June 17, 1958 M. F. MUSE 2,838,773

TUBE END FORMING TOOL WITH PIVOTED MANDREL

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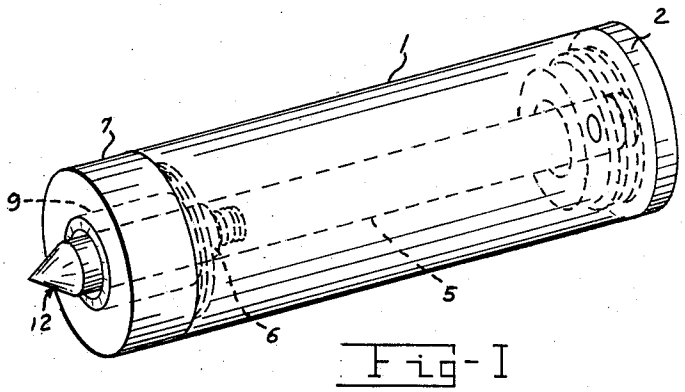



Fig-1

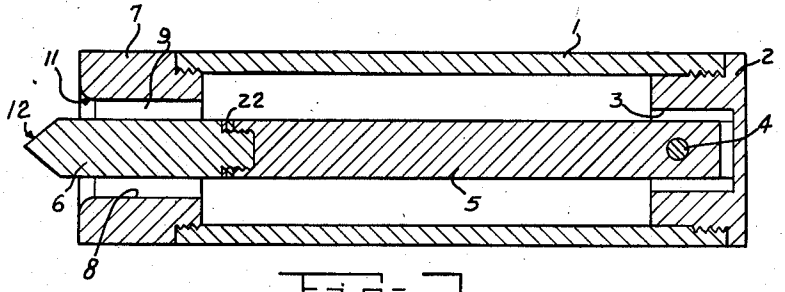



Fig-2

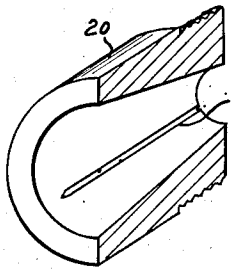



Fig-5

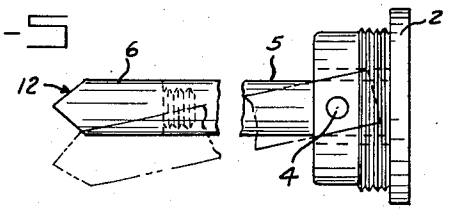



Fig-3

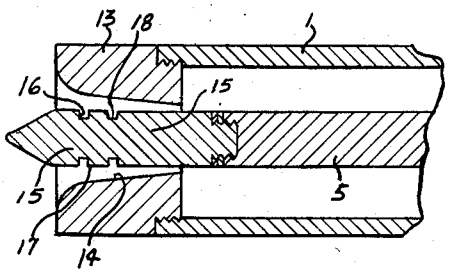



Fig-4

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# TUBE END FORMING TOOL WITH PIVOTED MANDREL

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10 Claims. (Cl. 7—14.1)

This invention relates to tube forming tools and particularly to a tool of the kind described effective to shape tube ends or to restore roundness in tube ends which have been deformed, as by the transverse cutting thereof.

The object of the invention is to simplify the construction as well as the means and mode of operation of tube forming tools, whereby such tools may not only be economically manufactured, but will be more efficient and satisfactory in use, adaptable to a wide variety of applications, and be unlikely to get out of repair.

A further object of the invention is to facilitate introduction of a mandrel into the interior of a tube end to be reshaped.

Another object of the invention is to provide a tool of the kind described effective to remove internal and external burrs on the tube and to crimp or inwardly taper the extremities of tube ends for a better interfitting with adjacent contiguous parts.

A further object of the invention is to permit modification of the tool quickly and easily to adapt it for use with tube material of different wall thicknesses and diameters.

A further object of the invention is to provide a tube forming tool possessing the advantageous structural features, the inherent meritorious characteristics and the mode of operation herein mentioned.

With the above primary and other incidental objects in view as will more fully appear in the specification, the invention intended to be protected by Letters Patent consists of the features of construction, the parts and combinations thereof, and the mode of operation as hereinafter described or illustrated in the accompanying drawings, or their equivalents.

Referring to the accompanying drawing wherein is shown one but obviously not necessarily the only form of embodiment of the invention,

Fig. 1 is a view in perspective of a tool of the kind described, in accordance with a first illustrated form of the invention;

Fig. 2 is a view of the tool of Fig. 1 in longitudinal section;

Fig. 3 is a detail view in side elevation of mandrel and the mounting means therefor comprised in the device of Figs. 1–2;

Fig. 4 is a view similar to Fig. 2, showing a device of the kind described in accordance with a modified concept of the invention; and

Fig. 5 is a sectional view of a modified part of the tool.

Like parts are indicated by similar characters of reference throughout the several views.

Referring to the drawings, in the embodiment of Figs. 1 through 3, a tool for reshaping tube ends comprises a cylinder 1 internally screw threaded at its opposite ends. In one end there is installed, by virtue of matching screw threads, a closure member or plug 2 having a recess 3 axially aligned with the cylinder 1 and opening into the interior thereof. A cross pin 4 is mounted in the plug member 2 in transverse intersecting relation to the recess 3. A mandrel 5 is longitudinally disposed in the cylinder



1 and has its one or base end received in the recess 3 and pivotally mounted on the transverse pin 4 in such manner as to permit the mandrel limited rocking motion in the recess 3 about the pin 4.

The opposite end of the mandrel 5 extends towards the other end of the cylinder 1 and detachably mounts a coaxial tip portion 6 extending through and beyond the said other or open end of the cylinder 1. Installed in such last mentioned end of the cylinder 1 is a replaceable die element 7 having a screw threaded mounting in the cylinder. A bore 8 in the die element 7 is located in axially aligned relation to the cylinder 1 and to the recess 3, and the tip 6 on the mandrel 5 passes through such bore. Between the mandrel tip 6 and the wall of bore 8 there is thus defined an annular space 9 of a size to receive a tube end of predetermined wall thickness. The outer end of the bore 8 may be tapered, as indicated at 11, for more facile introduction of the tube end into the die element. Similarly, the extremity of the mandrel tip 6 is tapered, as indicated at 12, for better entry thereof into the tube end. In this latter regard, it will be understood that on account of its pivotal mounting at its base end, the mandrel 5 is capable of self-adjustment to locate and to follow the path of easiest entry into the tube end, with the result that inwardly deformed portions of the tube are pressed out gradually and without likelihood of cutting or weakening the material of the tube. Also, since the tip 6 is replaceable on the mandrel 5 there may be provided a number of such tips interchangeable one with another in accordance with the different wall thicknesses of the tubes to be worked upon. The die element 7 is interchangeable for similar reasons or to provide bores of different configuration.

In this latter connection, and as shown in Fig. 4, a cylinder 1 mounting a pivotal mandrel 5 has a die element 13 installed in the open end thereof, in which is a tapered bore 14. A tip 15 on the mandrel 5 is formed with a groove 16 defining a circular cutting surface 17 for removing internal burrs from the tube. Rearwardly of the cutting surface 17 is a second undercut or grooved surface 18. In conjunction with the tapered bore 14, axial motion of the tube end into the bore 14 serves to press the extremity of the tube end into the undercut area 18 so as to give to the tube end a beveled or chamfered formation for better interfitting of adjacent tube sections.

A further modification is shown in Fig. 5 in which a die member 20 similar to the die members 7 and 13, of Figs. 2 and 4, is provided with one or more serrations 21 extending longitudinally of the die on the interior of the surface thereof. This particular die member is comparable to the die member 13 of Fig. 4 in which the end of the tube is beveled or chamfered. In operation, the tool incorporating the die 20 of Fig. 5 provides a bevel or chamfer on the end of the tube similar to that formed by the die 13 of Fig. 4, except that all outside burrs and roughness are removed by the serrations 21 upon relative rotational movement of the tube and tool. The serrations 21 act much like a knife edge and shave the outer end of the tube adjacent the tip extremity thereof. This is accomplished by rotating the tube relative to the tool, or rotating the tool relative to the tube, while the tube and tool are in telescoping relation to one anoher.

In use the present tool for forming or reshaping tube ends may be held stationary while a section of the tube to be formed is advanced in to telescoping relation thereto. The tube end to be shaped is inserted into the outer open end of the bore 9 of Fig. 2 or the bore 14 of Fig. 4, or a similar bore provided when the die of Fig. 5 is used. The present tool is of course equally adaptable

to situations where the tube is held stationary and the tool advanced in to telescoping relation thereto. Continued relative axial motion of the tool and tube results in the reshaping or reforming of the tube end in the manner heretofore described. In connection with device of Fig. 2 it is possible to straighten kinks or dents in the tube which may lie somewhat inwardly from the end thereof since the tube may be freely passed over the tip 6 of mandrel 5 to a distance comparable to the length of the tool housing 1. The device of Fig. 4 or if modified by use of the die of Fig. 5 is intended primarily for reforming only the end area of the tube since with the tapered interior wall of the die it is not well suited for acceptance of the tube to any great extent.

The present tool is also well adapted for power operation whether power be supplied to the tool or to the tube being formed. The tube may be stationarily held while the tool is power driven longitudinally and rotatably relative thereto, or conversely the tool may be stationarily held while the tube is power driven longitudinally and rotatably relative thereto.

By the use of shims 22 (Figs. 2 and 4) it is possible to vary the position of the mandrel tip in relation to the die member. With different types of tubing and shapes to be produced it is desirable to slightly vary the position of the mandrel tip with respect to the die particularly if the tool of Fig. 4 is utilized.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise but one of several modes of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention, I claim:

1. A tool for reshaping tube ends including a perforate die means, a closure for one end of said die means, and a mandrel longitudinally disposed in said die means to define therein an annular space to receive a tube end, one end of said mandrel being pivotally connected to said closure and the other end thereof projecting through the other end of said die means.

2. A tool according to claim 1, characterized by a die element replaceably installed in said other end of said die means and having a bore therein defining with said mandrel an annular space variable by substitution of one die element for another.

3. A tool according to claim 2, characterized by a removable tip on said mandrel replaceable in lieu of or in conjunction with replacement of said die element.



4. A tool for reshaping tube ends, including an open ended housing, a closure for one end of said housing, a mandrel longitudinally disposed in said housing and having one end pivotally connected to said closure, the other end of said mandrel extending toward the other end of said housing, a die element replaceably installed in said other end of the housing and having a longitudinal bore therethrough, a coaxial replaceable tip on said mandrel extending into said bore and defining an annular space to receive a tube end, the outer end of said tip being tapered to enter the tube end, and means for adjusting said tip longitudinally of the die element.

5. A tool for reshaping tube ends, including a cylindrical die means closed at one end and open at the other end, a mandrel longitudinally disposed in said die means and having a base end connected to the closed end of said doe means for relative pivotal motion of said mandrel, said mandrel having a tip end extending toward the open end of said die means, and a die element installed in said open end of said die means and having a through bore receiving the tip end of said mandrel with freedom for relative lateral movement.

6. A tool according to claim 5, characterized in that the tip end of said mandrel comprises a replaceable tip element defining with said die element an annular space of a size variable by replacement of said tip.

7. A tool according to claim 5, characterized by means defining a cutting edge on said mandrel tip end for removal of burrs on the interior of the tube end.

8. A tool according to claim 5, characterized by complementary formations on said mandrel tip end and on said die element for providing the extremity of the tube end with a chamfered surface.

9. A tool according to claim 5, characterized by means defining a cutting edge on said mandrel and die element for removal of burrs on the interior and exterior of the tube end.

10. A tool for reshaping tube ends, including an outer held part having a hollow interior, a cylindrical die element on said part providing an opening to the interior of said part, a mandrel longitudinally disposed in said opening in said die element to define with said element an annular space for the entrance of a tube end, one end of said mandrel entering the tube end and the other end being received within the interior of said part, and means connecting the said other end of said mandrel to said part to absorb axial thrust on said mandrel and for relative pivotal motion of the mandrel so that said mandrel may adjust itself for the most facile entry of the said one end thereof into the tube.

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