Nov. 25, 1958 G. E. FRANCK 2,861,623

TUBE FLARING TOOL WITH FRUSTO CONICAL ROLLER BEARING GROOVE

Filed Oct. 29, 1957

Fig. 1.

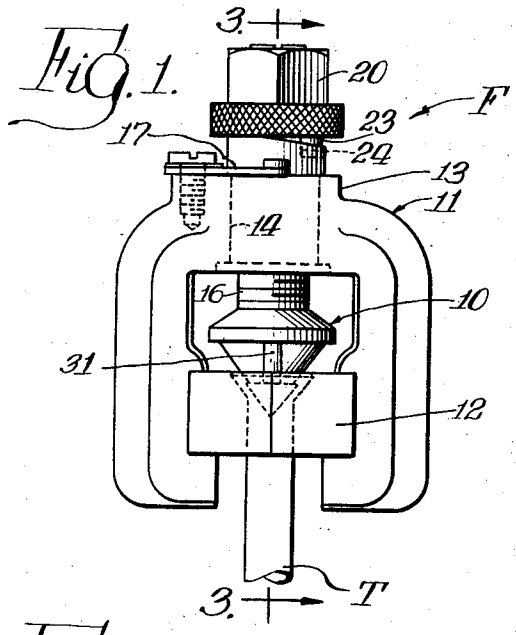


Fig. 2.

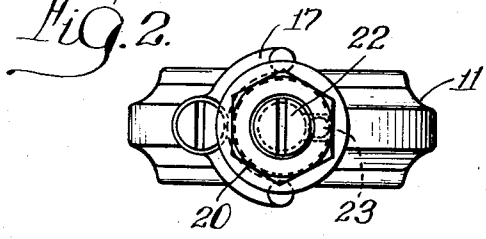


Fig. 4.

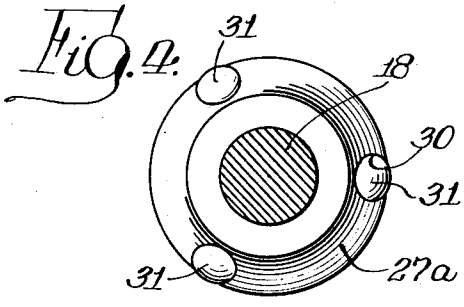


Fig. 5.

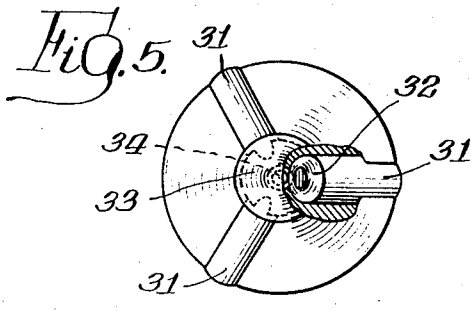
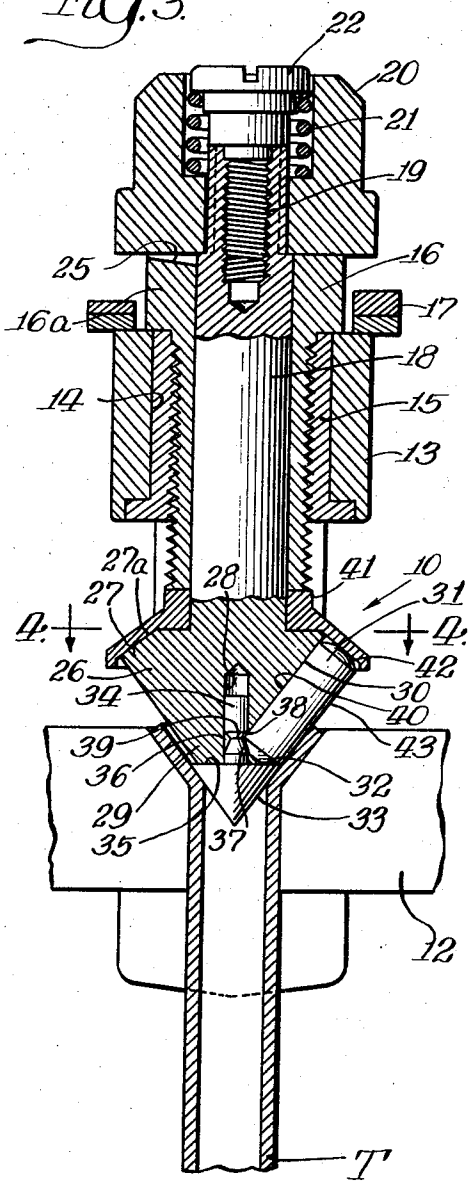


Fig. 3.



INVENTOR.

George E. Franck,

BY Schroeder, Huffman, Brady & Hagman, Attys.

United States Patent Office 2,861,623 Patented Nov. 25, 1958

2,861,623

TUBE FLARING TOOL WITH FRUSTO CONICAL ROLLER BEARING GROOVE

George E. Franck, Riverside, Ill., assignor to The Imperial Brass Manufacturing Company, a corporation of Illinois

Application October 29, 1957, Serial No. 693,132

6 Claims. (Cl. 153—81)

This invention relates to a tube flaring tool and in particular to a flaring cone for use therein.

Conventionally, in flaring the end of a tube a conical flaring cone is forcibly urged into the tube end. This forceful engagement of the cone surface with the inner surface of the tube wall often results in tearing or splitting of the tube due to the frictional forces developed between the cone surface and the tube wall. To remedy this, flaring cone constructions have been developed utilizing rollers for the tube engaging means.

The principal object of this invention is to provide a flaring cone construction having new and improved roller means.

Another object is to provide a novel flaring cone construction having a spreader cone and a plurality of rollers, for engaging alternatively or conjointly the inner wall surface of a tube during a flaring operation.

A further object is to provide such a flaring cone construction having a conical spreader rotatably mounted on the support means carrying the rollers, and associated with the rollers in a new and improved manner to effect retention thereof on the support means.

Still another object of the invention is to provide such a flaring cone construction wherein the spreader is provided with an upstanding pin having an annular groove arranged to engage the end of each roller for retaining the pin on the support.

Yet another object is to provide such a flaring cone construction having novel cap means for retaining the rollers against longitudinal movement away from the spreader.

Other features and advantages of this invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

Figure 1 is an elevational view of a tube flaring tool having a flaring cone construction embodying the invention, the tool being shown as arranged upon completion of a flaring operation on a tube;

Figure 2 is a top plan view thereof;

Figure 3 is an enlarged, longitudinal diametric section thereof taken approximately along the lines 3—3 of Figure 1;

Figure 4 is a transverse section thereof taken approximately along the line 4—4 of Figure 3, the roller retaining cap being omitted, and

Figure 5 is an end view of the flaring cone construction with a portion thereof broken away.

In the exemplary embodiment of the invention as disclosed in the drawings, a flaring cone construction embodying the invention, generally designated **10** is shown to be mounted in a flaring tool F of more or less conventional construction. Thus, flaring tool F comprises a yoke generally designated **11** arranged to carry removably a suitable clamp means **12** for holding the tube T to be flared. A bridge portion **13** of the yoke is provided with a bore **14** axially aligned with clamp **12**. An internally threaded bushing **15**, which may be exteriorly knurled, is

fixed in the bore to carry, for longitudinal movement therethrough, an exteriorly threaded sleeve **16**. The advance of sleeve **16** through bore **14** is limited by abutment of an enlarged outer end **16***a* thereof with bridge portion **13**. However, a spacer gage **17** is movably mounted on yoke **11** and is associated with sleeve **16** to limit further, when desired, the advance of the sleeve, whereby the cone **10** may be used to gage the positioning of the tube T in the clamp block to effect a proper flare.

In the illustrated embodiment, a stem **18** is integrally associated with cone construction **10** and extends rotatably through sleeve **16**. The outer end **19** of stem **18** is squared to receive in rotatably fixed, longitudinally movable association a knurled and squared knob **20**. The knob is urged to a longitudinal inner position by means of a spring **21** and a retaining screw **22**. Depending from knob **20** is a pin **23** which is urged by spring **21** into a recess **24** in the outer end of sleeve **16**. Thus, when pin **23** is in recess **24**, rotation of knob **20** effects rotation of stem **18** and cone **10** thereon and concurrently effects a longitudinal movement thereof by threadedly moving sleeve **16** through bushing **15**. When it is desired to effect rotation of cone **10** without concurrent longitudinal movement thereof, knob **20** is moved longitudinally outwardly against the action of spring **21** so as to withdraw pin **23** from recess **24**. A beveled surface **25** is provided on the outer end of sleeve **16** to permit **23** to slide thereon for approximately one complete revolution of knob **20** until the pin is repositioned over recess **24**, whereupon spring **21** may effect reinsertion of the pin into the recess thereby automatically limiting the burnishing action to one revolution. However, if additional burnishing is desired knob **20** is merely retained outwardly and one or more additional revolutions of the knob **20**, to effect the desired amount of burnishing, may be similarly effected.

Flaring cone construction **10** comprises a generally frusto-conical support **26**. Stem **18** extends axially from an enlarged end **27** of the support and a cylindrical bore **28** extends axially inwardly through the small end **29** thereof. A plurality of uniformly spaced cylindrical recesses **30** are provided in the support, each recess extending parallel to the generatrix of the frusto-conical exterior of the support and opening radially outwardly therethrough. Each recess is greater than 180 and less than 360 degrees in transverse cross-section and extends longitudinally completely through the support to open through the opposite ends thereof.

A roller **31** is rotatably mounted in each of recesses **30**. The diameter of roller **31** is preferably comparable to the diameter of recesses **30** so that an accurate fit is had therebetween. The outer end **32** of roller **31** is frusto-conical and extends slightly into the cylindrical axial recess **28**. The taper angle of frusto-conical end **32** is preferably the complement of the angle of recess **30** (and correspondingly roller **31**) relative to the longitudinal axis of support **26**. Thus, the lowermost line segment of end **32**, as seen in Fig. 3, is substantially perpendicular to the longitudinal axis of the support.

A conical spreader **33** is rotatably mounted on support **26**, to extend axially from the small end **29** thereof, by means of a pin **34** freely received within recess **28** of the support. Spreader **33** forms a conical tip of the frusto-conical support and its taper angle is made comparable to the taper angle of the support (and correspondingly to the angle made by the axis of the rollers **31** to the longitudinal axis of the support). The base **35** of cone **33** is defined by a radial surface from which pin **34** upstands. As discussed above, the lowermost line segment of roller end **32** extends perpendicularly, or radially, relative to the axis of the spreader and, result-

ingly, roller end 32 has movable line contact with base surface 35.

An improved, simplified means is provided for locking the spreader 33 and roller 31 rotatively in support 26. This means comprises an annular groove 36 defined by a first frusto-conical surface 37 abutting the frusto-conical end 32 of each roller, and a second frusto-conical surface 38 extending from a juncture 39 with the first frusto-conical surface 37 and abutting the cylindrical, or sidewall, surface 40 of each roller 31. Thus, rollers 31 are prevented from moving toward the axis of support 26 by their abutment with first frusto-conical surface 37; and as the rollers cannot swing laterally in grooves 30, spreader 33 is retained against movement away from support 26 by the abutment of surface 38 with the roller surfaces 40.

To retain the rollers 31 against longitudinal movement outwardly from recesses 30, an annular cap 41 is secured on stem 18 and extends over the longitudinally outer ends of the recesses. The upper surface 27*a* of the support 26 through which recesses 30 longitudinally open is made frusto-conical and perpendicular to the axes of recesses 30. Thus, the retaining action of cap 41 is directed longitudinally of each roller. To minimize resistance to free rotation of the rollers 31, the outer ends 42 of the rollers may be rounded so as to have only an axial point contact with cap 41.

As best seen in Fig. 3, the diameter of radial base 35 of spreader 33 is slightly larger than the diameter of the small end 29 of support 26 against which base 35 abuts. Rollers 31 extend outwardly from semi-cylindrical recesses 30 a distance exactly equal to this increment and, thus, the radially outermost portion 43 of each roller is rectilinearly aligned with the conical outer surface of spreader 33. Thus, a continuous tube-engaging structure is provided extending from the tip of spreader 33 outwardly to the outer end 42 of each roller.

When flaring cone 10 is employed to flare a tube end having an internal diameter less than the diameter of spreader base 35, the spreader is forced axially into the end of the tube T by the rotative advancement of stem 18 effected by rotation of knob 20 driving sleeve 16 through bushing 15. However, as spreader 33 is free to rotate on support 26 as a result of the rotatable mounting of pin 34 in bore 28, spreader 33 is forced longitudinally into the tube end without concurrent rotation, thereby effectively eliminating any tendency to tear the tube end during the flaring operation. Where the diameter of the tube is sufficiently small so that the flared end thereof does not extend out to rollers 31, the flaring effected by spreader 33 is smooth and regular and no burnishing action ordinarily is required. Thus, upon completion of the flaring operation, cone 10 is withdrawn by reverse rotation of knob 20, allowing the flared tube to be removed in a conventional manner.

Where the diameter of the tube T is sufficiently large so that all or part of the flaring thereof is effected by rollers 31, the slight unevenness of the flare as effected by the rollers may be removed by a burnishing operation. Thus, when cone 10 has been fully inserted into the tube end by advancing rotation of knob 20, the knob may be urged longitudinally outwardly against spring 21 to remove pin 23 from recess 24. The knob is then rotated while pin 23 slides over surfaces 25. This rotates stem 18 and cone 10 thereon without rotating sleeve 16, and thus, cone 10 is rotated without longitudinal movement thereof. If the diameter of tube T is such that a portion of the flared end is in contact with spreader 33, the spreader may remain rotatably fixed, but rollers 31 are moved over the inner surface of the flare portion with which they are associated to burnish that portion. During the flaring operation rollers 31, being free to rotate in recesses 30, have a rolling engagement with the inner surface of tube T thereby effectively eliminating tearing of the tube end as it is flared.

Where the internal diameter of tube T is greater than the diameter of base 35 of spreader 33, the entire flare is produced by rollers 31 and the entire flare is burnished as described above. Thus, cone 10 provides a smooth, non-tearing flaring of a tube end over a wide range of tube diameters including extremely small diameters. This improved functioning is obtained with a cone construction of improved simple and economical construction.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A flaring cone construction for use in a tube flaring tool, comprising: a generally frusto-conical support having a plurality of uniformly spaced cylindrical recesses each parallel to the generatrix of the support and opening laterally through the frusto-conical surface of the support and longitudinally through the small end of the support, said recesses being greater than 180° in transverse cross-section, said support further having an axial bore opening longitudinally through the small end thereof; a plurality of cylindrical rollers each rotatably mounted in a recess to project radially outwardly therefrom, each roller being provided with a frusto-conical end at the small end of the support; and a conical spreader having a radial base surface and a generally cylindrical pin upstanding axially therefrom rotatably received in said support bore, said pin having an annular groove defined by a first frusto-conical surface abutting the frusto-conical end of each roller and a second frusto-conical surface extending from a juncture with said first frusto-conical surface and abutting the cylindrical surface of each roller to retain said rollers and spreader against movement in the direction of narrowing of the support.

2. The flaring cone construction of claim 1 wherein the taper angle of the frusto-conical end of each roller is the complement of the taper angle of the frusto-conical support whereby said frusto-conical ends may each have line contact with the spreader base surface.

3. The flaring cone of claim 2 wherein the spreader taper angle is equal to the support taper angle and the radius of the spreader base surface is equal to the distance between the axis of the support and the radially outer portion of the cylindrical surface of the rollers adjacent the frusto-conical ends of each, whereby each roller defines with the spreader an outer, continuous, rectilinear line.

4. A flaring cone construction for use in a tube flaring tool, comprising: a generally frusto-conical support having a plurality of spaced cylindrical recesses each parallel to the generatrix of the support and opening laterally through the frusto-conical surface of the support and longitudinally through the small end of the support, said recesses being greater than 180° in transverse cross-section, said support further having an axial bore opening longitudinally through said small end of the support; a cylindrical roller complementary to and rotatably mounted in each recess, each roller being provided with a beveled end extending into said bore at the small end of the support; a cap across the large end of the support and extending over the ends of the cylindrical recesses to retain the rollers in said recesses against movement outwardly through said ends thereof; and a conical spreader having a radial base and a generally cylindrical pin upstanding axially therefrom rotatably received in said bore, said pin having an annular groove defined by a first surface abutting the beveled end of each roller and a second beveled surface extending from a juncture with said first beveled surface and abutting the cylindrical surface of each roller.

5. A flaring cone construction for use in a tube flaring tool, comprising: a generally frusto-conical support hav-

ing a plurality of spaced cylindrical recesses each parallel to the generatrix of the support and opening laterally through the frusto-conical surface of the support and longitudinally through the small end of the support, said recesses being greater than 180° in transverse cross-section, said support further having an axial bore opening longitudinally through the small end thereof and communicating with said recesses; a cylindrical roller complementary to and rotatably mounted in each recess for engaging and flaring the ends of large diameter tubes, each roller being provided with an end extending into said bore; and a conical spreader having a radial base, the diameter of the base being substantial whereby said spreader may be employed to flare tubes having diameters less than said base diameter, and a generally cylindrical pin upstanding axially therefrom rotatably received in said bore, said pin having an annular groove defining an abutment for said end of each roller and the adjacent cylindrical surface of each roller.

6. A flaring cone construction for use in a tube flaring

tool, comprising: a generally, frusto-conical support having a plurality of spaced cylindrical recesses each parallel to the generatrix of the support and opening laterally through the frusto-conical surface of the support and longitudinally through the small end of the support, said recesses being greater than 180° in transverse cross-section, said support further having an axial bore opening longitudinally through the small end thereof, and a stem extending from the large end of the support; a cylindrical roller complementary to and rotatably mounted in each recess, each roller being provided with a frusto-conical end at the small end of the support; a cap secured to the stem to extend over the recesses at the large end of the support to retain the rollers therein; and a conical spreader having a radial base surface and a pin upstanding axially therefrom rotatably received in said bore, said pin having an annular groove abutting the frusto-conical end and the adjacent cylindrical surface of each roller.

No references cited.