April 18, 1961 G. E. FRANCK 2,979,976

PLIER-TYPE TUBE BENDING TOOL

Filed April 6, 1959

Fig. 1.

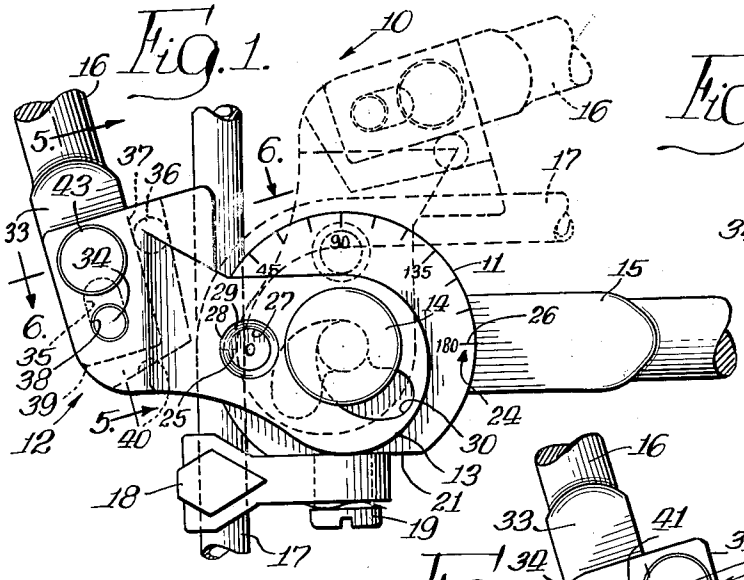


Fig. 3.

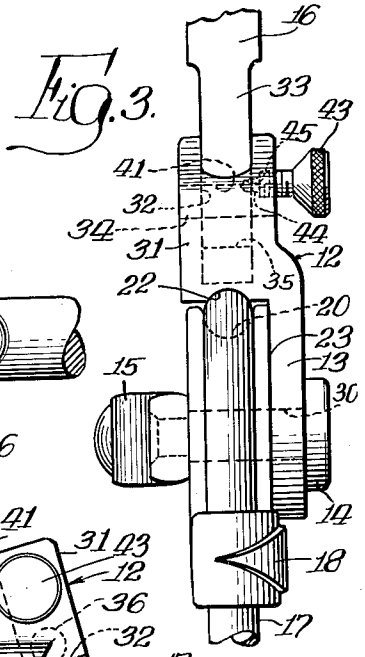


Fig. 2.

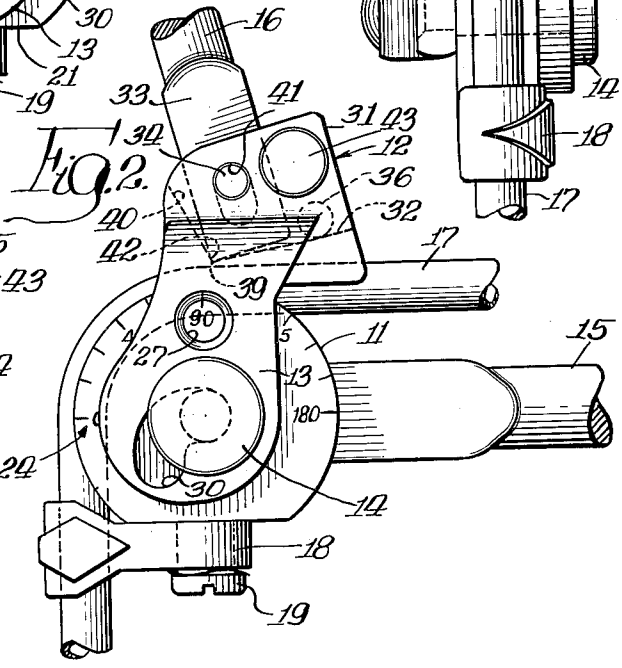


Fig. 5.

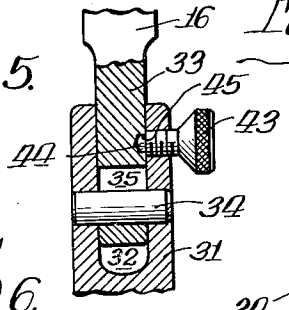


Fig. 6.

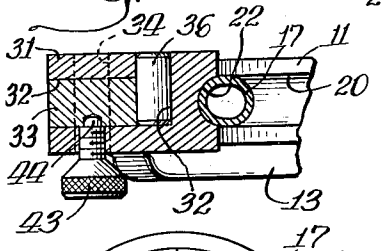
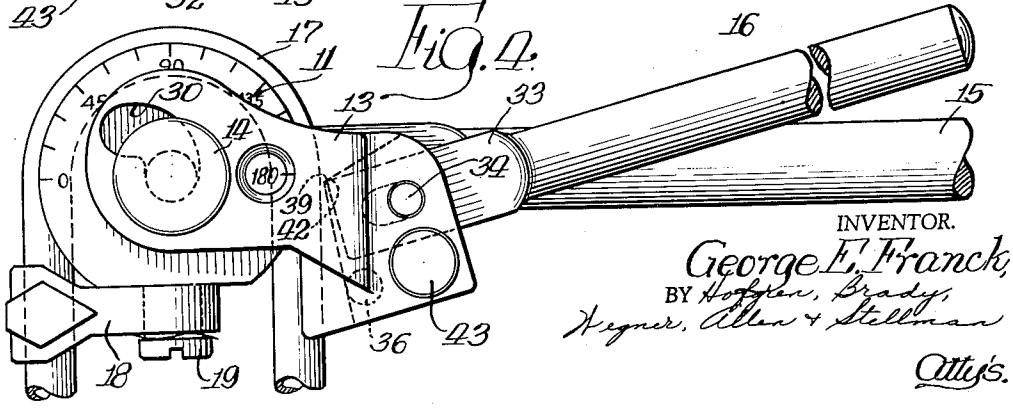


Fig. 4.



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PLIER-TYPE TUBE BENDING TOOL

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12 Claims. (Cl. 81—15)

This invention relates to tube bending tools and in particular to manually operable tube bending tools adapted to provide a bend of greater than 90° in a tube.

In manually operable tube bending tools of known construction, a pair of handles is associated one each respectively with the two relatively movable tube bending members, i.e., the mandrel and bending shoe. In such tube bending tools, where it is desired to provide for a tube bend of greater than 90° and up to 180°, the tool is arranged so that the handles are in generally aligned end-to-end relationship in the bend-start position and are pivotable to a generally side-by-side relationship in a 180° bend-completed position. This arrangement is used so that the handles do not have to cross each other in making such a 180° bend.

While such an arrangement has been relatively satisfactory where relatively soft tubing is bent in the tool, it has a serious disadvantage where more rigid tubing, such as stainless steel tubing, is to be bent. In starting the bend with such a tool, it has been found necessary for the operator to brace the mandrel of the tool, as with his knee, to permit the relative pivoting of the handles until they reach a substantial angular relationship of upwards to 90°. The final 90° of bending may be relatively readily effected, as during this portion of the bending operation the operator merely brings the two handles together with an ordinary scissors action, no unbalanced lateral force component existing at this time requiring additional support of the mandrel.

The instant invention comprehends a new and improved tube bending tool arranged to limit the maximum angle between the handles to substantially 90° while permitting tube bends therein of up to 180°.

The principal object of this invention, therefore, is to provide a new and improved tube bending tool for bending tubing over 90°.

Another object of the invention is to provide such a tube bending tool having new and improved means causing successive relative pivotal movements of the handles through a single 90° sector to effect cumulative corresponding movement of a tube bending shoe of up to 180° relative to the tube bending mandrel of the tool.

A further object is to provide such a tube bending tool wherein at least one of the handles is connected to its associated tube bending member by means of a pivot shaft on that member extending through a hole in the handle having an elongated cross section and a pair of stop means on that member to retain the handle relative to that member in two different 90° related positions depending on the disposition of the shaft in either of two spaced portions of the hole.

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

Fig. 1 is a fragmentary side view of a tube bending tool embodying the invention, the full line showing thereof illustrating the arrangement of the tool in a bend-start position and the dotted line showing thereof illustrating the arrangement of the tool upon the completion of a 90° bend;

Fig. 2 is a side view similar to that of Fig. 1 but with the tool as arranged upon completion of a 90° bend and with the handle connected to the shoe member reconnected thereto to extend generally perpendicular to the other handle;

Fig. 3 is an end view of the tube bending tool looking from the left as seen in Fig. 2;

Fig. 4 is a side view thereof similar to that of Fig. 2 but with the tool arranged as at the completion of a 180° bend;

Fig. 5 is a longitudinal section taken substantially along the line 5—5 of Fig. 1; and

Fig. 6 is a transverse section taken approximately along the line 6—6 of Fig. 1.

In the exemplary embodiment of the invention as disclosed in the drawing, a manually operable tube bending tool generally designated **10** comprises a mandrel member **11** and a shoe member **12** including a connecting portion **13** pivotally mounted on a post **14** coaxially associated with mandrel member **11**. A first handle **15** is fixed at one end to mandrel member **11** and a second handle **16** is secured at one end to shoe member **12** for manually effecting tube bending movement of the shoe member **12** relative to the mandrel member **11**. To retain the tube **17** against undesirable movement as it is being bent in tube bending tool **10**, a hook **18** is secured to mandrel member **11** by a stud **19** to have pivotal movement about an axis perpendicular to the axis of post **14**.

The bending of tube **17** is effected in tool **10** by the pressing of the tube by shoe member **12** into a peripheral groove **20** of mandrel member **11** extending concentrically of the axis of post **14**, which groove terminates at its opposite ends in a chordal surface **21** against which hook **18** is slidably retained. As best seen in Fig. 3, shoe member **12** is provided with a complementary groove **22**. Shoe groove **22** is preferably shallow and mandrel groove **20** is preferably deep to provide improved bending of tube **17**, as disclosed in Philippe Patent Re. 24,449. Side surface **23** of mandrel member **11** is provided with a scale **24** indicating the tube bend angle from a starting point **25** marked "0" to a maximum bend point **26** marked "180." Connecting portion **13** of shoe member **12** is provided with a hole **27** through which the markings of scale **24** may be viewed. A reference line **28** provided on a bevelled outer surface **29** of hole **27** permits accurate registration of the shoe member with the selected markings of scale **24**. To permit shoe member **12** to be spaced outwardly from mandrel member **11**, such as to permit insertion and release of tube **17** therebetween, connecting portion **13** of the shoe member is provided with a kidney-shaped opening through which post **14** extends.

The instant invention comprehends a new and improved means for effecting tube bending movement of shoe member **12** about the perpihery of mandrel member **11**, to provide tube bends of up to 180° by successive pivotal movements of handle **16** within the 90° range of movement thereof between the full line position of Fig. 1 and the position of Fig. 4. More specifically, shoe member **12** includes a block portion **31** provided with the inwardly opening bending groove **22** and an opposite, outwardly opening recess **32** in which a flattened end portion **33** of handle **16** is movably received. A shaft **34** is fixed in block **31** to pass through an elongated hole **35** in handle portion **33**. The width of hole **35**, transversely to handle portion **33**, is comparable to the diameter of shaft **34**, and the length of hole **35**, longitudinally of handle portion **33**, is approximately twice the diameter of shaft **34**.

Two stops are provided in block portion 31 for co-operation with handle portion 33 to retain the handle selectively in either of two 90° related positions relative to the shoe member. More specifically, a first stop 36 comprises a pin fixed in block portion 31 to extend across recess 32 parallel to shaft 34. Pin 36 is positioned relative to shaft 34 so as to be engaged by side surface 37 of handle portion 33 when the handle is pivoted to an extreme clockwise position relative to the shoe member, as seen in Fig. 1. In this position, handle 16 extends at an angle of only slightly over 90° relative to handle 15 when shoe member 12 is disposed at the starting point 28 of the mandrel groove. From this position, handle 16 may be readily urged in a clockwise direction, as seen in Fig. 1, approximately 90° to the dotted position, resulting in a 90° bend in tube 17.

To extend the bend beyond 90° and up to 180°, handle 16 is repositioned relative to shoe member 12 so as to extend again at an angle of slightly over 90° relative to handle 15 while shoe member 12 remains at the 90° position, as seen in Fig. 2. To effect this repositioning of handle 16, the handle is pivoted about shaft 34 while maintaining the shaft within inner portion 38 of hole 35 whereby a rounded trailing corner 39 of handle portion 33 moves inwardly through recess 32 while having clearance with an end surface 40 of recess 32. When handle 16 has been pivoted approximately 90° in a counterclockwise direction from the position of Fig. 1 to the position of Fig. 2, the handle is moved longitudinally inwardly through recess 32 until shaft 34 is disposed in outer portion 41 of hole 35 and corner 39 engages inner end 42 of recess surface 40, surface end 42 thereby comprising the second stop means of shoe member 12. Thus, stop means 42 prevents pivotal movement of handle 16 in a clockwise direction relative to shoe member 12 beyond the position shown in Fig. 2, whereby urging of handle 16 in a clockwise direction causes shoe member 12 to move farther along the peripheral groove 20 of mandrel member 11 and continue the bend of tube 17 beyond the 90° bend previously effected. This clockwise pivotal movement of handle 16 may be continued until shoe member 12 reaches the position of Fig. 4 wherein a full 180° bend in tube 17 is effected. It should be noted that, in the 180° position, handle 16 has substantially the same relationship to handle 15 as it had upon the completion of the first 90° bend as shown in dotted lines in Fig. 1. Thus, two cumulative 90° bends resulting in an over-all 180° bend in tube 17 may be effected in tube bending tool 10 by successive movements of handle 16 through the 90° sector defined by the two extreme positions of Figs. 1 and 4.

Experience indicates that a majority of the tube bends made with such bending tools are 90° or less. Thus, in the instant tool, a thumbscrew 43 is threaded through block portion 31 of the shoe member to dispose an inner end projection 44 of the thumbscrew removably in a corresponding recess 45 in handle portion 33 to retain the handle in the position wherein surface 37 thereof abuts stop pin 36. When it is desired to reposition the handle in the 90° counterclockwise related position, thumbscrew 43 is merely unthreaded to withdraw end projection 44 from recess 45.

While I have shown and described one embodiment 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. In a tube bender having a mandrel with a peripheral bending groove concentric of an axis, and a first handle fixed to the mandrel, bending shoe means comprising a block having a groove complementary to and confronting the bending groove of the mandrel, a shaft on the block extending axially parallel to said mandrel axis, a second handle having one end provided with a hole having an elongated cross section and receiving said shaft for pivotal movement and limited longitudinal displacement of the handle relative to the shaft, a first stop on the block limiting pivotal movement of said second handle relative to the shaft to a first position when said second handle is pivoted in one direction and the shaft is disposed at one end of the hole, a second stop on the block limiting pivotal movement of said second handle relative to the shaft to a second position 90° behind the first position when said second handle is pivoted in said one direction and the shaft is disposed at the other end of the hole, and means connecting the block to the mandrel to dispose said second handle substantially perpendicular to the first handle when said second handle is in said first position and the shoe is at a bend starting point of the mandrel groove.

2. In a tube bender having a mandrel with a peripheral bending groove concentric of an axis, bending shoe means comprising a block having a groove complementary to and confronting the bending groove of the mandrel, a shaft on the block extending axially parallel to said mandrel axis, a handle having one end provided with a hole having an elongated cross section and receiving said shaft for pivotal movement and limited longitudinal displacement of the handle relative to the shaft, a first stop on the block limiting pivotal movement of the handle relative to the shaft to a first position when the handle is pivoted in one direction and the shaft is disposed at one end of the hole, a second stop on the block limiting pivotal movement of the handle relative to the shaft to a second position 90° behind the first position when the handle is pivoted in said one direction and the shaft is disposed at the other end of the hole, and means connecting the block to the mandrel selectively for pivotal movement about the mandrel axis with the block groove in tube bending association with the mandrel groove and in tube released spaced relationship with the mandrel groove.

3. The bending shoe means of claim 2 including means on the block for releasably retaining said handle in said first position.

4. In a tube bender having a mandrel with a peripheral bending groove concentric of an axis, bending shoe means comprising a block having a groove complementary to and confronting the bending groove of the mandrel, a shaft on the block extending axially parallel to said mandrel axis, a handle having one end provided with a hole having an elongated cross section and receiving said shaft for pivotal movement and limited longitudinal displacement of the handle relative to the shaft, a first stop on the block engaging one side of the handle to limit pivotal movement thereof relative to the shaft to a first position when the handle is pivoted in one direction and the shaft is disposed at one end of the hole, a second stop on the block engaging the opposite side of the handle to limit pivotal movement thereof relative to the shaft to a second position 90° behind the first position when the handle is pivoted in said one direction and the shaft is disposed at the other end of the hole, and means connecting the block to the mandrel selectively for pivotal movement about the mandrel axis with the block groove in tube bending association with the mandrel groove and in tube released spaced relationship with the mandrel groove.

5. In a tube bender, bending shoe means comprising a block having a bending groove, a shaft on the block extending perpendicularly to the plane defined by the axis and root of the bending groove, a handle having one end provided with a hole having an elongated cross section and receiving said shaft for pivotal movement and limited longitudinal displacement of the handle relative to the shaft, a first stop on the block limiting pivotal movement of the handle relative to the shaft to a first position when the handle is pivoted in one direction and

the shaft is disposed at one end of the hole, and a second stop on the block limiting pivotal movement of the handle relative to the shaft to a second position 90° behind the first position when the handle is pivoted in said one direction and the shaft is disposed at the other end of the hole.

6. The bending shoe means of claim 5 wherein the block is provided with a recess and said stops extend across the recess.

7. The bending means of claim 6 wherein at least one of said stops comprises a pin secured to the block to extend across the recess.

8. The bending shoe means of claim 5 wherein the block is provided with a recess and at least one of said stops comprises a surface of the recess extending generally parallel to the axis of the shaft and inclined slightly to the axis of the handle when the handle is in said second position.

9. In a tube bender, bending shoe means comprising a block having a bending groove, a shaft on the block extending perpendicularly to the central plane of the axis of the bending groove, a handle having one end provided with a hole having an elongated cross section and receiving said shaft for pivotal movement and limited longitudinal displacement of the handle relative to the shaft, a first stop on the block limiting pivotal movement of the handle relative to the shaft to a first position when the handle is pivoted in one direction and the shaft is disposed at one end of the hole, a second stop on the block limiting pivotal movement of the handle relative to the shaft to a second position 90° behind the first position when the handle is pivoted in said one direction and the shaft is disposed at the other end of the hole, and means releasably retaining said handle in said first position.

10. The bending shoe means of claim 9 wherein said

means releasably retaining the handle comprises a screw threaded on said block for releasable engagement with a complementary portion of the handle when the handle is in said first position.

11. In a tube bender having a mandrel with a peripheral bending groove concentric of an axis, bending shoe means comprising a block movable about said axis and having a groove complementary to and confronting the bending groove of the mandrel, an elongated handle, and means movably connecting the handle to the block including stop means positioning the handle in either of two perpendicularly related positions in a plane perpendicular to said axis.

12. In a tube bender having a mandrel with a peripheral bending groove concentric of an axis, bending means comprising a block movable about said axis and confronting the bending groove of the mandrel to press a tube into said bending groove, an elongated handle, and means movably connecting the handle to the block including means positioning the handle in either of two preselected angularly related positions relative to said block.

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