METAL-SHAPING LUBRICANT COMPOSITIONS AND METHOD

Filed Feb. 5, 1958 2 Sheets-Sheet 1

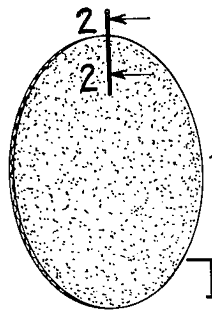

Fig. 1

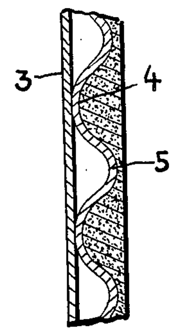

Fig. 2

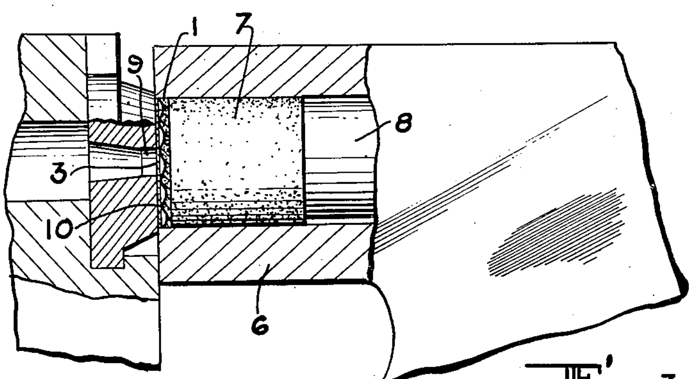

Fig. 3

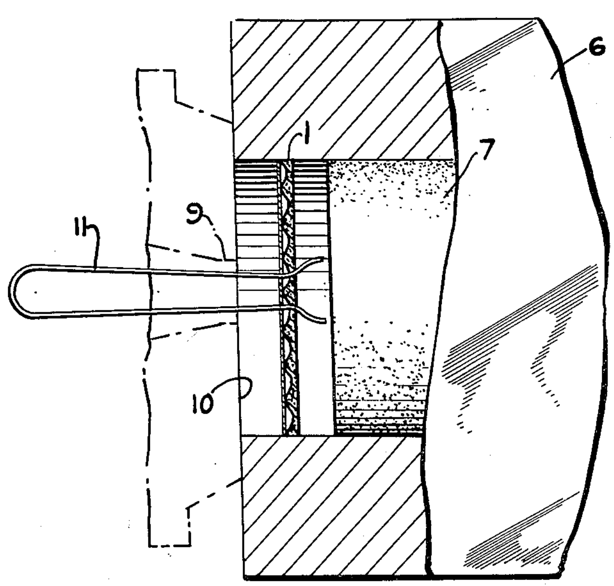

Fig. 4

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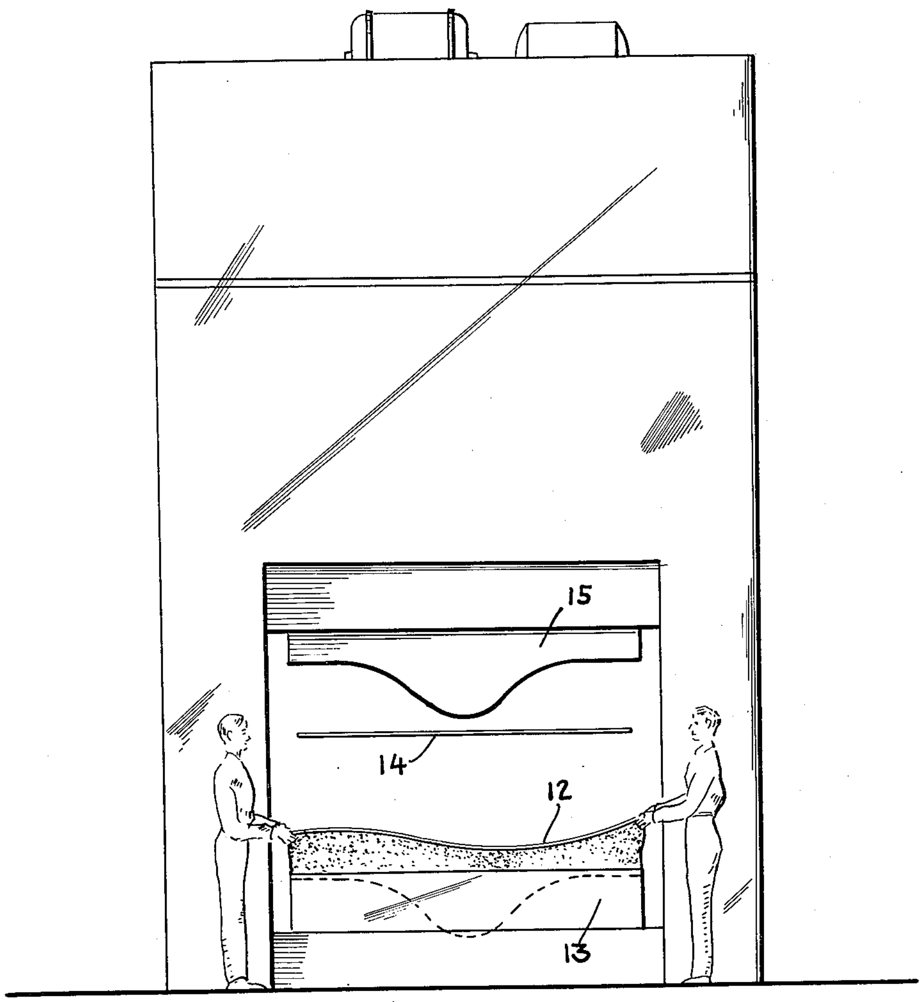

Fig. 5

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METAL-SHAPING LUBRICANT COMPOSITIONS AND METHOD

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13 Claims. (Cl. 29—424)

The invention relates to a lubricant useful in lubricating hot metal billets or blanks in extrusion and forging processes.

In various plastic metal shaping processes such as extrusion, forging, drawing and the like, metal blanks or billets, heated to the temperature at which they undergo plastic deformation under pressure, are pressed between forging dies, or extruded or drawn through extrusion or drawing dies to form the hot metal into the shape desired. It is essential, if the particular plastic metal shaping process is to proceed successfully, that the metal should not be subjected to an excessive temperature drop as it is shaped, since otherwise undue wear on the dies would occur with the rapid deterioration of their surfaces. At the same time, it is necessary to prevent excessive heating of the dies which, if it occurs, also results in rapid wear. It is customary to meet these requirements by applying a lubricant between the surfaces of the work-piece and die face. The standard lubricants, such as oils and greases, undergo transformation at the work temperatures and give off large volumes of smoke. They also tend to cool the work-piece. They are thus extremely unsatisfactory, having poor lubricating properties and presenting a health hazard.

When utilizing an extrusion process, it has been proposed to insert into the extrusion chamber, against the end wall thereof, defined by the die plate, a glass disc adapted to serve as a thermal insulation between the front end surface of the billet and the die plate, and thereby prevent both excessive cooling of the metal and heating of the die. On application of the extruding pressure to the rear end of the billet, the glass insulating disc is perforated at its center and flows with the metal and thus enables the metal to pass more readily through the die. Such a method is described and claimed in U.S. Patent No. 2,538,917, granted January 23, 1951.

The method just described, however, does not yield wholly satisfactory results, and its use is not without its drawbacks. In the first place, fragments of broken glass are carried to various points of the extruding apparatus and result in premature wear therein due to their abrasive action. Moreover, the lubricating effect exerted in this method by the molten glass gradually diminishes as the temperature of the billet falls, owing to the fact that the increasing pressure expels the molten glass from between the adjacent surfaces of the billet and the die plate. Also the extruded parts have glass particles adhering thereto which are objectionable and are scratched and roughened by the glass. In addition the temperature of the work-piece is lowered when it comes into contact with the glass blank as the blank has to be heated to a point where it becomes plastic.

In a process of forging it has been proposed that the work-piece be lubricated by means of a flexible sheet containing glass fibers, either in the form of a spun-glass fiber fabric or a felt containing glass fibers imbedded therein. Such a method is described and claimed in United States Patent No. 2,706,850, granted Apr. 26, 1955. This method suffers the same defects described above regarding the glass lubricated extrusion process.

It has also been proposed that the metal work-piece subjected to a forging operation be lubricated by an

asbestos blanket impregnated with a suspension of graphite in white spirit. This method suffers the drawback that the asbestos builds up on the surface of the dies and must be removed therefrom after only a few forgings as otherwise the dimensions of the forged piece will be varied. Such a removal requires that the forging operation be suspended until the dies cool sufficiently so that a worker can remove the layer of asbestos, thus interfering with the work-cycle and lowering output. In the extrusion process, the various defects listed above regarding previous lubricating methods were overcome by the method of lubricating disclosed in the United States Patent No. 2,757,138, granted July 31, 1956, and commonly owned. This patent discloses a method of lubricating work-pieces being extruded by inserting between the work-piece and the die a solid, infusible heat-insulating and lubricating composition in the form of a self-supported disc consisting of a heat-insulating, porous, non-abrasive organic substance in a finely divided state, flaked graphite, a higher metal oxide selected from the group consisting of pyrolusite (manganese dioxide), lead dioxide and bismuth tetraoxide, and finely divided carbon black, said materials being present in sufficient amounts to produce an exothermic reaction at the extrusion temperature, and a combustible binder selected from the group consisting of natural and synthetic resin, pitch and agglomerating vegetable oils.

This composition provides a combination of a combustible insulating non-abrasive organic filler in a divided state, such as sawdust, pulverized cork or straw, with:

(1) A flaked graphite, the lamellar structure of which allows a lubricating powder to be obtained which increases with the pressure to which the composition is subjected,

(2) A finely divided carbon (carbon black or plumbago) which exothermically reacts with the higher metal oxides (pyrolusite, dioxide of lead, tetraoxide of bismuth) at the extrusion temperature thus preventing the cooling of the billet.

This lubricating composition provides several important advantages over the prior art:

(1) It is easy and simple to produce.

(2) It reacts exothermically at the face of the billet in the beginning of the extrusion operation so as to reduce the chilling of the face of the billet which normally occurs when it contacts the colder die.

(3) It provides a lubricating function during the extrusion operation which does not introduce an abrasive into the metal being extruded or against the die.

(4) Its use results in an increase of the hardness of the die during the operation which produces longer life, less sticking of the extruded metal to the die, and provides other advantages.

The lubricant composition according to this patent, however, is in the form of extremely brittle plates which cannot undergo any extensive handling. Thus the commercial application of the lubricant composition is limited. In view of the extreme brittleness of the composition it cannot be easily shipped in normal trade channels. Moreover, such a composition cannot be used to lubricate the work-piece in a forging operation where an irregular shaped forging is produced. It also suffers a considerable drawback in that the presence of the carbon black, required to maintain the exothermic reaction with the higher metal oxide has a deleterious effect on the lubricating powers of the laminated graphite. It has been found that the small particles of carbon black interspersed throughout the composition interfere with the sliding action of the graphite flakes causing an over-all decrease in their lubricating power.

We have found that by the processes hereinafter described the drawbacks of the above-noted lubricating processes can be overcome and metal blanks in a plastic condition can be readily shaped by such processes as extrusion, forging, drawing and the like.

It is an object of the invention to provide an improved method of shaping metal blanks or billets in a plastic condition by conducting such a shaping, be it extrusion, forging, drawing or the like, in the presence of a new and improved lubricant composition operable at the temperatures involved, which lubricant composition leaves no residue, does not smoke, provides a heat-insulating blanket between the die and work-piece and undergoes an exothermic reaction at the metal shaping temperature.

It is a further object of the invention to provide a lubricant composition useful in shaping metal blanks or billets in a plastic condition which composition is in a form which is not excessively brittle and will readily undergo the rigors of transportation.

It is a further object of the invention to provide a lubricant composition useful in shaping metal blanks or billets in a plastic condition which lubricant composition is carried on a paper or textile backing.

Another object of the invention is to provide a lubricant composition useful in shaping metal blanks or billets in a plastic condition which may be applied as a swab, spray or in the form of a flexible blanket or a rigid but non-brittle disc.

Various other objects and advantages of our invention will appear as this description proceeds.

According to the invention, there is essentially provided a heat-insulating element or composition adapted to be interposed between at least one surface of a body or billet of metal to be shaped and an adjacent surface of an extrusion or forging chamber, tool or die, which element or composition is characterized in that it is made of an agglomerated, porous, heat-insulating material free of any abrasive constituents therein. The invention contemplates including among the constituents of the material or composition from which the element or coating is formed, in addition to a heat-insulating constituent, a lubricant constituent in the form of a suitable lamellar or flaked solid adapted to withstand the high metal shaping temperatures, such as flaked graphite or a combination of graphite and molybdenum disulfide.

The heat-insulating and lubricating element or composition according to the invention is preferably provided in the form of a cake, disc, or slab, shaped for insertion between the metal blank or billet to be shaped and the adjacent surface of the die plate or in the form of a coating composition adapted to be brushed or sprayed on the shaping tools and dies.

Alternatively or in addition to the above modes of operation, an element according to the invention may be slipped around an axial die core member or mandrel in connection with the extrusion of tubular parts when in solid form or it may be applied as a spray coating.

In the preferred form of the invention, the composition from which the heat-insulating element is made includes constituents adapted to react exothermically with one another at the metal shaping temperature. The heat evolved by this reaction will serve to compensate for the drop in temperature occurring on the shaping surfaces of the heated metal blank or billet and thus greatly facilitate the initial stage of the shaping operation. The method includes the step of causing the constituents of said composition to react at the extrusion temperature to generate heat and also cause a hardening effect on the adjacent surface of the tools and dies.

The lubricant constituent which, as stated, is preferably included in the composition of the heat-insulating element, is a lamellar solid capable of resisting the high temperatures used, and preferably comprises graphite or a combination of graphite and molybdenum disulfide. Provision of these solid lubricants greatly promotes the flow of metal through the die. The use, as a lubricant, of a solid possessing a lamellar structure is particularly advan-

tageous in that the relative displacement of the flakes or lamellae, which displacement is responsible for the lubricating effect, is precisely produced by the application of pressure, and hence increases with the pressure; thus the lubrication increases with the pressure.

The essential heat-insulating constituent of the material used according to the invention may comprise any suitable non-abrasive combustible organic substance, in a high state of division, such as sawdust, pulverized cork or straw, or the like, which substance is mixed with a super-oxygenated substance adapted to react exothermically with the carbon at high temperature, for example a suitable metal oxide such as pyrolusite, lead dioxide or bismuth tetraoxide. It has been further theorized that the said super-oxygenated substance reacts with the metal surfaces of the die and workpiece to cause a thin oxide layer to form on these metal surfaces. The graphite present is believed to adhere better to the oxidized surfaces, thus giving better lubrication between the sliding parts.

In a specific embodiment of the invention, a lubricating powder is obtained by mixing a lamellar solid capable of resisting the high temperatures above about 500° C. used with a heat-insulating component and a metal oxide. Such a lamellar solid as graphite or a combination of graphite and molybdenum disulphide in a range of 65% to 95% by weight is preferred; to this is added sufficient of a heat-insulating non-abrasive combustible organic substance in a high state of division such as sawdust, pulverized cork or straw or the like to react exothermically with the metal oxide at the high temperature. This organic substance, added in amounts of about 3% to about 20% by weight acts as a heat-insulator and being combustible undergoes an exothermic reaction with the superoxygentaed metal oxide to produce heat. Both of these properties offset the cooling of the hot metal blank or billet in contact with the colder die surfaces. The metal oxide referred to above is a stable, superoxygenated compound such as pyrolusite, lead dioxide or bismuth tetraoxide. This oxide is added in amounts of about 2% to about 15%. The presence of this oxide is also important to give improved lubrication at the high temperatures involved.

This lubricating powder is then dispersed in a suitable vehicle with the aid of colloidal dispersing and bonding agents to form a thin paste. Suitable colloidal dispersing agents and bonding agents are powdered polystyrene, copolymers of styrene in powdered form, mixtures of powdered styrene with other powdered synthetic thermoplastic resins and mixtures of organic colloids and inorganic binding agents such as dextrin and sodium silicate. The ratio of lubricant powder to colloidal dispersing and bonding agent in the lubricant composition can vary between 15:1 and 1:1. Suitable vehicles are the common organic solvents such as the chlorinated hydrocarbons, liquid hydrocarbons and water which are added in sufficient amount to give the consistency desired.

This lubricant dispersion or paste can then be utilized per se by swabbing or spraying on the work-piece or surfaces of the die. In the preferred form, however, the lubricant dispersion in the form of a paste is spread on a completely combustible organic backing such as paper, textile fabric, felt, cardboard or sheets or films of synthetic and natural resins, and dried giving a solid heat-insulating and lubricating element which can be either flexible or stiff depending on the backing and which can be inserted between the surface of a metal blank or billet to be shaped and the adjacent surface of a shaping or forming tool or die.

Whether the lubricant dispersion or paste is applied directly to the dies by swabbing or spraying, or applied to the combustible organic backing, at the temperature to which the paste is subjected, either on the warm dies or at the drying temperature, the solvent medium evaporates, leaving behind a lubricant powder affixed to the surface treated by the binding agent used.

A brief description of the drawings follows:

FIG. 1 shows a round disc of the dried lubricant dispersion mounted on a corrugated paper backing;

FIG. 2 shows a cut-away section of FIG. 1 along lines 2—2;

FIG. 3 shows a cross section of parts of an extrusion press with the lubricant disc in place;

FIG. 4 shows a detail of the extrusion press of FIG. 3 with a method of maintaining the lubricant disc in place;

FIG. 5 is an elevation showing application of a lubricant blanket on the surfaces of a forging press.

LUBRICATING POWDER A

A lubricating powder was prepared by mixing the following ingredients:

450 parts of graphite (natural, large flakes, minimum 92% carbon, Madagascar F–10)
450 parts of graphite (natural, ground particles pass through 200 mesh screen, Madagascar D–10)
50 parts pyrolusite (manganese dioxide)
100 parts sawdust from hard wood

LUBRICATING POWDER B

A lubricating powder was prepared by mixing the following ingredients:

900 parts of graphite (natural, ground, small flakes, Madagascar P–10)
50 parts pyrolusite (manganese dioxide)
100 parts sawdust from hard wood

Paste-like dispersions of these lubricating powders were prepared as follows:

Example I

3 parts of lubricating Powder B
1 part of Lustrex 770 (a powdered polystyrene)
0.45 part of dextrin
0.45 part of sodium silicate
15 parts of water

This dispersion was very thin and used as a high temperature spray. The dispersion was sprayed on a heated steel die just prior to a forging operation in a high pressure press. The piece was forged with ease with a minimum of cycles. The life of the die surfaces was increased by ⅓ to ½ over corresponding non-lubricated die surfaces.

Example II

3 parts of lubricating powder B
1 part of Lustrex 770
15 parts of water

This dispersion is likewise very thin and is used as a low-temperature spray where the metal shaping is done at lower temperatures such as shaping brass or copper. The results are similar to those of Example I in that the life of the die surfaces is increased.

Example III

5 parts of lubricating powder A
2.5 parts of Lustrex 770
30 parts of water

This dispersion was paste-like in character and was used as a swab, being applied to the hot surface of the die between forging cycles in the hot working of steel by swabbing with the help of a wad of cheesecloth. This dispersion can also be utilized in extrusion of seamless steel pipe as a coating of lubricant applied with a piece of velvet pile on the preheated (or incompletely cooled) mandrel. If, however, the surface of the die is heated to beyond 400° F. the brushed or swabbed coat will not produce a uniform coat and blistering occurs. Below a die surface temperature of 800° F., however, a uniform, smooth coat can be obtained by spraying the lubricant paste.

Example IV

500 parts of lubricating powder A
450 parts of purified molybdenum disulphide powder
115 parts of powder polystyrene
2000 parts of trichloroethylene (this can be varied depending on the viscosity desired)

This dispersion was a rather fluid paste and was applied to a corrugated paper plate and dried. The plate thus prepared contained a thickness of 3–4 mm. of lubricant bound to the corrugated paper and filling the corrugations as shown in FIG. 2. Preparation of these paper plates is described below.

Example V

125 parts of lubricating powder A
125 parts of purified molybdenum disulphide powder
100 parts of Lustrex 770
1090 parts of water

This dispersion is similar to the dispersions prepared in Examples III and IV and is applied in the same manner.

Example VI

1000 parts of lubricating powder A
115 parts of powdered polystyrene
2000 parts of trichloroethylene

This dispersion is utilized in the same manner as that of Example IV.

PREPARATION OF CORRUGATED PAPER BACKED PLATES

A paste or dispersion as made in Examples III, IV, V or VI containing lubricating powder and binder is allowed to flow on a corrugated cardboard plate. Conveniently these cardboard plates are in the form of discs of various diameters. The lubricant paste is then dried at about 200° C. for about 20 minutes and a disc is obtained with a layer of lubricant some 3 to 4 mm. thick deposited thereon and bound thereto. These plates may then be placed between the heated billet and die in an extrusion press or between the heated billet and die surfaces in a forging press to lubricate the metal during the metal shaping operation. The plates are somewhat flexible and will undergo considerable deformations as in forging irregular pieces without breaking or crumbling, thus enabling all parts of the metal blank or billet to be in contact with the heat-insulating and lubricating action of the plate.

Example VII

A disc of corrugated paper 3, 220 mm. in diameter was coated on one side by brushing on the paste prepared as in Example IV so that the ridges 4 were filled in and a slight excess deposited over the corrugations 5 as shown in FIG. 2. The coated disc was dried at 200° C. for 20 minutes giving a round disc 1 containing a lubricant composition bound to one side thereof to a thickness of 3–4 mm. (FIG. 1). This disc 1 is then inserted in an extrusion press 6 as shown in FIG. 3 with the flat paper face 3 resting on the die surface 10 of the extrusion chamber and with the lubricant covered face between the heated billet 7 and the paper backing 3. Ram 8 forces the heated billet 7 to be extruded through the orifice 9 of the die in the form of a rod, bar or the like. The disc is ruptured adjacent to orifice 9 by the pressure applied and the lamellar graphite particles create a lubricant effect between the die and the heated billet. Meanwhile the sawdust, paper, binder ingredients and pyrolusite undergo an exothermic reaction at the temperature involved (about 650° F.) and keep the heated billet from loosing heat to the die surface as it is being extruded. The presence of the pyrolusite moreover creates a hardening effect of the surface of the die and improves lubrication properties of the graphite. The extrusion produced is smooth, uniform, free of striation and contains no foreign particles which must be removed.

As a further refinement, it has been found that the lubricant covered discs are difficult to position and maintain in position prior to the application of pressure. To overcome this, the embodiment shown in FIG. 4 is followed. FIG. 4 is an enlarged view of portions of the extrusion press 6 shown in FIG. 3. In this embodiment a support 11 is inserted into the lubricant coated disc 1 and is held therein by the spring action of the support, which may be a bent piece of spring wire. This support 11 is made slightly smaller than the orifice 9 of the die surface 10. The disc 1 with support 11, attached is then placed in the extrusion chamber and the support 11 pushed through the die opening 9 from the front of the die. As the ram 8 (not shown in FIG. 4) forces the heat billet 7 forward, support 11 is forced out of the orifice 9 ahead of the extrusion and is discarded from the runway table.

FIG. 5 illustrates the use of a fabric or corrugated paper blanket 12 similar to the disc 1 covered with the lubricant composition described above, which is spread over the lower die 13 between the lower die and the blank 14 being forged. After the blank 14 has been lowered onto the lower die 13 with the lubricating and insulating blanket 12 therebetween, a similar lubricating blanket can be spread over the top of blank 14 to provide a lubricating blanket between the blank 14 and the upper die 15. In this manner both of the dies will be lubricated. While the blankets 12 may not conform to all the die irregularities they are sufficiently flexible to provide lubrication over substantially the complete die faces and as the supporting fabric or paper is completely combustible at the forging temperature no objectionable residue is left on the die faces.

While it is possible that the heat insulating and lubricating composition of our invention may be dusted or blown as a fine dry powder on the heated dies or tools, it has been found that the use of a liquid or solid binder to promote adherence of the composition to the tools is desirable in order to obtain efficient lubrication.

Multiple layers of the said composition may be applied between extrusions to secure the desired thickness.

In the manufacture of extruded or drawn tubular products, such as tubes, rods, shells and the like, the axial core member or mandrel of the die serving to produce the tube or shell may desirably be surrounded or coated by material similar in nature to that described hereinabove. In this case, the material may either be applied as a liquid or paste coating spread around the periphery of the core or mandrel, or as a self-supporting tube or sheath prepared in advance by applying the lubricant paste to the paper backing, to be slipped about the core or mandrel.

If the composition is used to impregnate paper or cloth inserts or blankets, the inserts may be suitably placed between the billets and the tool faces as described above.

While the invention is particularly applicable to the heat-shaping of stainless and other alloy steels, it is equally applicable in the case of other metals and alloys and makes it possible readily to heat-shape metals which have been heretofore considered difficult to work in this manner.

In the metal shaping operation, the various constituents of the lubricating composition in contact with the hot billet on the one side and the tool or die on the other apparently function as follows:

The laminated graphite being relatively inert toward oxidants at the temperatures involved serves primarily as a lubricant, and due to its lamellar structure, the greater the pressure the greater its flow and hence its lubricating effect.

The remainder of the ingredients undergo an exothermic reaction at the temperatures involved even in the absence of air or oxygen; the heat thus produced offsets the cooling effect of the surface of the die on the hot metal blank or billet, thus enabling the metal shaping to occur without adverse effects and at lower temperatures than those customarily employed. In addition, presence of the superoxygenated oxide results in obtaining a better lubrication from the garphite and a hardening of the metal surfaces of the die, as is disclosed in our copending application Serial No. 572,189, filed March 19, 1956, now abandoned.

It will be understood that any ingredients and proportions specified herein are given primarily by way of illustration and should not be taken as restricting the scope of the invention, the limits of which are defined in the claims and that various modifications and changes may be made in our invention as disclosed without departing from the spirit of the invention or the scope of the following claims.

This application is a continuation-in-part of our copending application Serial No. 572,189, filed March 19, 1956, now abandoned, which in turn is a continuation-in-part of our application Serial No. 293,849, filed June 16, 1952, issued as U.S. Patent No. 2,757,138 on July 31, 1956.

We claim:

1. An infusible, heat-insulating lubricant composition adapted for interposition between the heated surface of a metal to be shaped and the shaping surfaces of the shaping assembly which comprises essentially, a lubricant powder containing about 65% to about 95% by weight of a lamellar solid selected from the group consisting of graphite and molybdenum disulfide, about 3% to about 20% by weight of a heat-insulating, porous, non-abrasive combustible organic substance in finely divided state and about 2% to about 15% by weight of a higher metal oxide selected from the group, consisting of pyrolusite (manganese dioxide), lead dioxide and bismuth tetraoxide, a colloidal dispersing and binding agent and a liquid vehicle selected from the group consisting of organic solvents and water.

2. An infusible, heat-insulating lubricant composition adapted for interposition between the heated surface of a metal to be shaped and the shaping surfaces of the shaping assembly which comprises essentially a lubricant powder containing about 65% to about 95% by weight of a lamellar solid selected from the group consisting of graphite and molybdenum disulfide, about 3% to about 20% by weight of a heat-insulating, porous, non-abrasive combustible organic substance in finely divided state and about 2% to about 15% by weight of a higher metal oxide selected from the group consisting of pyrolusite (manganese dioxide), lead dioxide and bismuth tetraoxide, and a colloidal dispersing and binding agent, said lubricating powder and said dispersing and binding agent being present in a ratio of from about 15 to 1 to about 1 to 1.

3. An infusible, heat-insulating lubricant composition adapted for interposition between the heated surface of a metal to be shaped and the shaping surfaces of the shaping assembly which comprises essentially a lubricant powder containing about 65% to about 95% by weight of a lamellar solid selected from the group consisting of graphite and molybdenum disulfide, about 3% to about 20% by weight of a heat-insulating, porous, non-abrasive combustible organic substance in finely divided state and about 2% to about 15% by weight of a higher metal oxide selected from the group consisting of pyrolusite (manganese dioxide), lead dioxide and bismuth tetraoxide, and a colloidal dispersing and binding agent, said lubricant powder and said dispersing and binding agent being present in a ratio of from about 15 to 1 to about 1 to 1, said lubricant composition being dispersed in a suitable vehicle selected from the group consisting of liquid organic solvents and water.

4. An infusible, heat-insulating lubricant composition adapted for interposition between the heated surface of

a metal to be shaped and the shaping surfaces of the shaping assembly which comprises essentially a lubricant powder containing about 65% to about 95% by weight of a lamellar solid selected from the group consisting of graphite and molybdenum disulfide, about 3% to about 20% by weight of a heat-insulating, porous, non-abrasive combustible organic substance in finely divided state and about 2% to about 15% by weight of a higher metal oxide selected from the group consisting of pyrolusite (manganese dioxide), lead dioxide and bismuth tetraoxide, and powdered polystyrene, said lubricant power and said polystyrene being present in a ratio of from about 15 to 1 to about 1 to 1, said lubricating composition being dispersed in a suitable vehicle selected from the group consisting of liquid organic solvents and water.

5. The composition of claim 4 wherein the said vehicle is water.

6. The composition of claim 4 wherein the said vehicle is trichloroethylene.

7. An infusible, heat-insulating lubricant composition adapted for interposition between the heated surface of a metal to be shaped and the shaping surfaces of the shaping assembly which comprises essentially a lubricant powder containing about 65% to about 95% by weight of a lamellar solid selected from the group consisting of a graphite and molybdenum disulfide, about 3% to about 20% by weight of a heat-insulating, porous, non-abrasive combustible organic substance in finely divided state and about 2% to about 15% by weight of a higher metal oxide selected from the group consisting of pyrolusite (manganese dioxide), lead dioxide and bismuth tetraoxide, and a colloidal dispersing and binding agent, said lubricant powder and said dispersing and binding agent being present in a ratio of from about 15 to 1 to about 1 to 1, said lubricant composition being bonded to a completely combustible organic backing.

8. An infusible, heat-insulating lubricant composition adapted for interposition between the heated surface of a metal to be shaped and the shaping surfaces of the shaping assembly which comprises essentially a lubricant powder containing about 65% to about 95% by weight of a lamellar solid selected from the group consisting of graphite and molybdenum disulfide, about 3% to about 20% by weight of a heat-insulating, porous, non-abrasive combustible organic substance in finely divided state and about 2% to about 15% by weight of a higher metal oxide selected from the group consisting of pyrolusite (manganese dioxide), lead dioxide and bismuth tetraoxide and powdered polystyrene, said lubricant powder and said polystyrene being present in a ratio of from about 15 to 1 to about 1 to 1, said lubricant composition being bonded to a completely combustible organic backing.

9. The composition of claim 8 wherein the said organic backing is corrugated paper.

10. The composition of claim 8 wherein said organic backing is a corrugated paper disc mounted on a wire support smaller than the orifice of an extrusion die, whereby the said support may be pushed through a die opening to support the said disc with the lubricant composition thereon in the front of a die.

11. An infusible, heat-insulating lubricant layer adapted for interposition between the heated surface of a metal to be shaped and the shaping surfaces of the shaping assembly which comprises a thin, stretchable completely combustible organic backing to which is bonded a layer of a lubricant composition containing about one part of a lubricant powder containing about 65% to about 95% by weight of a lamellar solid selected from the group consisting of graphite and molybdenum disulfide, about 3% to about 20% by weight of a heat-insulating, porous, non-abrasive combustible organic substance in finely divided state and about 2% to about 15% by weight of a higher metal oxide selected from the group consisting of pyrolusite (manganese dioxide), lead dioxide and bismuth tetraoxide and about 1 to about 15 parts of polystyrene.

12. A lubricant disc adapted for interposition between the heated surface of a metal to be extruded and the die face of an extrusion press which comprises a thin disc of corrugated paper to which is bonded a thin layer of a lubricant composition which comprises about 1 part of a lubricant powder containing about 65% to about 95% of a lamellar solid selected from the group consisting of graphite and molydenum disulfide, about 3% to about 20% by weight of a heat-insulating, porous, non-abrasive combustible organic substance in finely divided state and about 2% to about 15% by weight of pyrolusite (manganese dioxide) and about one to about fifteen parts of polystyrene.

13. In a method of producing a shaped metal body by subjecting a work-piece heated to a plastic condition to a metal shaping operation utilizing shaping dies and pressure, the steps of interposing between said heated metal work-piece and said shaping dies a lubricant layer comprising about one part of a lubricant powder containing about 65% to about 95% by weight of a lamellar solid selected from the group consisting of graphite and molybdenum disulfide, about 3% to about 20% by weight of a heat-insulating, porous, non-abrasive combustible organic substance in finely divided state and about 2% to about 15% by weight of a higher metal oxide selected from the group consisting of pyrolusite (manganese dioxide), lead dioxide and bismuth tetraoxide and about 1 to about 15 parts of a colloidal dispersing and binding agent selected from the group consisting of liquid organic solvents and water, wherein the said lubricant is deposited on and supported by a completely combustible organic backing and is interposed by inserting between said work-piece and said shaping dies, the completely combustible organic backing with said lubricant layer deposited and supported thereon.

References Cited in the file of this patent

UNITED STATES PATENTS

2,361,211	Kalischer	Oct. 24, 1944
2,588,625	Ferner	Mar. 11, 1952
2,706,850	Sejournet	Apr. 26, 1955
2,757,138	Clatot	July 31, 1956

FOREIGN PATENTS

712,007	Great Britain	July 14, 1954