

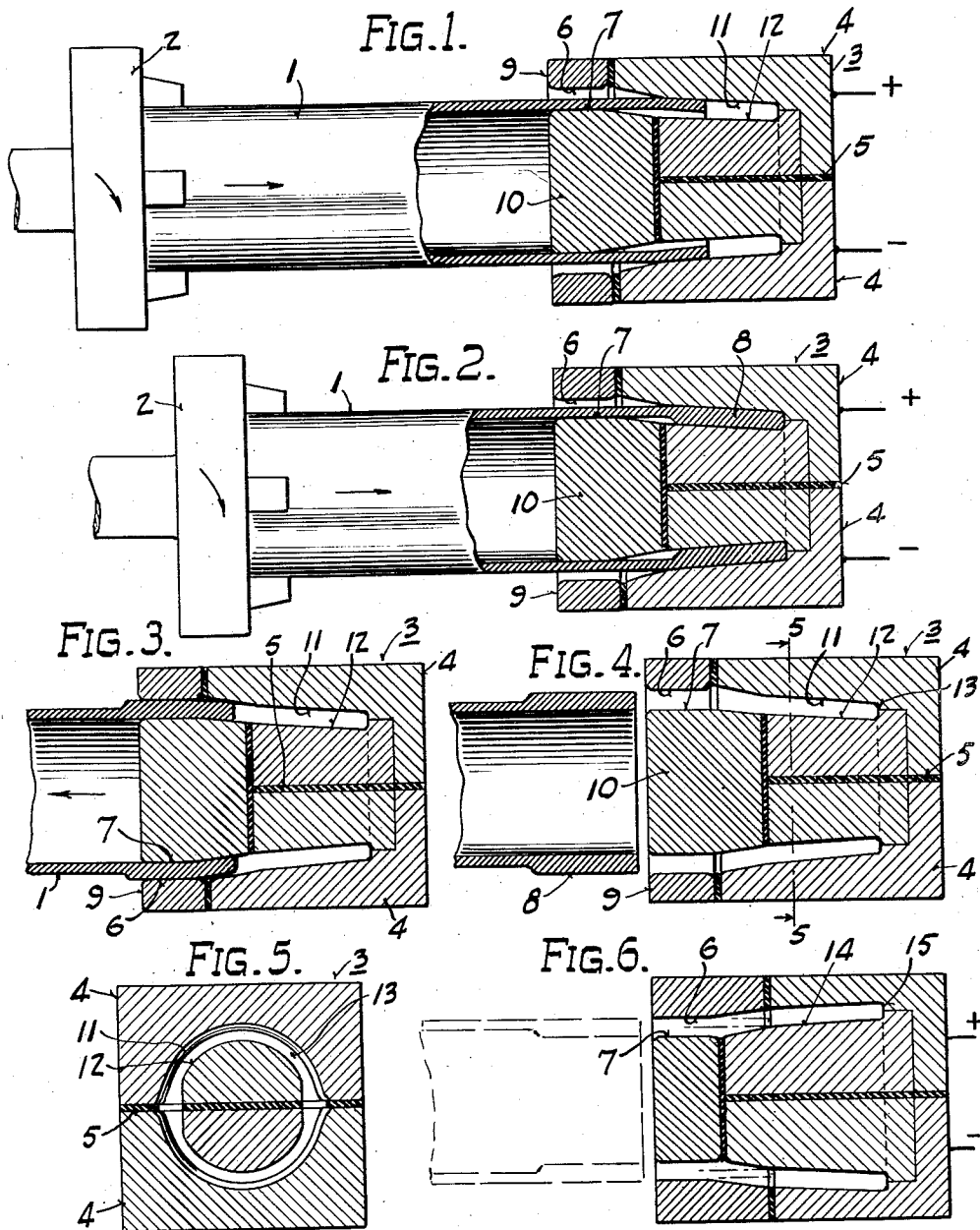
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METHOD AND APPARATUS FOR UPSETTING PIPE ENDS

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METHOD AND APPARATUS FOR UPSETTING
PIPE ENDS

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This invention relates to a method and apparatus for upsetting pipe ends, as in the thickening of the ends of well casing for threading, and the like.

The invention constitutes an improvement upon and application of the invention set forth in the copending application of the present inventors, 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 process of the invention therein disclosed comprises the forming of the ends of tubular blanks by applying thereto spaced electrode forming dies which simultaneously heat a portion of the blank by electric resistance heating and form the heated portion.

The object of the present invention is to provide for the employment of said process in the thickening and shaping of ends of pipe.

A more specific object of the invention is to provide for the accurate shaping of the thickened end both inside and outside.

Another object is to provide for entering the blank against a tapered or conical die surface and for stripping the blank from the die in a manner straightening the same.

In carrying out the invention the end of the pipe blank is fed onto or into a gradually tapered generally conical die surface to provide the electrical contact for heating the blank, the latter being rotated relative to the die and the die being split longitudinally to constitute electrodes for passing current circumferentially through the blank. The hot end of the blank is fed into engagement with an abutment at the inner end of the die and caused to upset and thicken to fill a recess formed by the conical die surface referred to and by an opposing surface for limiting the thickening of the blank. The blank is thereafter stripped from the die while hot and the opposing surface referred to serves to straighten the blank as it leaves the mouth of the die.

The invention is illustrated in the accompanying drawing in which:

Figure 1 is a longitudinal section through the die and showing a pipe blank entering the same to be upset;

Fig. 2 is a similar section showing the blank upset in the die;

Fig. 3 is a similar section showing the blank partially stripped from the die;

Fig. 4 is a similar view showing the blank completely stripped from the die;

Fig. 5 is a transverse section through the die taken on line 5-5 of Fig. 4; and

Fig. 6 is a section similar to Fig. 1 showing a modified form of die.

As shown in the drawing, the pipe blank 1 is cylindrical and has its outer end gripped in a suitable rotary chuck 2 for rotating the pipe and feeding it longitudinally into the die 3.

The die 3 comprises two or more circumferentially separated electrodes 4 with insulation 5 therebetween. The die electrodes 4 are complementary and provide a circular die cavity shaped as illustrated with a mouth in which the outer surface 6 of the die cavity is of larger diameter than the outer diameter of the pipe blank 1 while the inner surface 7 of the die cavity is of substantially the same diameter as the inside of the blank. The diameter of the surface 6 at the mouth should approximate the outside diameter of the thickened end 8 of the finished blank.

The mouth of the die cavity extends for a substantial distance, with the outer surface 6 and also preferably the inner surface 7 cylindrical. The cylindrical extension of the mouth is preferably provided by separate members 9 and 10 which are insulated from the electrodes 4 and between which the blank 1 is fed into the die cavity.

The inner portion of the die cavity constitutes the upsetting part and in it the outer and inner surfaces 11 and 12, respectively, are tapered to a smaller diameter with a transverse abutment 13 at the end or bottom of the cavity for stopping the inward movement of the end of the blank.

The outer conical surface 11 constitutes the forming and heating surface down which the end of the pipe moves as the blank is fed into the die. This surface 11 is preferably shaped as illustrated in Fig. 5 with the leading edges of the electrodes cut away to give maximum contact pressure centrally or toward the trailing edge of each electrode, as set forth and claimed in the copending application of the present inventors, Serial No. 458,216, filed September 14, 1942, for Electric Forming. Likewise, the surface 12 is flattened on the sides as shown in Fig. 5 for the same purpose.

The conical surfaces 11 and 12 are spaced radially an amount sufficient to provide for the required thickening of the blank therebetween after the end of the blank has abutted against the bottom 13 of the die cavity. As the blank gradually fills the die cavity and progressively contacts more and more of the surface thereof, the heating current more rapidly heats the metal so that the upsetting operation is completed very quickly.

After the blank has been upset to the required

length in the inner portion of the die cavity as illustrated in Fig. 2, and while the end of the blank is still soft, the blank is stripped from the die. During stripping it is preferable to disconnect the electrodes from the source of heating current and to stop the rotation of the blank.

In stripping the blank from the die, the thickened end of the blank is forced outwardly by the plug member 10 at the mouth of the die cavity as shown in Fig. 3 to a larger diameter, so that its inside diameter will be equal to the inside diameter of the pipe. The stripping operation is progressive and as it proceeds, the thickened part of the blank is forced outwardly against the outer surface 6 of the mouth of the die and of member 9. The surface 6, being cylindrical in member 9, straightens the blank and prevents the formation therein of a circumferential wrinkle at the line between the thick section and the original section of the blank.

Where it is desired to have the thickening of the blank on the inside of the latter, the mouth of the die cavity is merely changed in dimension so that the outer surface 6 has substantially the same diameter as the outside diameter of the pipe, and the inner surface 7 has the finished inner diameter of the thickened end. Any suitable variation between these dimensions may be employed to locate the thickening of the blank radially as desired.

The die 3 may be considered as comprising an outer shell with the surfaces 6 and 11, and an inner plug with the surfaces 7 and 12, respectively. The end abutment 13 is disposed between the shell and plug and may be separate from or integral with either or both. By providing the integral construction shown there is no danger of defects in the blank from possible extrusion into cracks between the parts, and the parts need only be insulated at the longitudinal separation of the electrodes. Preferably, the mouth-piece section is separated from the electrode dies and insulated therefrom.

The modified construction shown in Fig. 6 is essentially the same as that of the other figures except that the inner portion of the die cavity tapers outwardly instead of inwardly. In employing this construction the pipe end first engages the inner die surface 14 and moves along it to the abutment 15, after which the blank thickens outwardly to fill the cavity. In stripping, the outer shell forces the thickened end inwardly to the desired diameter and the central plug controls the movement to prevent wrinkling of the blank as previously described for the embodiment of Figs. 1 to 5.

By providing a gradually tapered surface upon which the pipe end is forced and rotated to apply the heating current to successive adjacent regions of the pipe in recurrent time intervals, the end of the pipe becomes heated to the required upsetting pressure. As the end of the blank reaches the abutment and the feed of the blank continues, the end, having been heated longest and being the softest, upsets and starts to fill the cavity at the bottom but due to the rotation of the blank maintains a cylindrical contour although the die is recessed at the joints. This thickening proceeds progressively toward the mouth of the die cavity until the thickening is completed. The heating current is then ordinarily disconnected and the rotation of the blank stopped. The blank is withdrawn from the die while the upset end is still hot so that the latter is reformed to provide the straight end 8 of the pipe.

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

We claim:

1. The method of electrically heating and forming a thickened end on a tubular blank, comprising simultaneously applying heating current and forming pressure recurrently to circumferentially adjacent regions of the blank and progressively from the end of the blank towards its center, and feeding the blank towards the heated end to effect a progressive radial upsetting of the latter from the end towards the center until the requisite length of upset is obtained.

2. The method of electrically heating and forming a thickened end on a tubular blank, comprising simultaneously applying heating current and forming pressure recurrently to circumferentially adjacent regions of the blank and progressively from the end of the blank towards its center, and feeding the blank relatively towards an abutment at the heated end to effect a progressive radial upsetting of the blank from the end towards the center until the requisite length of upset is obtained while confining the upset end of the blank to shape the same.

3. The method of electrically heating and forming a thickened end on a tubular blank, comprising simultaneously applying heating current and forming pressure recurrently to circumferentially adjacent regions of the blank and progressively from the end of the blank towards its center along lines symmetrically tapered with respect to the cylindrical wall of the blank, and feeding the blank towards the heated end to effect a progressive radial upsetting of the latter from the end towards the center until the requisite length of upset is obtained.

4. The method of electrically heating and forming a thickened end on a tubular blank, comprising simultaneously applying heating current and forming pressure recurrently to circumferentially adjacent regions of the blank and progressively from the end of the blank towards its center along lines symmetrically tapered with respect to the cylindrical wall of the blank, feeding the blank towards an abutment at the heated end to effect a progressive radial upsetting of the latter from the end towards the center until the requisite length of upset is obtained while confining the upset end of the blank in a tapered die cavity, and thereafter withdrawing the heated upset pipe end from said cavity through a restricted mouth of the cavity to straighten the end.

5. The process of thickening the end of a tubular blank which comprises heating and upsetting the end of the blank in a tapered die cavity, and thereafter withdrawing the blank through the mouth of the die cavity to shape the upset end cylindrically.

6. In apparatus for electrically heating and thickening the end of a tubular blank, a die consisting of circumferentially spaced die electrodes having a complementary circular die recess therein, means to rotate and axially feed the end of a tubular blank into the die recess, and means to supply electric current to said electrodes to heat the blank, said die recess being tapered to effect pressure contact between the electrodes and the blank and having an abutment at its end to effect upsetting of the blank as the latter is fed into the recess.

7. In apparatus for electrically heating and thickening the end of a tubular blank, a die consisting of circumferentially spaced die electrodes having a complementary circular die recess therein, means to rotate and axially feed the end of a tubular blank into the die recess, and means to supply electric current to said electrodes to heat the blank, said die recess being tapered to effect pressure contact between the electrodes and the blank and having an abutment at its end to effect upsetting of the blank as the latter is fed into the recess, and the mouth of said die recess having a straight substantially cylindrical section of a diameter controlling the corresponding diameter of the upset end of the blank as the latter is stripped from the die.

8. In apparatus for electrically heating and thickening the end of a tubular blank, a die consisting of circumferentially spaced die electrodes having a complementary circular die recess therein, means to rotate and axially feed the end of a tubular blank into the die recess, and means to supply electric current to said electrodes to heat the blank, said die recess being tapered inwardly to effect a contraction of the end of the blank resulting in a pressure contact between it and the electrodes as the blank is fed into the recess and having an abutment at its end to stop the forward movement of the end of the blank as the body of the blank is fed into the die recess.

9. In apparatus for electrically heating and thickening the end of a tubular blank, a die consisting of circumferentially spaced die electrodes having a complementary circular die recess therein, means to rotate and axially feed the end of a tubular blank into the die recess, and means to supply electric current to said electrodes to heat the blank, said die recess being tapered inwardly to effect a contraction of the end of the blank resulting in a pressure contact between it and the electrodes as the blank is fed into the recess and having an abutment at its end to stop the forward movement of the end of the blank as the body of the blank is fed into the die recess, and the inner surface of the mouth of the die recess having a diameter substantially equal to the inside diameter of the final thickened end of the blank to straighten the upset end to cylindrical shape as the same is stripped through the mouth of the recess.

10. In apparatus for electrically heating and thickening the end of a tubular blank, a die consisting of circumferentially spaced die electrodes having a complementary circular die recess therein, means to rotate and axially feed the end of a tubular blank into the die recess, and means to supply electric current to said electrodes to heat the blank, said die recess being tapered inwardly to effect a contraction of the end of the blank resulting in a pressure contact between it and the electrodes as the blank is fed into the recess and having an abutment at its end to stop the forward movement of the end of the blank as the body of the blank is fed into the die recess, the inner surface of the mouth of the die recess having a diameter substantially equal to the inside diameter of the final thickened end of the blank to straighten the upset end to cylindrical shape as the same is stripped through the mouth of the recess, and the outer surface of the mouth of the die recess being cylindrical and approximating the outside diameter of the final thickened end of the blank to

prevent wrinkling of the blank as the latter is stripped from the die.

11. In apparatus for electrically heating and thickening the end of a tubular blank, a die consisting of circumferentially spaced die electrodes having a complementary circular die recess therein, means to rotate and axially feed the end of a tubular blank into the die recess, and means to supply electric current to said electrodes to heat the blank, said die recess being tapered outwardly to effect an expansion of the end of the blank resulting in a pressure contact between it and the electrodes as the blank is fed into the recess and having an abutment at its end to stop the forward movement of the end of the blank as the body of the blank is fed into the die recess.

12. In apparatus for electrically heating and thickening the end of a tubular blank, a die consisting of circumferentially spaced die electrodes having a complementary circular die recess therein, means to rotate and axially feed the end of a tubular blank into the die recess, and means to supply electric current to said electrodes to heat the blank, said die recess being tapered outwardly to effect an expansion of the end of the blank resulting in a pressure contact between it and the electrodes as the blank is fed into the recess and having an abutment at its end to stop the forward movement of the end of the blank as the body of the blank is fed into the die recess, and the outer surface of the mouth of the die recess having a diameter substantially equal to the outside diameter of the final thickened end of the blank to straighten the upset end to cylindrical shape as the same is stripped through the mouth of the recess.

13. In apparatus for electrically heating and thickening the end of a tubular blank, a die consisting of circumferentially spaced die electrodes having a complementary circular die recess therein, means to rotate and axially feed the end of a tubular blank into the die recess, and means to supply electric current to said electrodes to heat the blank, said die recess being tapered outwardly to effect an expansion of the end of the blank resulting in a pressure contact between it and the electrodes as the blank is fed into the recess and having an abutment at its end to stop the forward movement of the end of the blank as the body of the blank is fed into the die recess, the outer surface of the mouth of the die recess having a diameter substantially equal to the outside diameter of the final thickened end of the blank to straighten the upset end to cylindrical shape as the same is stripped through the mouth of the recess, and the inner surface of the mouth of the die recess being cylindrical and approximating the inside diameter of the final thickened end of the blank to prevent wrinkling of the blank as the latter is stripped from the die.

14. In a device of the class described, a die for receiving the heated end of a tubular blank to effect upsetting of the same, said die defining a die cavity having a mouth of predetermined inside and outside diameters to effect coining of the upset end as the same is stripped from the die.

15. In a device of the class described, a die for receiving the heated end of a tubular blank to effect upsetting of the same, said die defining a die cavity of non-cylindrical shape and having a mouth of predetermined inside and outside

diameters to effect coining of the upset end of the blank to cylindrical shape as the blank is stripped from the die.

16. In a device of the class described, a die comprising a plurality of spaced complementary electrodes providing a circular tapered die cavity for receiving and forming a blank, and inner

and outer mouth sections providing a radial space of cylindrical shape therebetween through which the formed end of the blank is drawn when stripping the blank from the die.

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