Patented Nov. 4, 1947

2,430,092

UNITED STATES PATENT OFFICE

2,430,092

METHOD OF ELECTROFORMING OF METALS

Axel Westin, Milwaukee, Wis., assignor, by mesne assignments, of one-third to Sven Westin, Elm Grove, one-third to Axel Westin, and one-third to Charles Greenblatt, both of Milwaukee, Wis.

No Drawing. Continuation of application Serial No. 458,145, September 12, 1942. This application July 25, 1945, Serial No. 607,103

4 Claims. (Cl. 219—3)

1

This invention relates to a method of electro-forming of metals and constitutes an improvement upon the method set forth in U. S. Letters Patent No. 2,309,561.

This application is a continuation of applicant's co-pending application, Serial No. 458,145, filed September 12, 1942, for Die lubricant for hot forming.

In the electro-forming operations set forth in the patent referred to the workpiece and surrounding electrodes are relatively rotated and also relatively moved axially with respect to each other. In this manner pressure contact is effected between the dies and workpiece to form the latter and at the same time to conduct the requisite heating current through progressively changing and recurring circumferentially spaced regions of the workpiece.

The principal object of the invention is to facilitate conduction of the heating current from the dies to the workpiece.

Another object of the invention is to provide a resistance composition between the workpiece and dies through which the heating current passes and which facilitates heating of the workpiece.

Another object is to more effectively heat insulate the workpiece so that it is more readily heated to the required forming temperatures.

Another object is to provide a lubricant for the workpiece in the dies and reduce the energy required in the forming operation at the high temperatures involved and reduce wear on the dies.

Another object is to prevent scratching and pitting of the workpiece during the forming operation.

Another object is to prevent sparking and arcing between the workpiece and the electrode dies.

According to the present invention the electro-forming operations are carried out with a mobile conductor disposed between the workpiece and the electrode dies which additionally serves as a die lubricant, reducing wear on the die, and which retains its body at the high temperatures involved (approaching the melting point of steel) without sintering or reacting with the metal of the workpiece or dies.

The composition of the conductor-lubricant should comprise relatively heat stable elements such as graphite and a molten carrier, and may preferably comprise about 20% of graphite and about 45% of sodium chloride and the balance oil. The oil binder is employed to make the composition pasty so that it can be readily handled and applied to the dies and workpiece.

2

Sulphur may be added to melt and serve as a carrier after the oil has vaporized and before the sodium chloride melts, to thereby prevent any tendency of the composition to sinter and gall up during the early stages of the electro-forming operation. When sulphur is added, a suitable composition is constituted of about fifteen to thirty per cent of graphite and the balance is about evenly divided between sodium chloride and sulphur.

The graphite has considerably more body than the sodium chloride or the sulphur and tends to remain in the composition in minute flakes or powder form that constitute a good conductor and at the same time presents a very good sliding surface. However, too much of a body may result in sintering of the composition into hard particles which scratch the workpiece and dies.

The graphite employed should be as free of ash and impurities as possible, since these tend to cause sintering of the composition.

The salt or other carrier employed is molten at the forming temperature involved and should be present in sufficient proportion to maintain the composition plastic and mobile so that it constantly conforms to the workpiece and dies and assists in the conduction of heating current therebetween.

The oil or other vehicle employed should be fluid at room temperature and should be present in sufficient proportion to make the composition plastic and mobile when applied to the workpiece. The oil volatilizes before the final forming temperatures are reached leaving the salt to provide the fluidity during forming. A suitable petroleum oil has a viscosity of about S. A. E. 140.

When sulphur is employed it serves as an intermediate carrier, melting before volatilization of the oil and continuing as a vehicle until after melting of the salt.

In making up the composition, the graphite is first preferably thinned with the heavy petroleum oil and then the carrier added thereto. As a carrier, salt is preferred and sulphur may be additionally employed. Other carriers may be employed, although care should be taken not to employ a carrier that will be injurious to the metal of the workpiece at the high forming temperatures involved.

The composition may be applied to the workpiece and the die or merely to one or the other before the forming operation starts. It may also

be applied while the forming operation is actually in progress.

Various modes of applying the invention may be employed within the scope of the accompanying claims.

I claim:

1. In the electric forming of a metallic member in electrode dies which simultaneously heat and form the member, the conduction of heating current between the dies and member through a lubricant containing graphite, and the carrying of the lubricant on the member by the addition thereto of sulphur and sodium chloride which melt at different temperatures in the operation to provide a molten vehicle for the graphite.

2. In the electric forming of a metallic member in electrode dies which simultaneously heat and form the member, preparing a graphite lubricant to be disposed between the dies and member and having special properties for conducting heating current therebetween, which comprises first mixing the finely divided graphite with lubricating oil to give the same fluidity, and then adding sulphur and sodium chloride to act as carriers at elevated temperatures for the lubricant.

3. In the electric forming of a metallic member in electrode dies which simultaneously heat and form the member, the conduction of heating current between the dies and member at the high forming temperatures through a material principally composed of graphite and molten sodium chloride and which also serves as a lubricant for the dies.

4. In the electric forming of a metallic member in electrode dies which simultaneously heat and form the member, the conduction of heating current between the dies and member through a plastic mobile composition comprising graphite and a carrier which is molten at the elevated forming temperatures, the composition being sufficiently fluid at the forming temperatures to conform to the dies and member without injury to either, and constituting a conductor for the heating current.

AXEL WESTIN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
157,848	Mandel	Dec. 15, 1874
179,744	Upper	July 11, 1876
287,643	Dimick	Oct. 20, 1883
294,840	Bartlett	Mar. 11, 1884

FOREIGN PATENTS

Number	Country	Date
1,967	Great Britain	1862