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LUBRICANT FOR COLD DRAWING OF THORIUM WIRE

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The present invention is concerned with a novel lubricant for cold working metals and particularly with a lubricant for drawing or extruding such relatively soft metals as thorium and zirconium.

Metal wire is usually formed by drawing a metal rod through a succession of dies until the wire has been reduced to the proper diameter. The rod or wire is usually covered with a lubricant to assist in the drawing operation. There are many different types of commercial lubricants which are used in drawing metals. It has been found that, while with certain metals such as copper many different lubricants can be used and drawing can be accomplished fairly easily, there are other groups of metals which, although soft, are very difficult to draw because the soft, gummy metals tend to gall or seize in the die. Thorium, titanium, uranium and zirconium are metals of this group.

It has been found that conventional die lubricants are ineffective in preventing galling in the drawing of such metals through metal dies. In tests on the drawing of thorium wire through metal dies of the tungsten carbide type, many different natural and artificially produced lubricants were tried. These included such natural waxes as paraffin, beeswax, carnauba wax, and various commercially produced waxes. Greases such as petroleum jelly, vacuum stopcock grease and stopcock grease containing silicone were also tried unsuccessfully. Other miscellaneous lubricants which were found to be unsatisfactory included molybdenum disulfide, alone or in combination with natural waxes, colloidal graphite, alone and suspended in oil, water or wax, copper suspended in many different vehicles, various soaps, both alone and in combination with lime, and various waxes and fumed lead and zinc oxides in various suspending agents. In all cases in which the thorium rod was coated with these various lubricants the rod would gall or seize in the die as soon as pressure was applied or at least within one or two inches.

It is an object of the present invention to provide a novel lubricant useful in the drawing of soft metals.

It is an additional object of the present invention to provide a lubricant useful in the drawing of thorium.

Other objects will be apparent from the description which follows.

It has been found in accordance with the present invention that a mixture of molybdenum disulfide and fumed lead and zinc oxides, suspended in a drying medium, is a suitable lubricant for drawing metals and particularly such soft, gummy metals as uranium, thorium, zirconium and titanium. This lubricant may be used in the conventional manner and will permit the drawing of the soft metals through metal dies of the tungsten carbide type without seizing or galling even when a reduction as great as 21% is effected by the drawing pass.

The solid components of the present composition are combined together in a ratio of molybdenum disulfide to fumed lead-zinc oxides in a proportion of approximately 2:1 to 5:1 by weight. The molybdenum disulfide should be pure and the purified molybdenum disulfide product, "Molykote," of the Alpha Corporation is a suitable grade. A finely divided molybdenum disulfide of powder fineness is used. The leaded zinc oxide used in the composition may contain between 5 and 50% of commercial fumed lead oxide. The commercial fumed lead oxide is a basic lead sulfate having an empirical composition of approximately $2PbO_4 \cdot PbO$. The commercial basic lead sulfate, which has a range of 72–85% $PbSO_4$ and 15–28% PbO, is satisfactory. While the commercial fumed leaded zinc oxide is entirely satisfactory, other methods of preparing the zinc oxide and basic lead sulfate which produce granules of fineness equivalent to that of the commercial fumed leaded zinc oxides are equally satisfactory. The co-fumed leaded zinc oxide or mixtures of separately prepared zinc oxide and basic lead oxide may be used.

The solid components are suspended in a drying vehicle. The drying vehicle may be of varnish, shellac, or, preferably, lacquer of the nitrocellulose type. While shellac and varnish are suitable from the standpoint of forming a uniform adherent dispersion of the solid components of the drawing compound, they are less satisfactory than the lacquer in the point of drying time. The lacquer dries sufficiently rapidly that the coated metal may be drawn within about 5 minutes after application, whereas the shellac may require several hours and the varnish-base coating as much as 24 hours drying before drawing may be attempted. While the lacquer may be used without dilution, the drying time can be improved by the addition of a typical lacquer thinner such as ethyl, butyl, or amyl acetate, acetone, methyl ethyl ketone, cyclohexanone, glycol ethers, etc. The lacquer, even when thinned by as much as 3 parts of lacquer thinner per part of lacquer, retains sufficient viscosity to adequately suspend the solids therein. The drying component of the compound is important since it was found that the solid components of the compound could not be used either alone or with other suspending agents to obtain satisfactory results.

The preparation and use of the wire drawing composition may be illustrated by the following example.

Example

Thirty grams of purified molybdenum disulfide were mixed with 10 grams of fumed leaded zinc oxide. The leaded zinc oxide was a co-fumed product containing about 35% basic lead sulfate consisting of about 80% lead sulfate and 20% lead oxide. The mixture of molybdenum disulfide and leaded zinc oxide was then introduced into a medium consisting of 37.5 cc. of commercial lacquer thinner and 12.5 cc. of commercial nitrocellulose lacquer. The lubricant was used on test specimens of thorium rod. The specimens consisted of 1-foot lengths of thorium wire, 0.070 to 0.100 inch in diameter, which had been prepared from hot-rolled ¼-inch diameter thorium rod by drawing the rod in a copper jacket. Each sample was pointed by swaging prior to the application of the lubricant and the rods were then drawn through a tungsten carbide type die to effect a reduction of approximately 21%. It was found that with the above lubricant the thorium rods could be drawn without seizing or galling and the surface of the drawn wire was smooth. Two, and in some cases three, passes of the rod through the die could be made with one application of the lubricant. Two draws with one application of lubricant were desirable, since it was found that with one draw the resultant wire had a tendency to be slightly uneven in diameter. This is believed to result from an uneven coating of the lubricant. However, the first draw would leave a thin uniform coating

of the lubricant on the wire, while removing all excess lubricant, and a second pass through the die with the wire would then leave the wire even and smooth. It was found that the wire had to be completely covered with the lubricant, since any unlubricated spots would seize or gall to the die. Since the compound is a suspension, it was important that the mixture be well mixed before application to the rod.

It will be understood that this invention is not to be limited to the details given herein but that it may be modified within the scope of the appended claims.

What is claimed is:

1. A wire drawing composition consisting essentially of a mixture of 2 to 5 parts by weight molybdenum disulfide and 1 part by weight of finely divided leaded zinc oxide suspended in a drying vehicle.

2. The composition of claim 1 wherein the drying vehicle is a mixture of nitrocellulose lacquer and lacquer thinner.

3. The composition of claim 1 wherein the drying vehicle is shellac.

4. A composition of 2–5 parts by weight molybdenum disulfide to 1 part by weight fumed lead-zinc oxides suspended in a drying medium consisting of 1 part nitrocellulose lacquer and 3 parts lacquer thinner.

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