

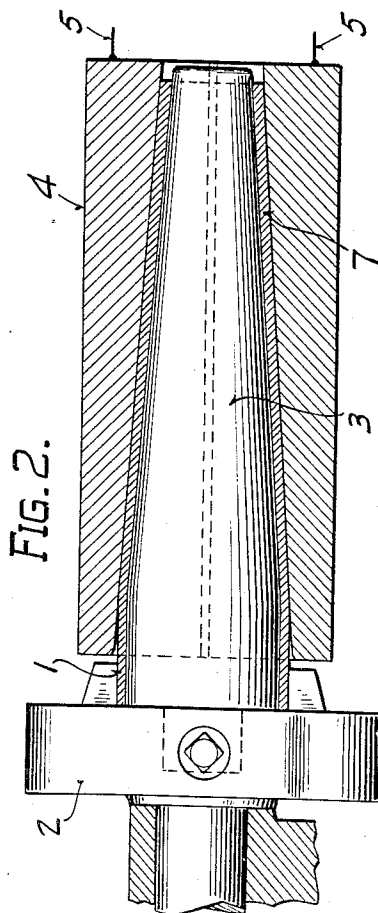
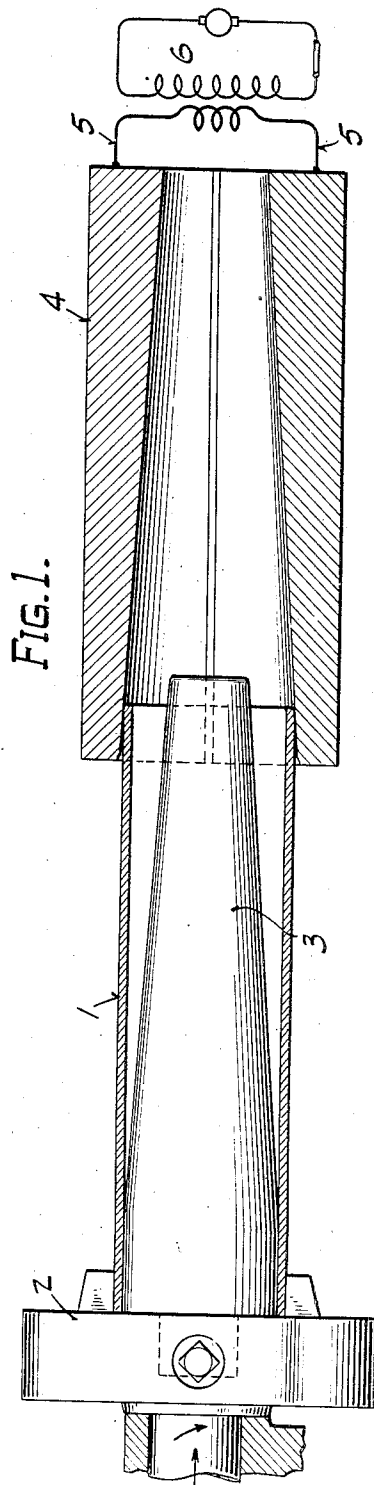
April 4, 1944.

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2,345,670

ELECTRICALLY FORMING TUBULAR SHAPES

Filed Nov. 30, 1942



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2,345,670

ELECTRICALLY FORMING TUBULAR SHAPES

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Application November 30, 1942, Serial No. 467,345

7 Claims. (Cl. 219-3)

This invention relates to electrically forming tubular shapes as in the forming of conically-shaped tubular blanks from cylindrical blanks by the process set forth in the application of Sven Westin and Axel Westin, Serial No. 376,669, filed January 30, 1941, for improvement in Method of treating metallic bodies, now Patent No. 2,309,561, dated January 26, 1943.

The invention has been applied in the manufacture of airplane struts of tapered or conical shape where the inside surface of the strut is smooth and devoid of scratches or defects that might cause failure from fatigue. The invention may be applied to the upsetting of tube ends and to the forming of various tubular shapes.

The principal object of the invention is to electrically heat and form the blanks and to iron out undesirable variations in thickness without injuring or scratching the inside surface of the blanks.

Another object of the invention is to facilitate the rotation of the blank in the forming die and substantially retard the tendency of the blank to twist spirally.

Other objects will appear in connection with a description of one embodiment and practice of the invention illustrated in the accompanying drawing.

In the drawing:

Figure 1 is a diagrammatic axial section through the forming apparatus, blank and drive therefor; and

Fig. 2 is a similar view showing the completion of the forming operation.

In carrying out the invention, a cylindrical tubular blank 1 is clamped at one end in a rotary chuck 2 having a conically-shaped mandrel 3 supported concentrically within the blank.

The mandrel 3 has its large end secured to the chuck and is of a diameter approximating the inside diameter of the blank 1. The small end of the mandrel 3 extends axially out of the free end of the blank.

The forging die 4 is disposed in axial alignment with the free end of the blank and mandrel and comprises a plurality of electrode die segments circumferentially separated along longitudinal lines and connected by leads 5 to a suitable source 6 of heating current.

The inside forming surface of the die 4 is conically-shaped with the end of largest diameter constituting the mouth of the die and having a diameter sufficient to receive the blank 1 as the latter is fed longitudinally into the die and rotated by the chuck 2.

As the blank 1 moves into pressure contact with the electrode dies, heating current is passed through successive circumferentially adjacent areas of the blank in recurrent cycles. As the end portion of the blank softens by heat the blank is gradually fed into the die resulting in the progressive heating and forming of the blank until the cone 7 is completed as shown in Fig. 2. In the last stages of the forming operation the mandrel 3 contacts with the inside surface of the blank and, rotating therewith, tends to press the blank uniformly against the die so as to iron out any unevenness in thickness that may exist.

The taper of the mandrel 3 and of the inside surface of die 4 may be the same so as to obtain a more nearly uniformly thick cone. However, it is preferable in the making of struts and the like to provide a slightly steeper taper for the mandrel 3 to compensate and allow at least in part for the tendency of the blank to thicken at the smaller end of the cone.

By having the mandrel rotate with the blank there is less tendency for friction therebetween and for scratching of the interior surface of the blank. The free end of the blank also has less tendency to twist under the friction of the die since as soon as the mandrel comes into contact with the blank it supports it and strengthens it against twisting. As a result the blank is more uniformly shaped. Where the form of the article being produced is such that the mandrel is in contact with the blank for a longer period this advantage becomes more pronounced. Movement of the mandrel longitudinally resulting from a further feeding of the blank into the die after the mandrel first contacts with the inside surface of the blank substantially evens out any irregularity in thickness in the blank.

The invention is applicable as an improvement upon that set forth in the copending application of William E. Crawford, Serial No. 466,135, filed November 19, 1942, for Apparatus for electrically upsetting pipe ends, now Patent No. 2,325,480, dated July 27, 1943. In such application of the present invention, the rotation of the mandrel with the blank serves to facilitate the forming of an upset end on pipe.

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

The invention is claimed as follows:

1. The improvement in the process of the class described which comprises employing an internal mandrel for supporting a tubular blank against the forming operation of an external die,

and rotating the mandrel with the blank as the latter enters the electrode dies to prevent injury to the inner surface of the blank during forming and obtain a more uniform shaping of the blank.

2. The improvement in the process of the class described which comprises rotating and feeding an internal supporting mandrel with the blank into the tubular electrode dies.

3. In apparatus of the class described, a die having a plurality of electrode die segments connected to a source of heating current, an internal die member forming with said die a die cavity for receiving and forming the end of a tubular blank, means to rotate a tubular blank and feed the same into said die cavity to heat and form the blank, and means to rotate said internal die member.

4. In apparatus of the class described, a die having a plurality of electrode die segments connected to a source of heating current, a longitudinally movable internal die member forming with said die a die cavity for receiving and forming the end of a tubular blank, means to rotate a tubular blank and feed the same into said die cavity to heat and form the blank, and means to rotate said internal die member with said blank.

5. In apparatus of the class described, a die

having a plurality of electrode die segments connected to a source of heating current and defining the outer surface of a die cavity, a mandrel for co-operating with said die and forming the inner surface of the die cavity, means to rotate and feed a tubular blank into said die cavity, and means to rotate said mandrel.

6. In apparatus of the class described, a die having a plurality of electrode die segments connected to a source of heating current and defining the outer surface of a die cavity, a mandrel for cooperating with said die and forming the inner surface of the die cavity, and means to rotate and feed said mandrel and a tubular blank surrounding the same into said die to form the blank.

7. In apparatus of the class described, a die providing a circular cavity confined externally and internally for receiving the end of a rotating tubular blank to form the same, one of the confining surfaces constituting a plurality of electrode die segments spaced circumferentially to supply heating current to the blank during forming, and the other confining surface of the die being disposed to rotate and advance with the blank to thereby support the same against forming pressures.

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