United States Patent

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[54] EXTRUSION LUBRICANT

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[52] **U.S. Cl.** **252/30**, 72/42, 252/23, 252/49.5

[51] **Int. Cl.** **C10m 3/04**, C10m 3/02

[58] **Field of Search** 252/29, 23, 30, 49.5; 72/42

[56] **References Cited**

UNITED STATES PATENTS

2,008,939	7/1935	Tufts	252/49.3
2,530,838	11/1950	Orozco et al.	252/25
2,821,016	1/1958	Dickson	252/29
2,986,492	5/1961	Cannon	252/49.5
3,230,750	1/1966	Horbury et al.	252/28
3,278,429	10/1966	Agnew et al.	252/59
3,341,454	9/1967	Chor et al.	252/29

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[57] **ABSTRACT**

An extrusion lubricant comprising 2.5 to 30 percent graphite, 3 to 9 percent lead borate or zinc oxide, 10 to 15 percent sodium monophosphate or ammonium monophosphate, 1 to 5 percent wetting agent, up to 1 percent microbicide, and balance water.

2 Claims, No Drawings

EXTRUSION LUBRICANT

BACKGROUND OF THE INVENTION

This invention relates to an extrusion lubricant. More particularly, it relates to a water-base extrusion lubricant adapted for application to billet and dies to result in an improved surface finish on an extruded metal workpiece.

Until now problems have been many with respect to lubrication of dies and workpieces in formation of shaped articles from billets, particularly in extrusion operations on metals such as nonferrous materials like aluminum or aluminum base alloys. For example, it has been difficult to find a lubricant which would be uniformly coated on the die and workpiece surfaces to provide an adherent coating or film. Another problem has been how to develop a lubricant for extrusion purposes which has a good stability or shelf life and which does not contain solids which cause trouble by separating out or settling in such a manner that when the lubricant is sprayed or applied to the die or workpiece by dipping or spraying the resultant coating is too thin to provide the desired adhering film.

U.S. Pat. No. 2,821,016 proposes a water solution containing a relatively small percentage of suspended colloidal graphite and from 1½ to about 7 percent of a soluble oil as a cooling and lubricating solution for use in hot forging or extruding metal shapes. However, the wetting power of such a lubricant tends to be rather limited. U.S. Pat. No. 2,008,939 suggests coating metal with a concentrated aqueous solution of monosodium phosphate or monoammonium phosphate and cold working the metal while lubricated with this solution. While this patent teaches how the use of such a composition may help eliminate oily or insoluble greasy metal soap deposits which are difficult to remove from the workpiece, it lacks an efficient lubricating component and makes no suggestion as to how such a composition might be useful in extrusion situations where high temperatures are commonly encountered. U.S. Pat. No. 2,530.838 discloses applying an aqueous solution of a synthetic wax, a metal borate and inert water-soluble organic lubricating binder to wire or metal stock prior to a forming operation. This patent points out that such a composition provides a protective barrier film in wire drawing but is silent as to any possible use of such a composition in an extrusion operation where a uniform film resistant to high temperatures is required. Also, the patentee points out that in production of the required wax mixtures extreme caution has to used to insure that the melting point of the mixture is between about 95° C. and about 140° C. Therefore, development of an adhering, high-temperature resistant lubricant for application to either die or workpiece in the formation of shaped metal articles by extrusion represents a highly desirable result.

STATEMENT OF THE INVENTION

It is accordingly an object of this invention to provide a lubricating composition which can be applied substantially uniformly to both workpiece and die in extrusion operations. Another object is to provide a lubricant of good shelf life and stability which does not have any appreciable tendency for the solids therein to separate out and one which is readily and uniformly dispensable. A further object is to provide an extrusion lubricant which is capable of withstanding high temperatures, specifically up to about 1,050° F. without substantial decomposition or loss of the required protective film. A still further object is to provide a lubricant which can be applied to either billet or dies or both with a resulting improved surface finish on the extruded product. Another object is to provide a lubricant which when applied cold to billets will withstand subsequent temperatures as high as 1,050° F. These and other objects of our invention will be apparent from the description and claims which follow.

This invention is predicated upon the discovery that an improved lubricating composition for use in metal extrusion operations can be prepared by blending together 2.5 to 30 percent by weight colloidal graphite, 3 to 9 percent by weight lead borate or zinc oxide, 10 to 15 percent sodium monophosphate or ammonium monophosphate, 1 to 5 percent of a wetting agent such as an organic sulfonate, up to 1 percent by weight microbicide and water. While this composition may be applied only to ingot or only to die according to my invention, I prefer to use it on both ingot and die. My preferred composition contains 18 to 25 percent graphite, 5 to 7 percent lead borate or zinc oxide, 11.5 to 14 percent ammonium monophosphate or sodium monophosphate, 1.5 to 3.5 percent wetting agent, up to about 0.5 percent microbicide and 45 to 65 percent water. In preparing my lubricant, I have found it advantageous to first blend the colloidal graphite in the form of a dispersion of about 28 percent graphite in water with the ammonium or sodium monophosphate, the wetting agent and the microbicide before adding the lead borate or zinc oxide.

The size of the colloidal graphite is preferably such that at least 50 percent of the particles are 2.5 microns or less in average diameter. Representative of wetting agents which I have found useful in my extrusion lubricant are organic sulfonates such as the sodium salt of petroleum sulfonates, sulfonated mineral oils, alkyl aryl sulfonates, and substituted benzyl alkyl sulfonic acids.

The following examples are illustrative of my invention. The following lubricant were applied to dies and billets in forming shaped articles by extrusion of billets through die cavities. The dies and billets used had a substantially uniform film of the lubricant coated thereon in each case. Extrusion temperatures ranged from 600° to 1,100° F. No ram flashing was encountered. Percent herein refers to percent by weight.

EXAMPLE 1

4.8% graphite (2.5 microns)
6% lead borate
12.7% ammonium monophosphate
2.8% wetting agent (a substituted benzyl alkyl sulfonic acid)
73.7% water

EXAMPLE 2

4.8% graphite (2.5 microns)
6% lead borate
12.7% ammonium monophosphate
2.8% wetting agent (a substituted benzyl alkyl sulfonic acid)
73.6% water
0.1% microbicide

EXAMPLE 3

22% graphite (2.5 microns)
6% lead borate
12.7% ammonium monophosphate
2.8% wetting agent (a substituted benzyl alkyl sulfonic acid)
56.4% water
0.% microbicide

EXAMPLE 4

21.7% graphite (mostly 1 micron but some particles less than 0.5 micron in average diameter)
12.7% ammonium monophosphate
6.0% borate
2.8% wetting agent (a substituted benzyl alkyl sulfonic acid)
56.8% water

EXAMPLE 5

21.7% graphite (2.5 microns)
12.8% ammonium monophosphate
6.0% lead borate
2.8% wetting agent (a substituted benzyl alkyl sulfonic acid)
6.0% microbicide
56.7% water

EXAMPLE 6

22% graphite (2.5 microns)
12.7% ammonium monophosphate
6.0% lead borate
2.8% wetting agent (a substituted benzyl alkyl sulfonic acid)
0.1% microbicide
56.4% water

EXAMPLE

22% graphite (2.5 microns)
12.7% monobasic sodium phosphate
6.0% lead borate
2.8% wetting agent (a substituted benzyl alkyl sulfonic acid)
0.1% microbicide
56.4% water

EXAMPLE 8

22% graphite (2.5 microns)
12.7% ammonium monophosphate
6.0% zinc oxide
2.8% wetting agent (a substituted benzyl alkyl sulfonic acid)
0.1% microbicide
56.4% water

EXAMPLE 9

22% graphite (2.5 microns)
12.7% monobasic sodium phosphate
6.0% zinc oxide
2.8% wetting agent (a substituted benzyl alkyl sulfonic acid)
0.1% microbicide

56.4% water

Lubricants were prepared and used in extrusion operations (coated on billets and dies) and had substantially the same compositions as the lubricants of examples 6, 7, 8 and 9 except that the following wetting agents were used individually in separate formulations instead of the substituted benzyl alkyl sulfonic acid of examples 1–8:

sodium salt of petroleum sulfonate
sulfonated mineral oil
alkyl aryl sulfonate

All resulted in an adherence which was comparable to that for the formulations which used the substituted benzyl alkyl sulfonic acid wetting agent.

While the invention has been described in terms of preferred embodiments, the claims appended hereto are intended to encompass all embodiments which fall within the spirit of the invention.

Having thus described my invention and certain embodiments thereof, I claim:

1. An extrusion lubricant consisting essentially of 2.5 to 30 percent by weight colloidal graphite, 3 to 9 percent by weight lead borate or zinc oxide, 10 to 15 percent by weight sodium monophosphate or ammonium monophosphate, 1 to 5 percent by weight wetting agent, up to 1 percent microbicide, and balance water.

2. The lubricant of claim 1 wherein the colloidal graphite comprises 18–25 percent by weight, the lead borate or zinc oxide 5–7 percent by weight, the sodium monophosphate or ammonium monophosphate 1.5 to 3.5 percent by weight and the water 45 to 65 percent by weight.

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