June 25, 1957 L. J. KOWAL ET AL 2,796,784

TUBE BENDER

Filed Oct. 18, 1954

Fig. 1.

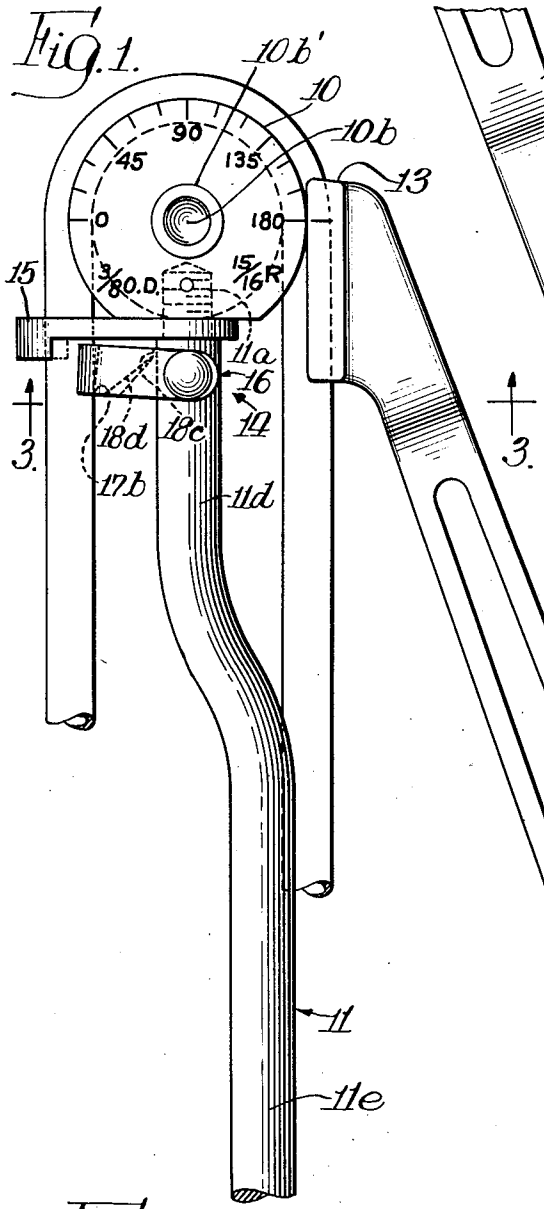


Fig. 2.

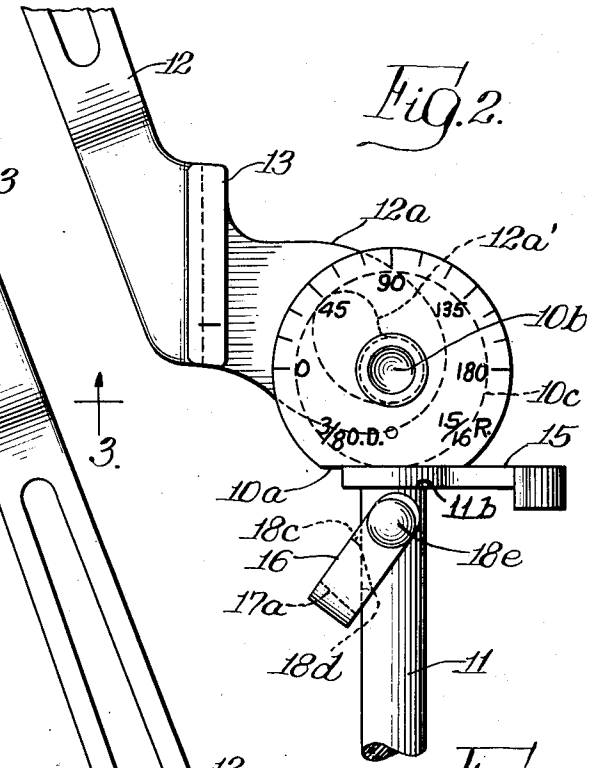


Fig. 4.

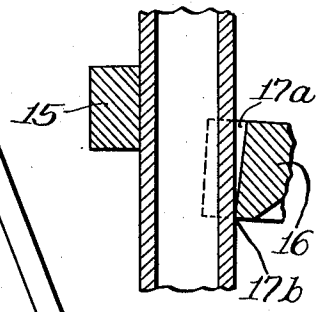
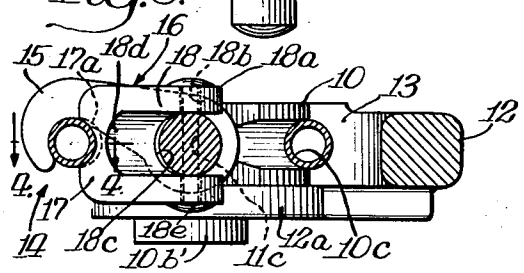


Fig. 3.



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TUBE BENDER

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5 Claims. (Cl. 81—15)

This invention relates to a tube-bending tool and in particular, to an improved means for holding the tubing during the bending operation.

In hand tube-bending tools, it is the general practice to provide means for holding one end of the tube to prevent lateral movement so that the bend may be made transversely to the longitudinal axis of the tube and to prevent any longitudinal movement due to the frictional forces developed during the bending operation. This means usually takes the form of a hook engaging a portion of the tubing on the side opposite that of the direction of the bend. Several serious disadvantages are inherent in such a device.

It is desirable to hold the tubing effectively and without deformation or gouging of the tubing surface. While a rounded-edged hook has been found satisfactory to hold tubing formed of the softer metals such as copper and aluminum without unduly digging in or defacing the tubing surface, a hook will not satisfactorily hold tubing formed of harder material such stainless steel. To hold such harder material tubes effectively, it was found necessary to provide a sharp-edged hook which would tend to dig into the surface of the tubing to a greater extent, however, when such a sharp-edged hook is used with softer metal tubing, considerable undesirable gouging and defacing of the tubing surface occurs.

The principal object of our invention is to provide a new and improved tube-bending tool having tube-holding means which will effectively hold the tubing during a bending operation without undesirable gouging and deformation of the surface.

Another object of the invention is to provide a tube-bending tool with tube-holding means adapted for effectively holding tubes having different hardness characteristics without undesirable gouging or deformation of the surface.

Still another object of the invention is to provide a tube-bending tool having tube-holding means which will react to the forces developed during a bending operation, tending to move the tube longitudinally, to exert the proper holding pressure on the tube.

Yet another object of the invention is to provide a tube-bending tool having tube-holding means pivotally attached thereto so that unneeded members can be placed in an inoperative position.

A further object of the invention is to provide a tube-holding clamping means which can be readily added to the existing tube-bending tools having hook-retaining means.

A still further object of the invention is to provide a hand tube-bending tool having an improved offset handle allowing for greater ease of operation.

Various other objects and advantages of the invention will hereinafter become more fully apparent from the following description taken in connection with the accompanying drawings wherein:

Fig. 1 is a side view of a tube-bending tool embodying our invention;

Fig. 2 is a partial side view showing the tube-holding device, hook and bending arm in the tube insertion position;

Fig. 3 is a sectional view taken approximately along the line 3—3 of Fig. 1;

Fig. 4 is a sectional and enlarged view taken approximately along the line 4—4 of Fig. 3.

As shown in the drawings for purposes of disclosure, the tube-bending tool comprises generally a disk-like die member **10** mounted on one end of an arm or handle **11** extending generally radially of the bending die member. Pivotally attached to the bending die member for swinging thereabout substantially in the plane thereof is a bending arm **12** having a shoe **13** for engaging the tube to be bent. Pivotally mounted on the handle **11** is a means generally designated **14** for retaining the tubing to be bent against longitudinal as well as lateral movement during the bending operation. This means herein is composed of two parts, namely, a main part **15** which is always employed and functions to retain all types of tubing against lateral displacement during the bending operation, and an auxiliary part **16** which can be brought into operation to aid the main part in holding the tube against longitudinal displacement where, due to the character of the material composing the tubing, forces are set up tending to move the tube longitudinally which cannot be restrained by the main part alone. This auxiliary part functions to increase the holding action of the means as the tendency for the tube to move longitudinally increases.

The bending die member, as above stated, is disk-like with a circular periphery save at the chord **10***a* where it is provided with a flat surface. It is at this surface that the die member is attached to the handle **11**, the threaded end **11***a* of the handle lying on a radius perpendicular to the chord. The periphery of the die member has formed in it a generally semicircular groove **10***c* in which the tubing lies during the bending operation. The bending arm shoe **13** also has formed in its surface a semicircular groove. Projecting beyond the shoe at one side only of the bending arm is a coupling plate portion **12***a* having a kidney-shaped slot **12***a'* formed therein for the reception therein of a pin **10***b* located concentrically of said die member. Pin **10***b* is provided with heads **10***b'* to retain the plate portion **12***a* and the member **10** in rotatable assembly. The kidney-shaped slot permits the bending arm to be positioned relative to the bending die member either as shown in Fig. 2 wherein the shoe is spaced radially away from the bending die member to permit lateral insertion of a piece of tubing to be bent, or to be positioned close to the bending die member, as shown in Fig. 1 for applying the bending force to the tubing.

The tube retaining or holding means, as already stated, is pivotally mounted on the handle **11**. The main part is more or less conventional and comprises a hook pivotally mounted on the handle intermediate the surface **10***a* on the bending die member and an annular shoulder **11***b* formed on the handle **11**.

Referring now more particularly to Figs. 1 and 3, holding member **16** comprises a generally U-shaped bar having a base portion **17** provided with a tube-engaging notch **17***a*. The bottom edge **17***b* of the notch is best seen in Fig. 4 and forms a slightly acute angle with the bottom surface of the bar, to provide positive tube engagement.

Holding member **16** is further provided with a bifurcated portion **18** with legs **18***a* each having a hole **18***b*. At the base of the legs and therebetween, portion **18** is provided with semi-cylindrical surfaces **18***c* and **18***d* which are adapted to allow the holding member **16** to swing down and partially surround handle **11** when not in use, as can best be seen in Fig. 2. Pin **18***e* extends through

holes 18*b* of legs 18*a* and a hole 11*c* in handle 11 pivotally to secure the holding member to the handle.

Hole 11*c* is so positioned longitudinally on the handle as to allow the free end of the holding member to swing past a position normal to the axis of the tubing when positioned in the tool to be bent. The length of member 16 is such that this causes the edge 17*b* of groove 17*a* to press into the tubing where it is held between hook 15 and the holding member, as can be seen in Fig. 1. Any longitudinal motion of the tubing in the direction of operation of the bending arm 12 (clockwise in Fig. 1) causes holding member 16 to pivot further, up to the point where its top surface strikes the bottom surface of hook 15 which provides a definite stop against further movement. Thus, it can be seen that the frictional forces developed by the sliding of the forming element or shoe 13 against the surface of the tubing to press it into die member groove 10*c* to form the bend tend to move the tubing longitudinally and pivot the holding member 16 so that the greater the tendency to move the tubing, the greater will be the holding or clamp-force exerted.

Handle 11 is provided with a second portion 11*e* having its longitudinal axis disposed parallel to and spaced from the longitudinal axis of a first portion 11*d* which terminates in end 11*a*, such displacement being in a direction generally away from the portion of tubing held between the hook and holding member 16. The resultant space between portion 11*e* and the tubing gives clearance for the insertion of the operator's hand during the bending operation.

Holding means of the type described can be incorporated into bending tools during the manufacture or may be added to the existing tools having the hook member 15 simply by the drilling of hole 11*c* in the handle and the securing of the holding means 16 thereto by fastening pin 18*e*.

When the tool is used for bending tubing formed of hard materials such as stainless steel holding member 16 is pivotally rotated to the position shown in Fig. 1 thereby firmly securing the tubing between it and hook 15. Whenever the tool is used for bending tubing formed of softer material such as copper or aluminum holding member 16 is allowed to fall into the position shown in Fig. 2 so that the hook provides the sole retaining force of the tubing. Thus, tubing having different degrees of hardness may be bent with ease and with improved results as the tubing surface is not deformed to an unsatisfactory extent and motion of the tubing during the bending operation is positively prevented.

While we have shown and described one embodiment in our 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.

We claim:

1. In a tube-bending tool having a handle, tube-holding means comprising: a first holding member pivotally mounted on said handle and having a portion to engage one portion of the external surface of a tube to be bent; and a second holding member having an end attached to said handle to pivot about an axis in a plane normal to the longitudinal axis of the tube, and another end having a tube-engaging surface spaced from said axis a distance slightly greater than the distance between said axis and a portion of the external surface of such tube opposite to said one portion, to wedge against said tube opposite portion, said another end being further arranged to press into the opposite tube portion and retain the tube positively against longitudinal movement.

2. In a tube-bending tool, tube-holding means comprising: a handle; a first holding member secured to said handle and having a portion to engage one portion of the external surface of a tube to be bent; and a second holding member movably secured to said handle and having a first portion movable alternatively to be spaced from or to engage a portion of the external surface of such tube opposite to said one portion, said member portions when in engagement with said tube portions being so spaced a distance as to wedge the tube tightly therebetween, said second member further having a second portion to abut said first member and thereby limit the movement of said second member.

3. In a tube-bending tool, tube-holding means comprising: a handle extending parallel to a tube to be bent; a first holding member secured to said handle and having a grooved portion to engage one portion of the external surface of such tube to be bent; a second holding member having a grooved portion and pivotally secured to said handle about an axis in a plane normal to the longitudinal axis of the handle to dispose said second member portion at any one of a plurality of distances from said first member portion and engage a portion of the external surface of the tube opposite to said one portion, thereby to wedge the tube tightly between said members; and means for limiting the pivoting thereof to limit the wedging force developed between said members.

4. In a tube-bending tool, tube-holding means comprising: a handle; a first holding member secured to said handle and having a portion to engage one portion of the external surface of a tube to be bent; and a second holding member movably secured to said handle and having a first portion movable alternatively to be spaced from or to engage a portion of the external surface of the tube opposite to said one portion, said member portions when in engagement with said tube portions being so spaced a distance as to wedge the tube tightly therebetween, said first portion of the second member further having an acute-angled edge to press into said opposite tube surface, and another portion to abut said first member and thereby limit the movement of said second member whereby said edge is positionally fixed and positively retains said tube against longitudinal movement.

5. In a tube-bending tool, a die member having a peripheral, semi-circular, tube-receiving groove; a handle secured to the die member to extend in the plane of the root of said groove oppositely therefrom; a tube-engaging hook pivotally secured to the handle about an axis in said plane, and a wedging member pivotaly secured to the handle about an axis normal to said plane and on a portion of said handle on the side of the hook away from the die member to move in a path aligned with said plane, said hook member cooperating with said wedging member to form a clamp means with an increasing clamping effect as said member is drawn toward said hook.

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