March 9, 1948. J. R. WELSHMAN 2,437,285

MEANS FOR FLARING TUBING

Filed Nov. 11, 1943

Fig. 1

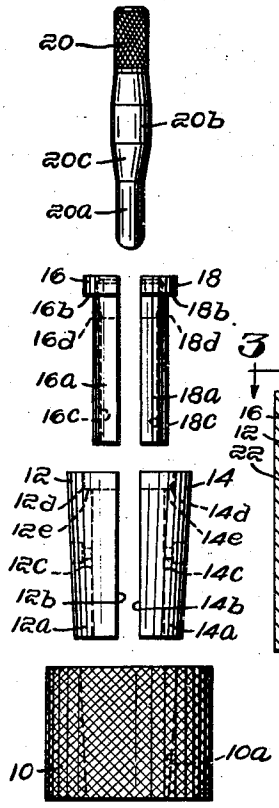


Fig. 2.

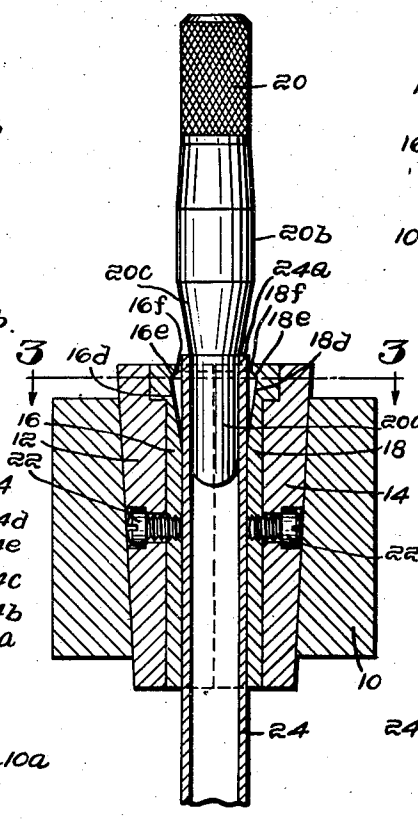


Fig. 3.

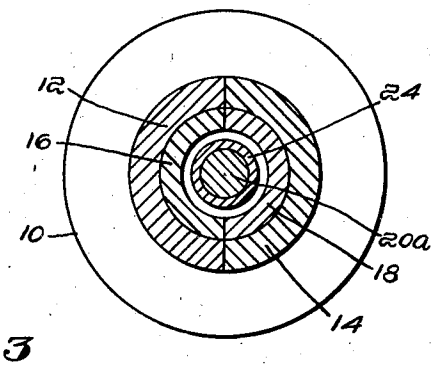


Fig. 7.

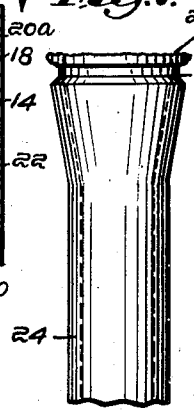


Fig. 8.

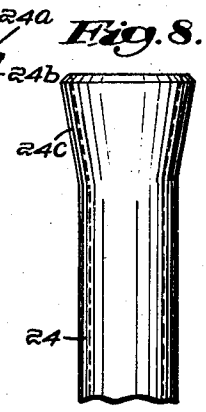


Fig. 4.

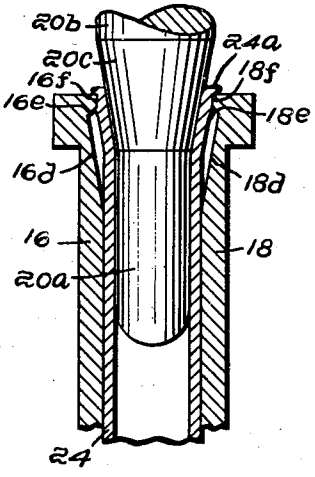


Fig. 5.

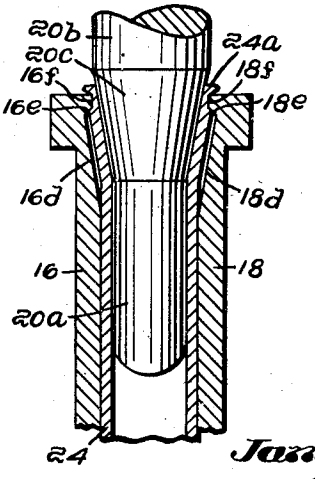
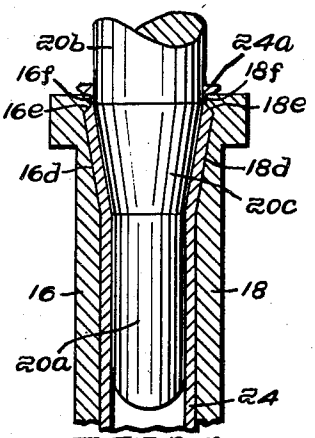


Fig. 6.



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MEANS FOR FLARING TUBING

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4 Claims. (Cl. 153—79)

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This invention relates to improvements in a method of and means for flaring tubing. More especially it has to do with the formation of a tapering flared portion at the end of tubing so that the tubing may be engaged by a flared fitting.

My improved method and means are particularly adapted for flaring tubing which has a weak longitudinal seam, or similar longitudinal weakness, likely to produce a split in the tube wall when an attempt is made to flare the tubing in the usual manner with the means customarily employed.

It is an object of my invention is provide a method of flaring such tubing without rupture of the tube wall and to provide simple but highly effective apparatus for practicing the improved method.

The best mode in which I have contemplated applying the principles of my invention is described in the following text and shown in the accompanying drawings, but the latter are to be deemed merely illustrative for it is intended that the patent shall cover by suitable expression in the claims whatever features of patentable novelty exist in the invention disclosed.

In the accompanying drawings,

Figure 1 is an exploded view of the several parts of a preferred form of apparatus for flaring tubing in accordance with my improved method;

Figure 2 is a medial section showing the parts of my improved apparatus and a piece of tubing in the relative positions they occupy when the flaring operation is about to be performed;

Figure 3 is a section on line 3—3 of Figure 2;

Figures 4, 5 and 6, show the tubing and immediately adjacent parts of the apparatus in their relative positions at different stages of the flaring operation;

Figure 7 shows the end of the tubing as it generally appears when removed from the apparatus; and

Figure 8 shows the finished flared end.

The essence of my improved method resides in holding the external surface of a portion adjacent the end of the tubing to a diameter less than the greatest diameter of the external surface of the flared portion of the tubing. The thickness of the wall close by the end is reduced, however, and part of the wall material is swaged downward slightly into that portion of the tubing which is flared. By thus holding the edge of the tube from any substantial expansion, coupled with the slight upsetting or swaging of the material toward where the greatest stretch of the tubing will normally occur, it is possible to flare the present available tubing without rupture or weakening of the tube wall.

Referring now to Figure 1, there is shown in separated relation the various parts of a preferred form of flaring means for practicing my invention. These comprise a block or clamping ring 10, a pair of jaw holders 12, 14, a pair of flaring jaws 16, 18, and a flaring plunger 20.

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The block 10 may be secured in a vise but its outer surface is knurled so that it can be held in one's hand. It has a tapered axial hole 10*a* extending through it.

The jaw holders 12, 14 have exterior curved surfaces 12*a*, 14*a* tapered to fit the wall of the hole 10*a* in the clamping ring 10, and also have opposed flat surfaces 12*b* and 14*b*. Each holder has a semi-cylindrical recess 12*c*, 14*c* which terminates in an enlargement 12*d*, 14*d* at the upper end to provide a shoulder 12*e*, 14*e*. When the holders are together they provide a cylindrical hole between them for the reception of the flaring jaws 16 and 18.

These jaws have external cylindrical surfaces 16*a*, 18*a* and external shoulders 16*b*, 18*b* to fit the hole formed by the holders 12, 14. A clamping jaw may be held to a holder by a screw 22, whose threaded portion passes through a shouldered hole in the holder and screws into a tapped hole in the jaw. Each jaw has for most of its length a semi-cylindrical recess 16*c*, 18*c*, but at its upper end is particularly formed with tapered surfaces 16*d*, 18*d* which diverge outward at an angle from the axis equal to one-half the degree of flare to be imposed on the tubing 24. Each outwardly tapered surface 16*d*, 18*d* extends along the axis as far as desired to make the length of the flare wanted. From the ring of greatest diameter of the outwardly flared surface, the wall is tapered inward sharply, as at 16*e* and 18*e*, to terminate in a short cylindrical portion 16*f*, 18*f*, a little larger than the outside dimension of the unflared tube.

The flaring plunger 20 has a cylindrical portion 20*a* substantially the same size as the hole in the tubing to be flared. From this portion, to another cylindrical portion 20*b*, is a tapered or flaring surface 20*c* making an angle with the axis of the plunger equal to the degree of flare to be imposed on the tubing. The diameter of the larger cylindrical portion 20*b* of the plunger is slightly less than that of the short cylindrical hole formed by the portions 16*f* and 18*f* of the flaring jaws.

In the practice of my improved method the tubing 24 to be flared is placed between the jaws 16 and 18 with its end 24*a* extending slightly beyond the ends of the jaws as shown in Figure 2. The jaws are set in the holders 12 and 14 and the latter in the ring 10. The larger ends of the holders are preferably tapped lightly with a hammer to tighten the jaws against the tubing. The plunger 20 is inserted in the tubing with its flared portion 20*c* resting on the edge 24*a* of the tube. The latter edge, by the way,

need not be cut or finished with any special care but may be the edge left when tubing is cut with a hack saw or pipe cutter.

The plunger is now subjected to hammer blows until the flaring is completed. In Figures 4, 5 and 6 I have attempted to illustrate what I believe occurs as the flaring takes place. As the plunger is driven into the tubing the holders 12 and 14 settle very firmly into the ring 10, causing the jaws 16 and 18 to grip more tightly the tubing 24 between them. As the flared surface 20c of the plunger moves downward it acts with swaging effect on the tube wall, gradually thinning it opposite the portions 16f and 18f of the jaws. Part of the metal displaced by the swaging action may move upward to swell very slightly the edge 24a of the tubing, but for the most part it moves downward and apparently slightly thickens the tubing just below the said portions 16f and 18f of the jaws.

As the progress of the plunger continues, the tube is forced outward into the space around it, formed by the tapered surfaces 16d, 18d, 16e and 18e, until when the plunger bottoms (that is, when the lower end of its flared portion is opposite the lower ends of the flared portions of the flaring jaws) the wall of the tube is flared outward as desired and as shown in Figure 6.

The holders 12 and 14 can then be tapped lightly at their smaller end to free them from the ring, the latter can be slipped downward, and the holders and jaws separated to remove them from the tubing. Either before this is done or afterward the plunger can be withdrawn from the tubing. The end of the tubing will appear generally as shown in Figure 7 and the final step is to clean off the necked portion 24b and edge 24a and thus produce the finished flared end 24c shown in Figure 8.

Examination of the flared end discloses no rupture, tear or crack in the tubing. The entire flared portion is intact. If anything, it may be slightly stronger than would be the case if flared in the usual way, because despite the increased circumferential size, the wall thickness of the flared portion is not appreciably thinned but usually measures as thick as the original thickness of the tube wall.

I claim:

1. Means for flaring tubing comprising a die having a cylindrical wall fitting the normal external wall of the tubing, a conically flared wall for determining the degree of flare of the tubing, and a short cylindrical wall adjacent the large end of said flared wall providing an opening slightly larger than the external dimensions of the tubing; and a plunger for insertion in the tubing having a conically flared surface whose larger end is slightly smaller than the said opening whereby upon the plunger being inserted into the tubing until the said larger end of the flared surface of the plunger is opposite the said short cylindrical wall of the die, the tubing is flared against the flared surface of the die and its wall opposite the said short cylindrical wall of the die is appreciably thinned.

2. Means for forming a conical flared end on tubing comprising a die having a cylindrical section fitting the normal external wall of the tubing, a conical section diverging outward from the end of the cylindrical section and a conical surface converging inward from the larger end of the diverging conical section, and a plunger for insertion in the tubing having a leading cylindrical section fitting the normal internal wall of the tubing and a conical section diverging outward from the end of the cylindrical section; the diverging conical section of the plunger having its largest external diameter substantially the same as the smallest internal diameter of the inwardly converging conical section of the die, whereby the conical section of the plunger and the converging conical section of the die effect a swaging of the tubing as the plunger is inserted therein.

3. Means for forming a conical flared end on tubing comprising a die having a cylindrical surface fitting the normal external wall of the tubing, a conical surface diverging outward from the end of the said cylindrical surface, a conical surface converging inward from the end of the diverging conical surface, and a short cylindrical surface extending from the end of the converging conical surface; and a plunger for insertion in the tubing having a leading cylindrical surface fitting the normal internal wall of the tubing, a conical surface diverging outward from the end of the last said cylindrical surface, and a second cylindrical surface extending from the end of said diverging conical surface; the diameter of the said second cylindrical surface of the plunger being substantially the same as the diameter of the said short cylindrical surface of the die.

4. Means for forming a conical flared end on tubing comprising a die having a cylindrical surface fitting the normal external wall of the tubing, a conical surface diverging outward from the end of said cylindrical surface for determining the flared end desired, a reentrant surface at the larger end of said conical surface having its smallest diameter substantially the same as the diameter of the normal external wall of the tubing; and a plunger for insertion in the tubing having a cylindrical surface fitting the normal internal wall of the tubing, a conical surface diverging outward from the end of the last said cylindrical surface to a diameter only slightly smaller than the said smallest diameter of the reentrant surface of the die; the said reentrant surface of the die and the conical surface of the plunger coacting to swage the tubing as the plunger is inserted, thereby maintaining the wall of the flared end of the tubing substantially at the same thickness as that of the unflared tubing wall and causing the tubing between the said reentrant wall and the conical surface of the plunger having the largest diameter to be appreciably thinned.

JAMES R. WELSHMAN.

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