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REDUCTION OF TUBULAR BLANKS

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Fig. 1

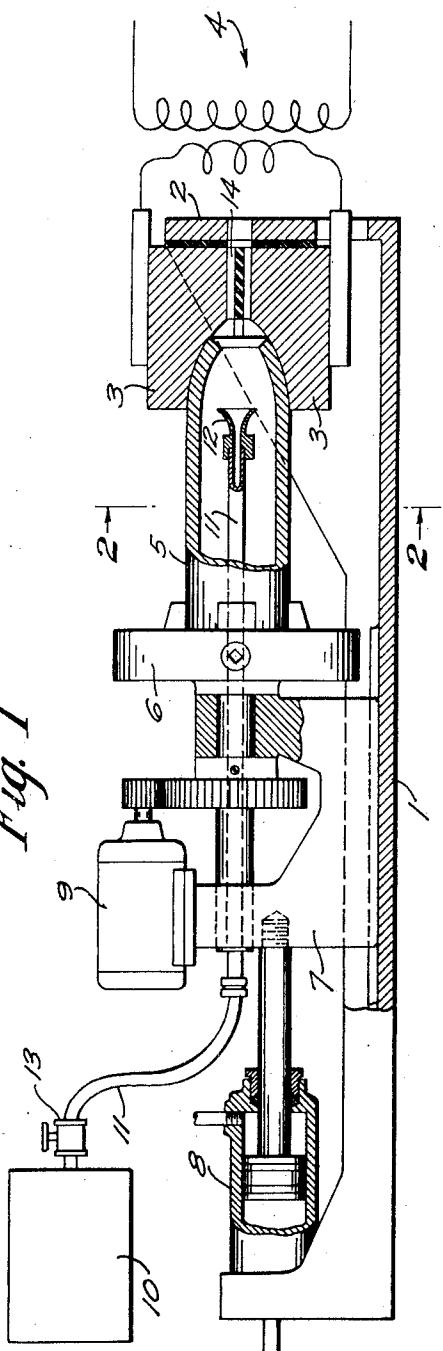
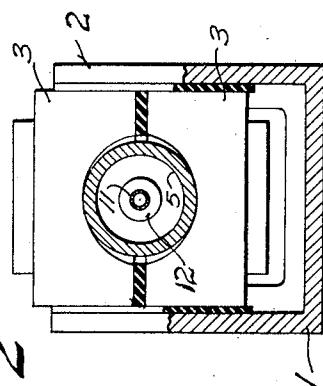


Fig. 2



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## UNITED STATES PATENT OFFICE

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## REDUCTION OF TUBULAR BLANKS

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11 Claims. (Cl. 219—3)

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This invention relates to the reduction of tubular blanks, and is applicable to the electro-forming operations set forth in U. S. Letters Patent No. 2,309,561, issued to the present inventor jointly with Sven Westin.

The object of the present invention is to prevent the enlargement of surface flaws on the inside of the blank during the forming operation.

The accompanying drawing illustrates the invention and the views therein are as follows:

Figure 1 is a side elevation of an apparatus for forming a tapered tubular body from a cylindrical blank, showing the blank and dies in section with the blank partially reduced; and

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

The apparatus illustrated comprises in general a base 1 upon which is mounted a pedestal 2 supporting a pair of complementary electrode dies 3 and a transformer 4 for supplying current to the dies. The dies 3 constitute two longitudinal semi-cylindrical sections spaced circumferentially from each other and cooperate to provide a tapered die cavity for receiving and forming a cylindrical blank 5.

The blank 5 is supported by a rotary chuck 6 at its rear end and rotated thereby as it is forced into the die cavity under longitudinal force to contract the same therein. For this purpose the chuck 6 is rotatably mounted on a pedestal 7 which is moved longitudinally along base 1 toward and away from the pedestal 2 by means of the hydraulic cylinder 8. A motor 9 on pedestal 7 drives the chuck 6.

During a forming operation the end of blank 5 is rotated and forced into engagement with the tapered internal surface of the dies 3. At the same time electric heating current is conducted circumferentially through the blank between the two electrode die segments from transformer 4. As the end band of the blank becomes heated by the current, the metal softens and yields to the pressure of the blank against the dies. This heating and yielding is progressive as the blank moves into the die and the metal walls of the blank are upset and contracted to a tapered form, resulting in a thickening and lengthening of the blank at the tapered end.

Where flaws or crevices exist on the inside surface of the blank, it has been found that they tend to enlarge or become deeper as the forming operation progresses. This sometimes produces an undesirable inside surface for the blank requiring its rejection.

The present invention is based upon the dis-

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covery that this undesirable result can be prevented by retarding the upsetting of the metal at the inner surface as by slightly chilling it with air or other fluid media.

5 A preferred method is to feed compressed air from a suitable source such as an air tank 10 through conduit 11 axially through chuck 6 and into the blank 5 where it is discharged radially against the heated interior of the blank through the nozzle 12 of the conduit. The passage of air through the conduit 11 is regulated by the valve 13 at the juncture of conduit 11 and pressure source 10. Sufficient air should be supplied, having regard to the size of the blank and its material to chill the inside surface and retard upsetting as compared to the upsetting of the metal of the remainder of the blank.

10 The air may be allowed to escape through the rear end of the blank 5, and a vent opening 14 axially of the dies may be provided for escape of air.

15 The invention is applicable to the forming of tapered ends on tubular blanks, as illustrated, and also to the reduction of pipe as where the blanks are passed progressively through an open tapered die mouth.

20 Reducing gas may be employed as the chilling media, or an inert gas may be used, although it has been found to be satisfactory generally to employ ordinary dry air. The term "air" as herein employed is meant to include any gaseous media.

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

I claim:

1. The method of reducing a tubular blank by electro-forming, comprising forcing the blank endwise into a tapered die cavity while relatively 30 rotating the blank with respect to the die and applying electric resistance heating current to the blank through the dies, and chilling the unsupported inner surface of the blank during forming to thereby prevent enlargement of surface flaws on the inside of the blank.

2. In the reduction of heated tubular blanks by progressive upsetting of the same in a tapered die, the retarding of the upsetting of the metal at the inner unsupported surface of the blank as 35 by chilling the same during the upsetting operation to thereby prevent enlargement of surface flaws on the inside of the blank.

3. In the reduction of heated tubular blanks by progressive upsetting of the same in a tapered die, the application of a fluid media to the inner sur-

face of the blanks to chill the same during the upsetting operations and thereby prevent enlargement of surface flaws on the inside of the blank.

4. In the reduction of heated tubular blanks by longitudinal movement of the same into a tapered die, the prevention of enlargement of defects in the inner surface of the blank by chilling the same during forming.

5. In the reduction of heated tubular blanks by longitudinal movement of the same into a tapered die, the prevention of enlargement of defects in the inner surface of the blank by the impinging of the same with air under pressure to chill the same during forming.

6. In apparatus for reducing a heated tubular blank in diameter, a forming die having a tapered die surface adapted to receive the blank and contract the same as the blank is moved longitudinally into the die, a conduit adapted to extend axially through one end of the blank to be formed and having a nozzle disposed to discharge air against the inner surface of the blank in the region of forming to thereby prevent enlargement of surface flaws inside the blank, and means for supplying air to said conduit.

7. In apparatus for reducing a heated tubular blank in diameter, a forming die having a tapered die surface adapted to receive the blank and contract the same as the blank is moved longitudinally into the die, means to relatively rotate the blank and die during forming operations, a conduit adapted to extend axially through one end of the blank to be formed and having a nozzle disposed to discharge air against the inner surface of the blank in the region of forming to thereby prevent enlargement of surface flaws inside the blank, and means for supplying air to said conduit.

8. In apparatus for reducing a tubular blank in tapered electrode dies, means to rotate the blank and force the same endwise relative to the electrode dies to effect a simultaneous application of heating current and forming pressure to the blank progressively from one end thereof toward the other, and means to chill the unsupported inner surface of the blank during forming to retard the propagation of surface flaws therein.

9. In apparatus for reducing a tubular blank in tapered electrode dies, means to rotate the blank and force the same endwise relative to the electrode dies to effect a simultaneous application of heating current and forming pressure to the blank progressively from one end thereof toward the other, and means to blow air against the inner surface of the blank during forming to retard the propagation of surface flaws therein.

10. In apparatus for reducing a tubular blank in tapered electrode dies, means to rotate the blank and force the same endwise relative to the electrode dies to effect a simultaneous application of heating current and forming pressure to the blank progressively from one end thereof toward the other, and means to blow air against the inner surface of the blank during forming to retard the propagation of surface flaws therein.

11. In apparatus for reducing a tubular blank in tapered electrode dies, means to rotate the blank and force the same endwise relative to the electrode dies to effect a simultaneous application of heating current and forming pressure to the blank progressively from one end thereof toward the other, and means to blow a reducing gas against the inner surface of the blank during forming to thereby prevent the formation of defects on the inner surface of the blank.

12. In apparatus of the class described, comprising a plurality of complementary electrode die members disposed to provide a tapered die cavity for receiving a tubular blank, means to rotate the blank relative to the die members and to feed the blank progressively into the die cavity, and means to direct a fluid media against the inner surface of the blank in the region of the dies to chill the same and prevent the formation of surface defects in the blank.

AXEL WESTIN.

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

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