—$C_{18}H_{17}OSO_3Na$. Particular compounds of the alkyl sulfonate group (RSO_3X) suitable for this purpose include sodium octyl sulfonate—$C_8H_{17}SO_3Na$, sodium decyl sulfonate—$C_{10}H_{31}SO_3Na$, sodium lauryl sulfonate—$C_{12}H_{25}SO_3Na$, sodium palmityl sulfonate—

$$C_{16}H_{31}SO_3Na$$

and sodium stearyl sulfonate—$C_{18}H_{17}SO_3Na$. Particular compounds of the alkyl aryl sulfonate group (RR^1SO_3X) suitable for this purpose include octyl benzene sodium sulfonate—$C_8H_{17}C_6H_4SO_3Na$, decyl benzene sodium sulfonate—$C_{10}H_{31}C_6H_4SO_3Na$, lauryl benzene sodium sulfonate—$C_{12}H_{25}C_6H_4SO_3Na$, palmityl benzene sodium sulfonate—$C_{16}H_{31}C_6H_4SO_3Na$ and stearyl benzene sodium sulfonate—$C_{18}H_{17}C_6H_4SO_3Na$. Lithium or potassium can be substituted for the sodium in any one of the above listed compounds and the aromatic hydrocarbon naphthalene ($C_{10}H_8$) can be substituted for benzene (C_6H_6) in the alkyl aryl sulfonate group. In addition to one or more of the above mentioned compounds, the lubricant of my invention may include a water soluble compound of the group consisting of borax, copperas, phosphates and silicates which are well known wire drawing aids. The water soluble phosphates and silicates are the phosphates and silicates of the alkali metal group such as sodium orthophosphate, sodium pyrophosphate, potassium orthophosphate, potassium pyrophosphate, potassium metasilicate, potassium tetrasilicate, sodium metasilicate, sodium disilicate, sodium orthosilicate and sodium pyrosilicate.

In the drawing the wire it may be coated by dipping the wire to be drawn in a water solution containing between 2 and 20% by weight of one of the above-mentioned organic lubricants. In addition one or more of the above-mentioned water soluble drawing aids may be added to the solution, the amount of such addition not being critical. A typical solution would have from 2 to 20% by weight of sodium lauryl sulphate and the remainder borax at a concentration of 16 to 24 oz. per gallon with the solution being at a temperature between 150° and 200° F. Another typical solution has from 2 to 18% by weight of lauryl benzene sodium sulphonate ($C_{12}H_{25}C_6H_4SO_3Na$) and the remainder sodium orthophosphate at a concentration of 15 to 30 oz. per gallon with the solution being at a temperature between 150° and 200° F. The coated wire is then drawn through a plurality of dies and reduced to the desired diameter after which it is passed through water in the form of a bath or spray. The spray may be either in liquid form or steam.

Another manner of carrying out my method is to pass the wire either with or without a coating previously applied thereto in the manner described above through the lubricant of my invention in a powdered or dry form.

One specific method of drawing stainless steel found to be successful is as follows: A workpiece of annealed stainless steel having a diameter of .038 inch is dipped into a water solution containing 24 oz. per gallon of sodium lauryl sulphate and 36 oz. per gallon of borax at a temperature of between 180° and 200° F. After each of the first two dips the coated wire is dried in a flash baker at 450° F. and after the last dip it is allowed to dry in air. The coated wire is then drawn through ten tungsten carbide dies to a finished diameter of .013 inch at a finishing speed of 1000 feet per minute. Speed of between 600 and 1200 feet per minute may be attained in the drawing of stainless steel. With conventional lubricants the maximum speed obtainable is between 200 and 300 feet per minute. The die life is also increased over the die life when using conventional lubricants and methods since there is less galling in the dies; that is, slivers and other small particles of metal do not adhere to the die surfaces. Scratched and broken wires are almost completely eliminated when using this lubricant. As the wire is being drawn it passes through powdered sodium lauryl sulphate which is provided in all the die boxes.

While several embodiments of my invention have been described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. The method of dry drawing steel wire comprising dipping the wire in a water solution of a water soluble lubricant consisting of between 2% and 20% by weight of a sulphate having the formula $ROSO_3X$ where R is a saturated alkyl hydrocarbon chain containing between 8 and 18 carbon atoms and X is one of the alkali metals, a water soluble wire drawing aid of the group consisting of borax, alkali metal phosphates and alkali metal silicates and the remainder water, said lubricant forming a

coating on said wire, drying the coating on said wire, and passing said coated wire through a series of dies.

2. The method of dry drawing steel wire comprising dipping the wire in a water solution of a water soluble lubricant consisting of between 2% and 20% by weight of a sulphate having the formula $ROSO_3X$ where R is a saturated alkyl hydrocarbon chain containing between 8 and 18 carbon atoms and X is one of the alkali metals, a water soluble wire drawing aid of the group consisting of borax, alkali metal phosphates and alkali metal silicates and the remainder water, said lubricant forming a coating on said wire, drying the coating on said wire, passing said coated wire through a water soluble wire drawing lubricant containing one of said sulphates, and then through a series of dies.

3. The method of dry drawing steel wire comprising dipping the wire in a water solution of a water soluble lubricant consisting of between 2% and 20% by weight of sodium lauryl sulphate and the remainder borax and water, said lubricant forming a coating on said wire, drying the coating on said wire, and passing said coated wire through a series of dies.

4. The method of dry drawing stainless steel wire comprising dipping the wire in a water solution containing between 2% and 20% by weight of a sulphate having the formula $ROSO_3X$ where R is a saturated alkyl hydrocarbon chain containing between 8 and 18 carbon atoms and X is one of the alkali metals, a water soluble wire drawing aid of the group consisting of borax, alkali metal phosphates and alkali metal silicates and the remainder water, said sulphate and wire drawing aid forming a coating on said wire, drying the coating on said wire, passing said coated wire through a water soluble wire drawing lubricant containing one of said sulphates, and then through a series of tungsten carbide dies.

5. The method of dry drawing stainless steel wire comprising dipping the wire in a water solution containing between 2% and 20% by weight of a sulphate having the formula $ROSO_3X$ where R is a saturated alkyl hydrocarbon chain containing between 8 and 18 carbon atoms and X is one of the alkali metals, a water soluble wire drawing aid of the group consisting of borax, alkali metal phosphates and alkali metal silicates and the remainder water, said sulphate and wire drawing aid forming a coating on said wire, drying the coating on said wire, passing said coated wire through a water soluble wire drawing lubricant containing one of said sulphates, then through a series of tungsten carbide dies, and then removing the coating from the drawn wire by the application of water.

6. The method of dry drawing stainless steel wire comprising dipping the wire in a water solution containing between 2% and 20% by weight of sodium lauryl sulphate and the remainder borax and water at a temperature of between 180° and 200° F. so as to form a coating on said wire, drying said coated wire in a flash baker, repeating the dip and drying operations, again repeating

the dip, air drying the coated wire, then passing the coated wire through a series of tungsten carbide dies, and then removing the coating from the drawn wire by the application of water.

7. A water solution of a water soluble wire drawing lubricant consisting of between 2% and 20% by weight of a sulphate having the formula $ROSO_3X$ where R is a saturated alkyl hydrocarbon chain containing between 8 and 18 carbon atoms and X is one of the alkali metals, a water soluble wire drawing aid of the group consisting of borax, alkali metal phosphates and alkali metal silicates, and the remainder water.

8. A water solution of a water soluble wire drawing lubricant consisting of between 2% and 20% by weight of sodium lauryl sulphate and the remainder borax and water.

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