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FORGING COMPOUND

Walter D. Hodson, Chicago, Ill., assignor to The
Hodson Corporation, a corporation of Dela-
ware

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The present invention relates to improvements in lubricating compounds, and is more particularly directed to improvements in graphite-containing oils which are intended for application to hot forging and piercing dies and to other tools for use in the hot forging of metals, also at times to the piece to be forged, such as iron, steel, copper, brass and aluminum, for the lubrication of extrusion dies in which such metals as aluminum, copper, brass and the like are extruded through heated dies and for application to the metal being worked in such forging, piercing and extrusion operations.

In the preparation of such lubricating compounds, it is important to secure a uniform and stable suspension of large quantities of graphite in the lubricant, since at the high temperatures at which the compounds are used, the oil used as the vehicle is largely dissipated and the graphite remains as the principal lubricant. In compounds as hitherto produced, the graphite tends to settle out, resulting in a lack of uniformity in the lubricant, which results in the lack of uniformity in its effectiveness when used. The lubricant compound is applied by swabbing, mechanical spreading or spraying, and uniformity in its structure and graphite content is important to secure uniformity in application. Furthermore, it is important that the graphite-containing residue left upon the die in the use of the compound shall not cake or build up, resulting in defects in the forging or extruded form, and reducing the life of the die or tool.

In accordance with the present invention, I am enabled to prepare a lubricating compound containing high proportions of graphite, which is stable in structure and uniform in composition, and in which the graphitic material is maintained in suspended state and does not settle; which may be applied uniformly by swabs, brushes or sprays, and which in use and on contact with the hot forging or metal being worked, dissipate its oil component and leaves a residue on the die or tool in which the graphite is uniformly distributed and does not cake or build up. In the product of the present invention, the graphite used is maintained in uniform suspension in an oil having a colloid structure built up by the use of a gel-forming soap of a metal other than an alkali metal or alkaline earth metal, and I am able to use substantially larger proportions of graphite than have hitherto been employed in such compounds. In carrying out the invention, I preferably prepare a highly concentrated or base material of very high graphite content,

which may be readily converted into a final product or compound of the desired graphite content by the user, securing a product of great stability of structure and uniformity of graphite content. This is highly advantageous in use, since such a base material may be prepared and shipped or sold at considerably reduced transportation cost, or may be stored and converted into final products of varying graphite content at will.

In order to produce a suitable colloid structure in the lubricating compound to maintain the graphite suspended in uniform dispersion and to leave a uniform deposit of the graphite in use, I prefer to prepare the compound in the following manner.

The graphite employed may be amorphous, flake or deflocculated graphite. The oil employed is a lubricant mineral oil, preferably a distillate oil, of any desired viscosity. I prefer to employ the lighter oils, ranging from a viscosity of 50 to 100 seconds Saybolt at 100° F. upwardly, say to 300 to 350 seconds Saybolt at 100° F., since heavier oils are objectionable in use on account of smoke and char formation. In general I prefer to employ a paraffin distillate oil substantially free from wax and having a viscosity in the order of 50 to 100 seconds Saybolt at 100° F. and preferably of 60 to 80 seconds Saybolt. By the present invention I am enabled to use lighter oils than those hitherto used in such compounds, in which high viscosity of the oil was relied upon to retard settling of the graphite. Such heavy oils as hitherto used burned slowly with the evolution of considerable quantities of smoke and soot and left a tarry deposit on the work or die to which the lubricant was employed. By the present invention I am enabled to use light oils, while maintaining the graphite in uniform suspension. On use of the compound of the present invention, the light oil flashes quickly and cleanly or substantially completely on application to the hot die, tool or work, and does not leave objectionable tarry deposits which cause caking of the graphite. Furthermore, the compound produced in accordance with the present invention can be readily applied in a uniform, thin layer for effective lubrication by mechanical sprayers, with great economy in use.

While I may use soaps of various metals, such as copper, zinc, lead, iron and the like, I prefer to employ aluminum soaps.

Although the proportion of graphite employed in the final product may vary widely, say from 8 to 40%, my procedure may be illustrated in the case of the production of a compound containing

15 to 20% of graphite in which case I first prepare a base compound of greater graphite content, say 30 to 60%. A minor proportion of the metallic soap is used, sufficient to produce from 1 to 5% in the final product. Thus, a suitable base compound may contain 24 to 36% of a light paraffin distillate oil of a viscosity of about 80 seconds Saybolt at 100° F., 4 to 6% aluminum stearate and 30 to 40% of graphite. I preferably place the oil in a container provided with an agitator, and add successively the aluminum stearate and the graphite, stirring each in thoroughly. The mixing of the base is done without the application of heat. The resulting mixture, which constitutes the base compound, is then drawn off, and allowed to stand, preferably for in excess of one day. It may be stored for later use in preparing the final compound, or the base compound may be shipped, the process of preparing the final compound being completed at the point of use. The retention of the constituents of the mixture in contact with each other for a normalizing period, of say, 6 to 8 hours upwardly, and preferably at least 2 or 3 days, has a decidedly beneficial effect upon the character of the final product in securing greater stability with respect to the maintenance of uniform dispersion of the graphite therein.

In preparing the final product, the base compound, prepared as described, is placed in an agitator provided with suitable heating means, and the necessary amount of oil (preferably, a light oil of the same character as that used in the base compound) is added to secure the desired final product, which, in the case of the specific illustrative example, may be one containing 15 to 20% graphite. The agitator is operated to secure thorough admixture of the base compound and the oil and heat is turned on and gradually increased so that a temperature in the order of 250 to 350° and preferably of 275 to 300° is reached in about 6 hours. The mixture is held at that temperature for an additional period of 20 minutes or longer, say 30 minutes, the batch being then completed. It is drawn off into suitable containers and allowed to set for some time, say for 2 or 3 days or longer, in which period a more permanently stable structure appears to be formed. In the illustrative example, the use of an equal quantity of oil will result in a final product of 15 to 20% graphite concentration. Occasionally, on standing for a considerable period, there may be a slight bleeding of the oil, which can be poured off if desired, or can be stirred into the mixture when it is used without destroying its structure.

The resulting compound has a stable colloid structure and the graphite is uniformly suspended therein. Hence, it can be applied manually with a brush, spreader or dauber, or may be sprayed upon the piece or the die used for forging or extrusion. It may be applied evenly without difficulty, for example, by suitable spray mechanism, securing uniform distribution of the graphite. As a result, great savings are made in the use of the compound of the present invention over those hitherto known, of which the use of large quantities were necessary to secure the presence of adequate amounts of graphite. Thus in many cases I am able to secure adequate lubrication, using from one-third to one-tenth the quantity of compound as compared with that previously used.

Although in the example given, the amount

of oil subsequently added is equal to the amount of the base compound, it will be understood that these proportions may be varied widely. Thus, in the case of a final product with a high graphite content, say in the order of 30 to 40%, a larger proportion of graphite may be incorporated in the base compound and a smaller proportion of oil added after the normalizing period, or period of retention of the base compound. The base compound may suitably contain from 1.5 to 10% of the gel forming soap and from 10 to 75 or 80% of graphite, to be diluted with oil as heretofore described to secure the desired proportions of graphite in the final product.

In use, the heat of the metal, die or tool with which the compound is brought in contact quickly burns off substantially all the oil, leaving as a residue the mixture of aluminum stearate and graphite, probably with some minute quantity of mineral oil. By the use of light oils as heretofore described, the oil flashes off quickly and cleanly, leaving the graphite-containing residue desired for lubricating purposes in place. The colloid structure of the compound is such that this graphite-containing residue is uniform, is effective in securing desired lubricant action and preventing sticking to the die, and the residue does not cake or build up when the die is used. As a result, sticking of the forgings and checking and cracking of the die are avoided, resulting in less defective work and in longer life of the dies.

It will be readily understood that the proportion and nature of the graphite employed, the character of the mineral oil and the proportion of the metallic soap used in securing a desired structure may be varied in accordance with the specific requirements of the user. Although the present invention has been described in connection with a specific example thereof, it is to be understood that it is not limited to the details of the example given, except in so far as included in the accompanying claims.

I claim:

1. A stable colloidal base compound used in preparing a stable lubricant composition for use on dies and tools operating on highly heated metal which consists of a light lubricant hydrocarbon oil of 50 to 100 seconds Saybolt viscosity at 100° F., from about 10 to 30% of graphite and from about 1.5 to 10% of aluminum soap, said oil being maintained in the form of a stable colloidal gel structure by said metallic soap with the graphite uniformly and relatively permanently dispersed and suspended therein, the said base compound being capable, on dilution with oil of the same viscosity and on heating and mixing therewith, of forming the said lubricant with the graphite uniformly suspended therein.

2. A stable colloidal lubricant composition suitable for use on dies and tools operating on highly heated metal which comprises a substantially wax-free, light lubricant hydrocarbon oil of at least 50 to 100 seconds Saybolt viscosity at 100° F., from about 10 to 80% of graphite and from 1.5 to 10% of aluminum soap, said oil being maintained in the form of a stable colloidal gel structure by said metallic soap with the graphite uniformly and relatively permanently dispersed and suspended therein, the said lubricating composition being capable, on dilution with oil of the same viscosity and on heating and mixing therewith, of maintaining its stability with the graphite uniformly suspended therein.

3. A stable colloidal lubricant composition suitable for use on dies and tools operating on highly

heated metal which comprises a light lubricant hydrocarbon oil of at least 50 to 100 seconds Saybolt viscosity at 100° F., from about 10 to 80% of graphite and from about 1.5 to 10% of a heavy metal soap, said oil being maintained in the form of a stable colloidal gel structure by said heavy metal soap with the graphite uniformly and rela-

tively permanently dispersed and suspended therein, the said lubricating composition being capable, on dilution with oil of the same viscosity and on heating and mixing therewith, of maintaining its stability with the graphite uniformly suspended therein.

WALTER D. HODSON.