May 7, 1957 A. E. WESTIN ET AL 2,791,674

METHOD OF LUBRICATING TUBULAR WORKPIECES IN DIES

Filed Sept. 13, 1954

FIG. 1.

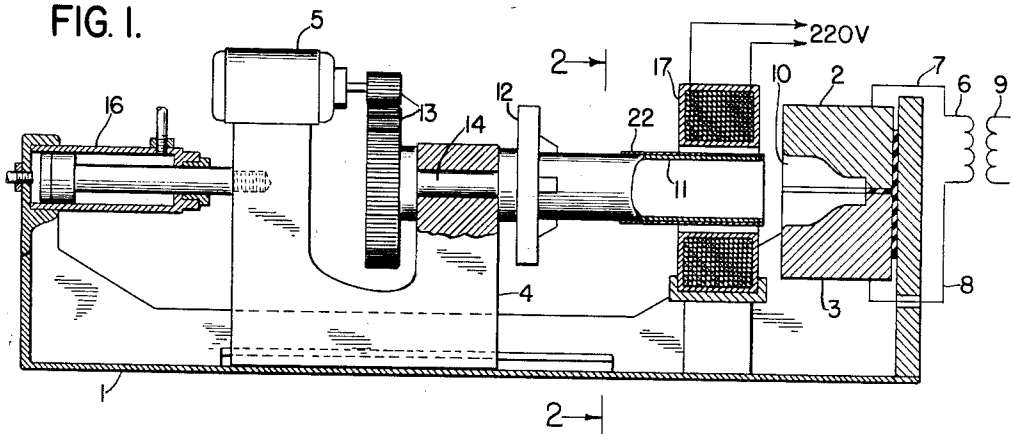


FIG. 2.

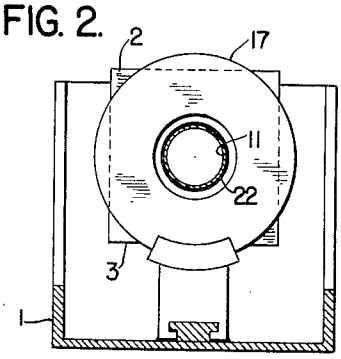


FIG. 3.

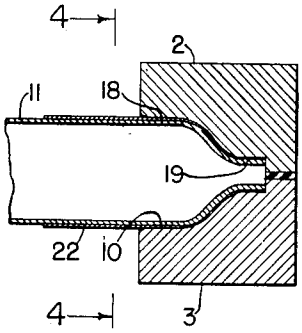


FIG. 4.

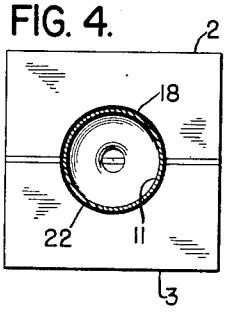
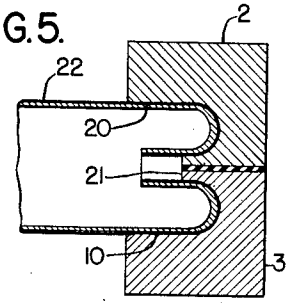


FIG. 5.



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METHOD OF LUBRICATING TUBULAR WORKPIECES IN DIES

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Application September 13, 1954, Serial No. 455,486

1 Claim. (Cl. 219—154)

This invention relates to an improved method of lubricating tubular workpieces, and more particularly to the lubrication of tube ends in the formation of pressure tanks, cylindrical rolls and the like which comprise a cylinder with a narrow neck or a reverse bend at one or both ends.

In general, the invention utilizes an apparatus similar to that described in United States Letters Patent No. 2,322,444 granted to W. C. Heath on June 22, 1943. In that patent a rotatably mounted tubular workpiece is preheated before being fed into a cavity formed by a plurality of circumferentially spaced electrode dies, this preheating serving to soften the workpiece so that it conforms more readily to the die cavity.

Heretofore, in forming tubular bodies of the nature described above, it has been found that the dies tended to show wear after a substantial number of tubes had been formed. This has resulted in reduced die life and consequently high replacement and relatively high maintenance costs.

The present invention is based on the discovery that prior lubrication methods were inadequate to completely lubricate the interface between the workpiece and dies during the forming operation, thereby resulting in die wear. It was found that the lubricant applied to the workpiece before forming did not completely remain thereon, but tended to run off.

The invention solves the problems of die wear by utilizing a novel process whereby an induction heater is used, prior to forming, to bake a lubricant onto the workpiece, and also simultaneously heat the workpiece to a temperature more conducive to forming.

The baked-on lubricant will not be affected to any great degree by the resistance heating action of the dies and will remain on the workpiece throughout substantially the entire forming operation.

It has been found that wearing of the dies is substantially eliminated. No more time need be taken than with prior methods, for the lubricant may be baked on at the same time the end of the workpiece is heated for forming.

The accompanying drawings illustrate the best mode presently contemplated by the inventors for carrying out the invention.

In the drawings:

Figure 1 is a side elevation of a forming apparatus with parts broken away and sectioned;

Fig. 2 is a section taken on line 2—2 of Fig. 1;

Fig. 3 is an enlarged section of the workpiece and dies during the forming operation;

Fig. 4 is a view taken on line 4—4 of Fig. 3; and

Fig. 5 is an enlarged section, similar to Fig. 3, showing the formation of a reverse bend in the workpiece.

The apparatus selected for illustration of the method comprises, in general, a base 1 which supports a plurality of circumferentially spaced electrode dies 2 and 3 at one end, and a slidably mounted carriage 4 at the other end upon which is mounted a suitable source of rotational power, such as an electric motor 5. If desired, carriage 4 may be stationary and dies 2 and 3 made slidable.

Dies 2 and 3 are connected to the secondary 6 of a transformer through suitable wires 7 and 8. The primary 9 of the transformer is supplied from an outside source of electricity, 220 volt or 440 volt being suitable. The coils of the transformer are such that the secondary 6 carries from approximately one to ten volts.

An opening or cavity 10 is provided in dies 2 and 3 to receive a workpiece 11.

Motor 5 drives a rotatably mounted chuck 12 through suitable gears 13 and shaft 14, said chuck gripping workpiece 11. Carriage 4 is moved longitudinally by means of a suitable source of pressure, such as hydraulic cylinder 16.

An electric induction heater 17 is disposed a relatively short distance rearwardly from the open end of die cavity 10 and along an axis running longitudinally through the center of die cavity 10 and chuck member 12. Electricity for heater 17 may be supplied from a suitable 220 volt source.

In Fig. 3, die cavity 10 is shaped to have a cylindrical portion 18 which curves rearwardly into a reduced cylindrical portion 19.

In Fig. 5, another die shape is shown in which die cavity 10 has a cylindrical portion 20 which, at its extreme inner end, curves inwardly to form a reverse bend and a plug portion 21.

In carrying out the process, one end of workpiece 11 is placed in chuck 12, and a suitable lubricant 22 is applied by brush or other means to the portion of the workpiece to be formed. Carriage 4 is then moved to dispose the portion of workpiece 11 to which the lubricant has been applied within heater 17. Heater 17 is then turned on and bakes lubricant 22 onto the workpiece.

An advantage of the electric induction heater is that the heating action is approximately uniform throughout the thickness of workpiece 11, thereby insuring a strong bond between the workpiece and lubricant 22.

During the baking operation, workpiece 11 may or may not be rotated. However, slow rotation may provide for a more even distribution of lubricant on the surface of workpiece 11.

The time necessary to bond the lubricant to workpiece 11, and to heat the workpiece so that it is sufficiently plastic, will vary according to the dimensions and composition of the workpiece.

Lubricant 22 comprises oil, sodium chloride and graphite, or water, sodium chloride and graphite. A suitable lubricant is disclosed in United States Patent No. 2,430,092, issued to Axel Westin, one of the present inventors, on November 4, 1947. Although the use of sodium chloride is preferable, other salts, such as copper sulfate, may be utilized with good results.

When a tubular workpiece of S. A. E. 4130 type steel and having a ¼" thickness and 6¾" outer diameter is used, it has been found that if heater 17 is set to about 1500° F., excellent softening and baking results may be obtained. A tapered heat may be provided if desired. Workpieces of other materials and dimensions will require different temperature settings for satisfactory results.

Although heater 17 has been described as being an integral part of the forming apparatus, it is often advantageous to place the heater to one side of the machine. In that case, it would be possible to bake the lubricant on one piece while another is being formed. This would result in substantial savings of time.

The baked-on lubricant tends to remain on the workpiece throughout the forming operation and coats the

workpiece so uniformly that die wear is greatly reduced.

Various modes of carrying out the invention are contemplated as within the scope of the following claim particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

We claim:

The method of hot forming the end of a tubular body or the like, comprising applying a lubricant containing salt and graphite to the circumferential end portion of the workpiece, electric induction pre-heating said end portion to simultaneously bond said lubricant to the workpiece and soften the workpiece so that it will be more conducive to forming, feeding the lubricated and softened workpiece into a plurality of circumferentially spaced electrode die segments which supply electric current to the workpiece through said bonded lubricant to further heat the workpiece, and rotating said workpiece relative to said die segments during said feeding movement.

References Cited in the file of this patent

UNITED STATES PATENTS

2,275,763	Howard et al.	Mar. 10, 1942
2,322,444	Heath	June 22, 1943
2,430,083	Sherman	Nov. 4, 1947
2,430,092	Westin	Nov. 4, 1947

OTHER REFERENCES

Steel: Issue of April 30, 1945, page 108 (summary in 113–51 L).

Steel: Issue of October 21, 1946, pages 103, 104.

Modern Industrial Press: Issue of September 1947, pages 6, 8 and 20.