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3,453,209 LUBRICANTS FOR DIES Wilhelm Sibert, Munich, Germany, assignor to Molykote Produktions G.m.b.H., Munich, Germany No Drawing. Filed Jan. 16, 1967, Ser. No. 609,364 Claims priority, application Germany, Jan. 21, 1966, M 68,094 5 Int. Cl. C10m 7/06, 9/00 U.S. Cl. 252--25

3 Claims

ABSTRACT OF THE DISCLOSURE

Novel lubricating compositions for use with metal forming dies such as presses, forges and drop hammers 15 comprising a solid lubricant and a material evolving gas under the operating conditions, such compositions consisting of a single compound or mixtures of compounds.

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BACKGROUND

In general, dies employed for forming metal and particularly wherein the metal is to be deeply engraved are 25 lubricated with graphite in oil pastes. These pastes are frequently supplemented by manually adding sawdust to the paste during the metal forming or forging operation. The sawdust is added to bring about gas evolution through decomposition or combustion of the sawdust during the 30 metal forming operation. The gas evolved assists in ejecting the formed metal piece from the die.

It is well known that the lubrication of dies as described above suffers several severe deficiencies. Repeated application of the graphite-oil paste results in buildup of 35 more solid lubricants together with one or more gas graphite on the die surface thereby carbonizing, misshaping or otherwise causing the metal workpiece to be unsatisfactory. The sawdust is also a weak point in the system because it is frequently nonuniform in quality and the method of applying the sawdust results in non-40uniform distribution over the surface of the die. Further, the buildup of graphite and sawdust residue on the die reduces the service life of the die and requires frequent cleaning and downtime for the equipment.

The search for a suitable lubricant for heavy metal 45 dies has continued and it is an object of this invention to introduce a novel lubricant composition for use on heavy metal working dies. A lubricant avoiding the difficulties noted above and particularly suited for use on heavy metal working dies is a further object of this 50 invention. Other objects and advantages of this invention are detailed in or will be apparent from this disclosure.

SUMMARY OF INVENTION

This invention relates to a novel lubricant composition for use on metal working dies consisting essentially of a solid lubricant and a material which evolves gas under the operating conditions of the dies, said compositions being selected from the group consisting of

(1) Ammonium molybdate,

- (2) Graphite, zinc sulfide, cadmium sulfide, calcium fluoride and cryolite modified by contacting with an anion selected from the group consisting of sulfides, 65 sulfates, sulfites, thiosulfates, persulfates, halides and cyanoammonium group in an inorganic solvent in accordance with the procedure set forth in U.S. patent application Ser. No. 473,220, now Patent No. 3,377,279, filed July 19, 1965, and 70
- (3) Mixtures of solid lubricants selected from the group consisting of zinc sulfide, molybdenum sulfide, cadmium

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sulfide, tungsten disulfide and inorganic fluorides with gas-evolving materials selected from the group consisting of sodium bicarbonate, ammonium carbonate, urea and cyanamide.

DETAILED DESCRIPTION OF INVENTION

The use of ammonium molybdate as a lubricant on heavy metal working dies is particularly advantageous because the desired lubrication as well as evolution of gas to obtain the desired ejection of the finished work piece is realized. The ammonium molybdate is converted to molybdenum trioxide which acts as an excellent solid lubricant on the die and to ammonia which acts as an ejecting gas on the work piece under the conditions of operation. Thus, one applies ammonium molybdate to the die and at the temperatures and pressures of operation of the die the desired lubrication and gas evolution are obtained.

Another excellent lubricant for heavy metal dies producing both the desired degree of lubrication and gas evolution under operating conditions is graphite and other layer-lattice structure solid lubricants treated in accordance with U. S. patent application Ser. No. 473,220. The layer-lattice structure solid lubricants include graphites, zinc sulfide, cadmium sulfide, calcium fluoride, sodium-aluminum fluorides such as cryolite. The solid lubricant is treatment in an inorganic solvent containing an inorganic anion selected from =S, $=SO_4$, $=S_2O_3$, $=SO_3$, $=S_2O_8$, F-, Cl-, Br-, I-, and cyano-ammonium groups. It has been found the graphite so treated and activated does not carbonize the work piece and produces the desired lubrication and gas evolution on the die.

A further development herein is to employ one or evolving materials as the lubricants on the die. In this mixture, one may use well known solid lubricants such as metal sulfides, e.g., zinc sulfide, molybdenum sulfide, cadmium sulfide, tungsten disulfide and inorganic fluorides such as calcium fluoride and cryolite. The gas evolving substance in such mixture can be any compound which forms gas, as by decomposition of the compound, at the temperature of operation of the dies. Such compounds include acid carbonates such as sodium bicarbonate and potassium bicarbonate; ammonium salts such as ammonium carbonate, urea and cyanamide. Various perborates, formates and oxalates are also useful as gas evolving compounds herein.

As is stated above, certain compounds act both as solid lubricant and gas evolving compound herein, whereas other compounds act as either lubricant or gas evolving compound. However, mixtures of compounds are contemplated herein so long as the mixture contains at least one compound acting as solid lubricant and at 55 least one compound acting as a gas evolver. In these mixtures, it is desirable to a ratio of solid lubricant to gas evolving compound in the range from 95 parts by weight lubricant to 5 parts by weight gas evolver to 20 parts by weight lubricant to 80 parts by weight gas 60 evolver (i. e., lubricant to gas evolver is 95/5 to 20/80 on a weight basis).

The compositions of this invention are employed in suspensions in conventional die lubricant carriers such as spindle oils, synthetic oils, water, organic solvents and mineral oils. The suspensions can be prepared in any known and desired manner and can be applied to the dies in the usual manner (i. e., spraying, brushing, flowing, etc.).

The following examples are included herein to assist those skilled in the art to gain a full understanding of this invention. The scope of the invention is defined by the appended claims and is not restricted by the examples,

Example 1

A mixture was prepared employing 35 parts by weight of zinc sulfide, 7.5 parts by weight of sodium bicarbonate and 7.5 parts by weight of ammonium carbonate. This mixture was added to 50 parts by weight of liquid polyethylenepolypropylene glycol and the mixture worked up to form a paste. When the paste so formed was employed as a lubricant on a metal die in a hydraulic press, the workpieces were adequately lubricated while in the press and were smoothly and easily ejected from the die face. 10 The surface of the workpiece was not carbonized and showed no pits or crevices. There was little or no buildup of lubricant or residue on the die face even after repeated use.

Example 2

A mixture of 35 parts by weight of zinc sulfide and 15 parts by weight technical grade cynamide $(CN \cdot NH_2)$ was added to 50 parts by weight of spindle oil to produce a paste. The paste was employed as a lubricant and 20 release agent in a tube bending apparatus. Excellent lubrication of the die and good ejection and release of the finished workpiece were accomplished.

Example 3

When a mixture of 30 parts by weight of spindle oil and 70 parts by weight of ammonium molybdate was employed as a lubricant and mold release agent on a metal forming die in a drop hammer employed to form panels for automobile manufacture, excellent results were 30 achieved in that the die was properly lubricated and the finished workpiece was readily removed and showed no defects resulting from use of said mixture.

Example 4

When graphite powder, cryolite powder, zinc sulfide powder and cadmium sulfide powder are treated with ammonium sulfide, sodium sulfite, sodium fluoride or sodium thiosulfate in accordance with the method of Example 3 of U.S. patent application Ser. No. 473,220, 40 filed July 19, 1965, the resulting product can be employed in the method of Example 3 with equivalent results.

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Example 5

When the treated solid lubricant (graphite, cryolite, zinc sulfide or cadmium sulfide) set forth in Example 4 is admixed with sodium bicarbonate, ammonium carbonate, urea or cyanamide employed as a gas evolver in ratios of 25 to 75 parts by weight solid lubricant and 75 to 25 parts by weight of gas evolving compound, the product can be mixed with a silicone oil such as a dimethylpolysiloxane having a viscosity in the range from 50 cs. to 5,000 cs. at 25° C. to produce a composition useful in the method of Example 1 or Example 3.

That which is claimed is:

1. A lubricant and mold release agent for use on heavy metal-working dies consisting essentially of a mixture of

15 (1) solid lubricants selected from the group consisting of zinc sulfide, molybdenum sulfide, and inorganic fluorides with (2) gas-evolving materials selected from the group consisting of sodium bicarbonate, ammonium carbonate, and urea.

2. A lubricant and mold release agent for use on heavy metalworking dies, as defined in claim 1 wherein said solid lubricant and gas-evolving substance is suspended in a liquid carrier.

3. A lubricant and mold release agent for use on heavy 25 metalworking dies as defined in claim 1 wherein the ratio on a weight basis of solid lubricant (1) to gasevolving materials in (2) is between 95 to 5 and 20 to 80.

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