March 9, 1943. W. F. HEINEMAN 2,313,068

ELECTRIC FORGING APPARATUS

Filed May 1, 1941

FIG. 1.

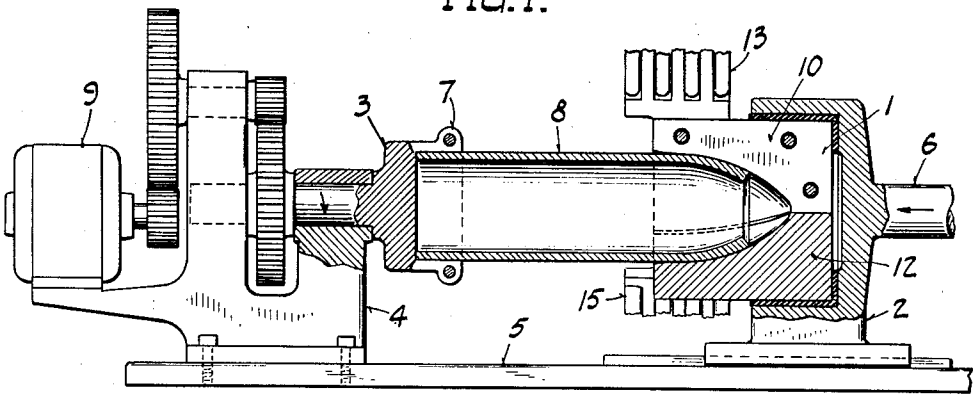
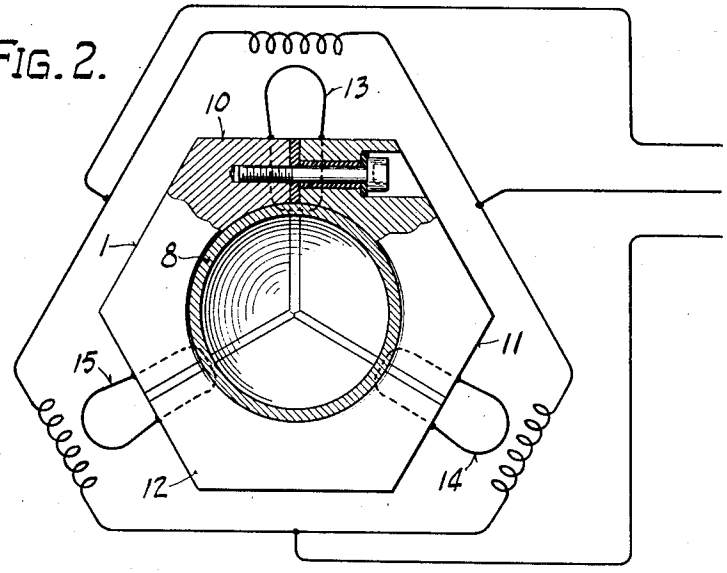


FIG. 2.



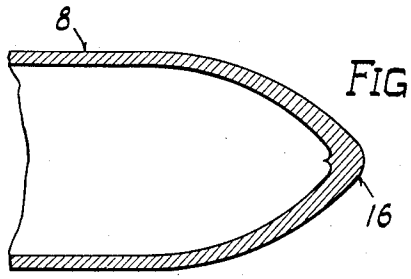


FIG. 3.

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ELECTRIC FORGING APPARATUS

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10 Claims. (Cl. 219—3)

This invention relates to electric forging apparatus and constitutes an improvement upon apparatus heretofore proposed for the nosing down and thickening of tubes in the manufacture of bomb shells and various other products.

The principal object of the invention is to provide for more uniform contact between the electrodes which constitute the forming dies and the piece being formed.

Another object of the invention is to provide a more efficient apparatus for the use of three phase current for heating.

A further object is to provide more uniform heating conditions and prevent undue heating of the shell at the end of the nose.

One embodiment of the invention is illustrated in the accompanying drawing in which:

Figure 1 is a schematic view of the apparatus showing a longitudinal section through the dies and showing the shell being formed;

Fig. 2 is an enlarged end view of the dies partly in section, and a schematic showing of the electric circuit employed; and

Fig. 3 is a longitudinal section through the completed nose of a bomb shell formed by the dies.

The apparatus comprises in general, a set of forging dies 1 suitably supported on a standard 2, and a chuck 3 supported on a standard 4. The two standards 2 and 4 are mounted for relative movement toward and away from each other on a bed 5, and the dies 1 and chuck 3 are disposed in alignment and supported for rotation relative to each other.

Preferably, the standard 2 is moved along suitable guideways on the bed by a ram 6. And also preferably the chuck 3 which has suitable clamps 7 for holding the tube 8 being formed, is rotated by a motor 9 mounted on standard 4.

The dies 1 comprise three separate electrodes 10, 11 and 12, each connected at adjacent ends to transformer leads 13, 14 and 15, respectively, and which supply a three phase current to the electrodes.

The electrodes are complementary, and except for a space between the adjacent edges of the same they provide a cup-shaped die having the requisite shape for forming the nose on the end of tube 8 as the latter is advanced into the die.

The electrodes 10, 11 and 12 are insulated from one another and from the standard 2 in which they are held.

As the tube 8 advances into the dies 1, its end engages the inner surface of the electrodes 10, 11 and 12 and heating current following the path of the dotted lines in Fig. 2 passes through the metal of the tube bridging the gaps between the respective electrodes. Rotation of the tube 8 effects heating of a circumferential portion of the tube end, and as the tube softens, the pressure of the tube against the dies effects an inward forming of the end of the tube.

Progressive movement of tube 8 into the dies 1 effects a gradual and progressive heating and forming of the end of the tube until the nose 16 is completed thereon, the walls of the tube being forced inwardly and thickened as shown in Fig. 1.

The internal shape of the dies will depend upon the desired finished shape of the work piece and may vary from conical to any curved symmetrical shape desired. The dies may be shaped for purely upsetting operations or for forming either internal or external flanges or tubes.

The invention has very considerable advantage over the two half die construction heretofore proposed, and in which the dies were shaped somewhat elliptical to provide the required electrical contact for heating. In the present invention, by providing three electrodes a uniform contact with the pipe is provided at the adjacent edges of the electrodes.

The power saving by the efficient use of three phase current is another advantage of the invention. Furthermore only that part of the tube that is to be formed is heated and there is substantially no waste of heat.

It has been found that there is a tendency for the current to flow toward the end of the nose and to heat the metal at the end of the pipe 8 more than is necessary. When the metal gets too soft, there is less control of the forming of the same.

This difficulty is substantially overcome by attaching the leads 13, 14 and 15 to their respective electrodes 10, 11 and 12 at or near the region of greatest internal diameter or open end of the dies 1. This provides a longer path for current flowing toward the tip of the nose than for that flowing through the pipe 8 at regions of larger diameter. As a result the major heating zone in the dies is near the region where the pipe first engages the dies as a forming operation is started.

While the invention has been illustrated as applied to apparatus for the forging of the ends on tubes in the manufacture of bomb shells, it may be applied to apparatus for other purposes.

The invention may have various embodiments within the scope of the accompanying claims.

I claim:

1. In an electric forging apparatus at least three complementary symmetrically shaped electrodes constituting forming dies presenting radially opposed circumferential forming surfaces for engagement by a relatively rotating work piece, said electrodes being spaced apart to apply a heating current passing from one electrode to another through a part of the work piece being formed.

2. In an electric forging apparatus, three complementary symmetrically shaped electrodes constituting forming dies presenting radially opposed circumferential forming surfaces for engagement by a relatively rotating work piece, said electrodes being spaced apart to apply a heating current passing from one electrode to another through a part of the work piece being formed, and means connecting said electrodes respectively to the separate leads of a three phase current source.

3. In an electric forging apparatus, at least three complementary symmetrically shaped electrodes constituting forming dies presenting radially opposed circumferential forming surfaces for engagement by a relatively rotating work piece, said electrodes being spaced apart circumferentially to apply a heating current to that part of the work piece being formed passing from one electrode to another in a generally circumferential direction.

4. In an electric forging apparatus, three complementary symmetrically shaped electrodes constituting forming dies presenting radially opposed circumferential forming surfaces for engagement by a relatively rotating work piece, said electrodes being spaced apart circumferentially to apply a heating current to that part of the work piece being formed passing from one electrode to another in a generally circumferential direction, and means connecting said electrodes respectively to the separate leads of a three phase current source.

5. In an electric forging apparatus, three complementary symmetrically shaped electrodes constituting forming dies presenting radially opposed circumferential forming surfaces for engagement by a relatively rotating work piece, said electrodes being spaced apart circumferentially to apply a heating current to that part of the work piece being formed passing from one electrode to another in a generally circumferential direction, and means connecting said electrodes respectively to the separate leads of a three phase current source, said leads being connected to the respective electrodes at the outer circumference near the forward end where contact is first made with the work piece.

6. In an electric forging apparatus, a plurality of electrodes constituting radially opposed forming dies having complementary symmetrical circumferential forming surfaces for engagement by a relatively rotating work piece, said electrodes being spaced apart circumferentially and connected to a source of electric energy to apply a heating current to the part of the work piece being formed, the electrical lead connections to the respective electrodes being at the outer circumference near the forward end of each electrode where contact is first made with the work piece.

7. In an apparatus for nosing down and thickening the end of a tube in manufacturing bomb shells and the like, a plurality of electrodes constituting forming dies disposed circumferentially and shaped to provide a common die recess having the shape of the nose to be formed on the tube, and leads from a source of electricity connected to said electrodes at the outer forward ends thereof, said electrodes being spaced apart circumferentially to provide for passing current through the tube at the gaps between the electrodes.

8. In an apparatus for nosing down and thickening the end of a tube in manufacturing bomb shells and the like, a plurality of electrodes constituting forming dies disposed to provide a common die recess having the shape of the nose to be formed on the tube, said electrodes being spaced apart to provide gaps therebetween, and means connecting the electrodes to a source of alternating electric energy having a plurality of phases to provide a heating current of different phase passing through the tube across the gap between each respective pair of electrodes.

9. In an electric forging apparatus of the class described, a plurality of spaced complementary symmetrically shaped electrodes constituting forming dies presenting radially opposed circumferential forming surfaces for engagement by a relatively rotating work piece, and means connecting said electrodes respectively to the separate leads of a source of multi-phase alternating current to provide for a heating current of different phase relation passing through the work piece across the gap between each pair of electrodes.

10. In an apparatus of the class described a plurality of opposed electrodes disposed to make recurrent contact with portions of an article being heated for a substantial distance longitudinally of the electrodes, and electrical connections supplying current to said electrodes and providing therewith current paths of different electrical impedance to effect a predetermined differential distribution of the heating current to the article in different longitudinal regions of contact of said electrodes.

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