United States Patent Office

3,098,294
Patented July 23, 1963

3,098,294

LUBRICANT FOR METAL FORMING PROCESS

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No Drawing. Filed Nov. 30, 1960, Ser. No. 72,809
3 Claims. (Cl. 29—528)
(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This application is a continuation-in-part of my application Serial No. 4,825, filed January 26, 1960, entitled "Lubricant for Metal Forming Process," now abandoned.

This invention relates to metal forming lubricants. Its purpose is to provide an improved lubricant whereby the force of the metal shaping operation, such as cold drawing and stamping, is materially reduced.

Heretofore various aqueous soap solutions have been utilized in the formation of metal objects. These solutions have generally included sodium soaps which contain a plurality of fatty acids. As a result of comparative tests, it has been found that certain sodium soaps containing a single acid will function to reduce the required metal forming force to an extent not realized with sodium soaps containing a plurality of fatty acids.

The results of these tests are shown in the following tabulation. The first column of this tabulation lists a series of single acid sodium soaps. The second column indicates the number of carbon atoms in the fatty acid while the third column shows the number of double bonds in the acid. The fourth column indicates the percent difference in the forces required to cold draw a 70–30 brass draw piece into a 30 caliber cartridge casing using typical commercially available multiple fatty acid soaps containing between about 20 to 40% sodium oleate and about 60 to 80% sodium stearate and the sodium soaps of my invention. The minus signs in column 4 indicate that the single acid soaps of the invention required less force to form the cartridge case than when multiple acid soaps were employed. The positive signs indicate the opposite. The last column presents data similar to those of column 4, but with a mild steel such as 1020.

Sodium Soap	No. of Carbon Atoms in Fatty Acid	No. of Double Bonds in Fatty Acid	Forming Force Difference	
			70-30 Brass, percent	1020 Steel, percent
Caprate	10	0	−0.3	−1.4
Laurate	12	0	+3.1	+1.6
Myristate	14	0	+0.3	−7.3
Palmitate	16	0	−5.8	−11.1
Oleate	18	1	+7.9	+1.6
Stearate	18	0	−2.7	−14.0
Hydroxy Stearate	18	0	−4.0	−8.3
Behenate	22	0	−5.2	−15.5
Erucicate	22	1	+6.5	−4.5

The percentages above represent averages of five individual runs. The multiple fatty acid soaps used to obtain the comparison data above, i.e., the 20–40% sodium oleate and 60–80% sodium stearate, were considered the most satisfactory to date as revealed by exhaustive laboratory experimentation with cold drawing 70–30 and 80–20 brass and mild steels. Other multiple fatty acid soaps containing a mixture of ingredients such as lard oil, soy bean oil, and tallow fatty acid soaps (40 titre) yielded results inferior to the multiple fatty acid soaps used. The data above are also representative of those obtained when cold drawing 50 caliber 70–30 brass, and 30 and 50 caliber mild steel, into cartridge casings.

In utilizing sodium behenate soap as a lubricant in cold drawing operations, the metal is cleaned if required and immersed in a 1 to 2% solution of sodium behenate in water which is maintained at a temperature of about 150° F. to 200° F. for about 3 to 5 minutes. Thereafter, one of several procedures is followed. According to one procedure, the metal is removed from the solution and immediately cold drawn while flooding it with the heated solution. Another procedure involves removing the metal from the heated solution and allowing it to dry over night, and then dipping it in the heated solution before cold drawing. Still another procedure is to remove the metal from the heated solution, dry over night, and cold draw in that condition. The tabulated data were obtained using the second procedure outlined above, but generally comparable data were obtained when using any of the three methods outlined above.

For larger caliber cases or heavier gauge metals, the sodium behenate may be increased upwardly to about 20% of the aqueous solution.

As will be understood by those skilled in the art, the improved lubrication made possible by the present invention has the important advantage that it decreases power consumption, prolongs the life of the dies used, and permits the forming of heavier gauge metal.

I claim:

1. In a process of cold drawing a small article from a draw piece made of a metal selected from the group consisting of 70–30 brass, 80–20 brass, and mild steel, the steps comprising immersing the metal to be cold drawn in an aqueous solution of about 1 to 2% sodium behenate soap, said solution being maintained at a temperature between about 150 to 200° F., permitting said immersed metal to remain submerged in said heated solution for a period ranging between about 3 to 5 minutes, removing said immersed metal from the heated solution and cold drawing said removed metal into a small article while flooding with said heated solution.

2. In a process of cold drawing a small cartridge case from a draw piece made of a metal selected from the group consisting of 70–30 brass, 80–20 brass, and mild steel, the steps comprising immersing the metal to be cold drawn in an aqueous solution of about 1 to 2% sodium behenate soap, said solution being maintained at a temperature between about 150 to 200° F., permitting said immersed metal to remain submerged in said heated solution for a period ranging between about 3 to 5 minutes, removing said immersed metal from the heated solution, allowing said removed metal to dry over night and cold drawing said dried metal into a small caliber cartridge case.

3. In a process of cold drawing a small cartridge case from a draw piece made of a metal selected from the group consisting of 70–30 brass, 80–20 brass, and mild steel, the steps comprising immersing the metal to be

cold drawn in an aqueous solution of about 1 to 2% sodium behenate soap, said solution being maintained at a temperature between about 150 to 200° F., permitting said immersed metal to remain submerged in said heated solution for a period ranging between about 3 to 5 minutes, removing said immersed metal from the heated solution, allowing said removed metal to dry over night, dipping said removed metal into said heated solution and immediately cold drawing said dipped metal into a small cartridge case.

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