Jan. 31, 1967 P. E. DAVIS, JR 3,301,036

SMALL DIAMETER TUBE BENDER

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Fig. 1

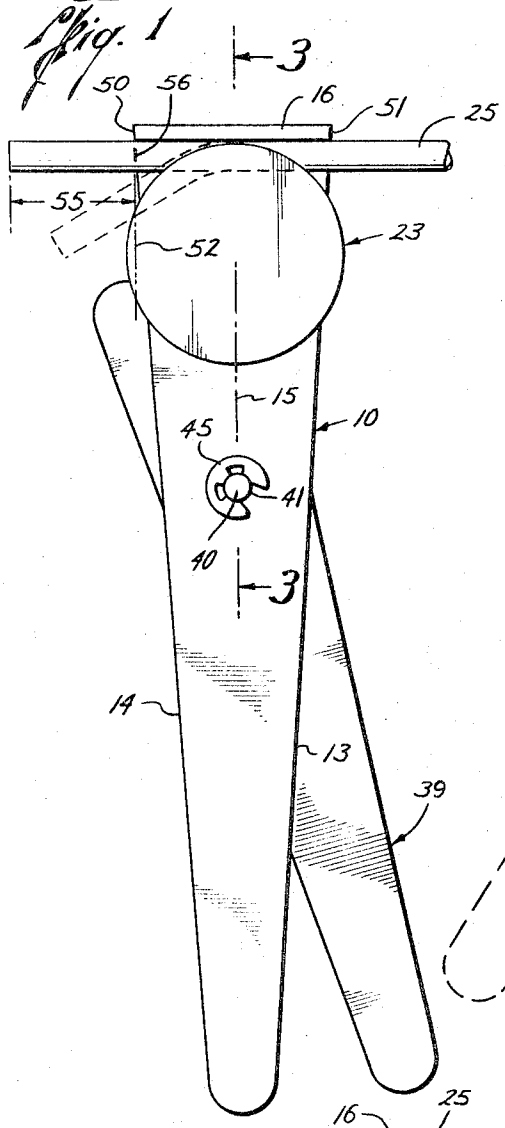


Fig. 2

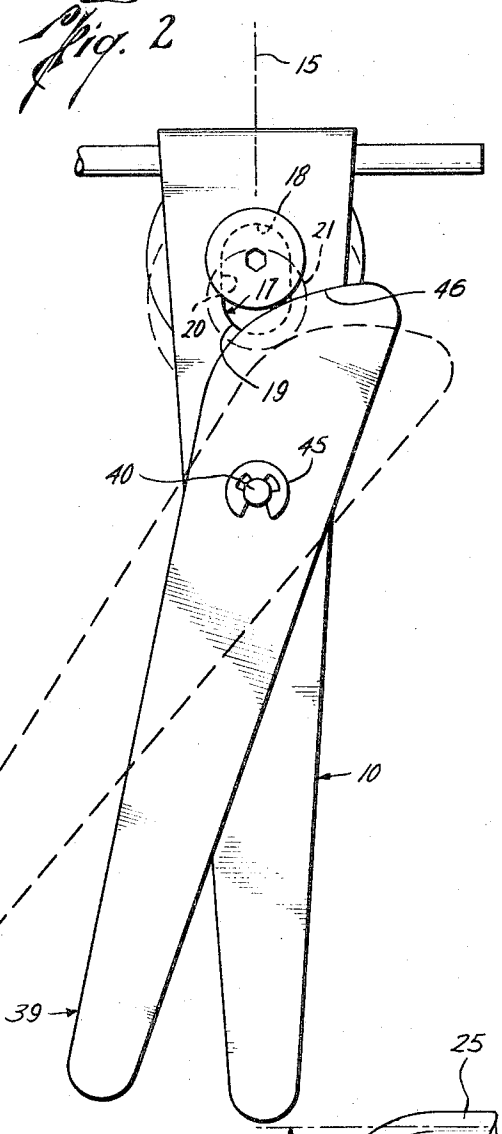


Fig. 3

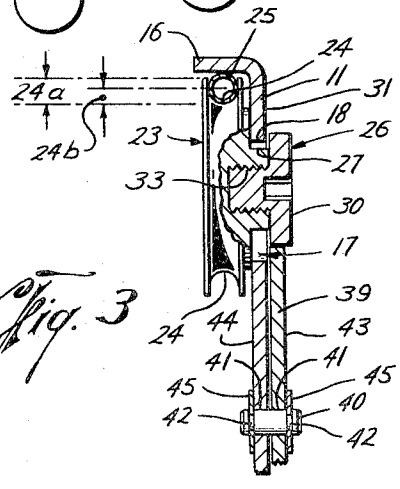
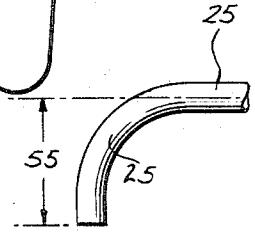


Fig. 4



Philip E. Davis, Jr.
INVENTOR.

BY Hayden & Prawl

ATTORNEYS

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SMALL DIAMETER TUBE BENDER

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Fig. 5

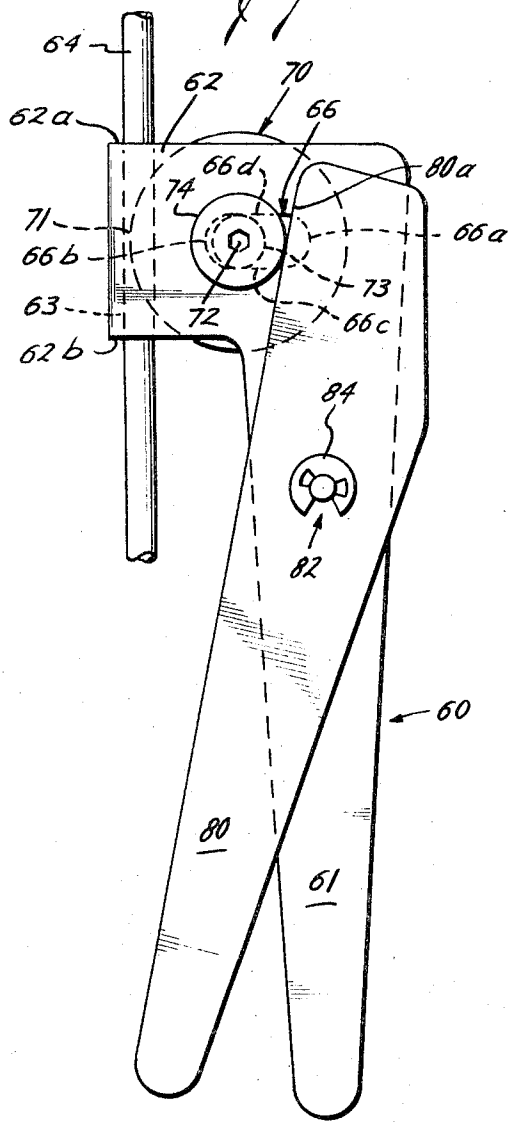
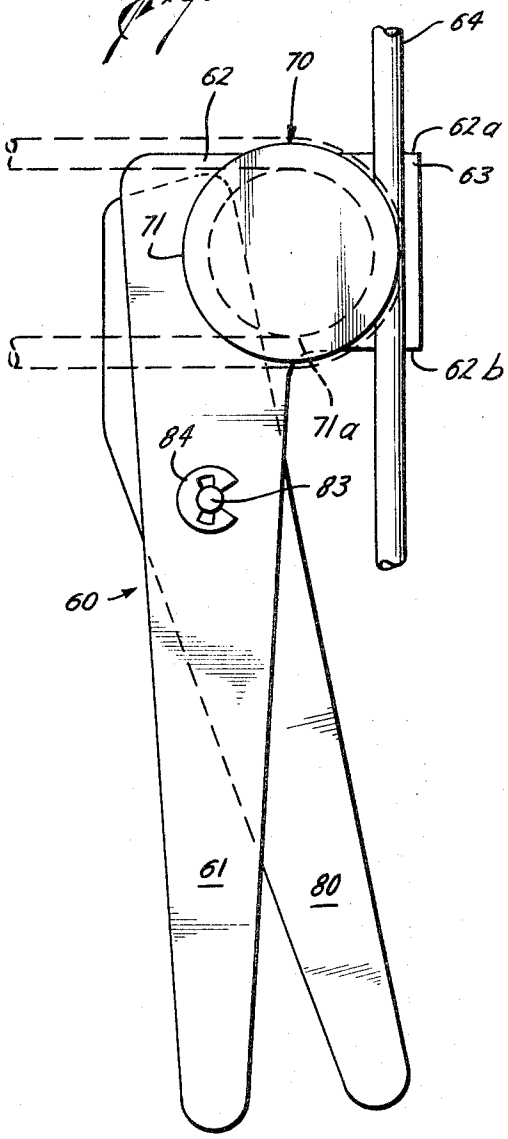


Fig. 6



Philip E. Davis, Jr.
INVENTOR.

BY Hayden & Pravel

ATTORNEYS

United States Patent Office

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SMALL DIAMETER TUBE BENDER

Philip E. Davis, Jr., 1423 Maury,
Houston, Tex. 77026

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5 Claims. (Cl. 72—457)

The present invention relates to a device for bending small diameter tubes, such as hollow tubes, up to approximately ⅝ inch outer diameter.

Various forms of tube and rod bending devices have been devised and used over the years. Most of such devices are bulky and are complicated in construction as well as in operation, requiring complex manipulation by the user.

The present invention relates to a simple device for bending small diameter tubes such as those up to approximately ⅝ inch outer diameter which can be carried in the pocket of the user and manipulated relatively easily with the hand or hands.

Still another object of the present invention is to provide a hollow tube bender so as to bend a tube and obtain a bend of a predetermined desired length.

Still another object of the present invention is to provide a tube bender for small diameter tubular elements which is constructed and arranged so as to inhibit wearing or flattening of any portion thereof during repeated or continued use.

Other objects and advantages of the present invention will become more readily apparent from a consideration of the following description and drawing wherein:

FIG. 1 is a front view illustrating the preferred form of the present invention with a hollow tube positioned therein ready to be bent;

FIG. 2 is a back view somewhat similar to FIG. 1 showing additional structural details and the relationship of the components of the invention;

FIG. 3 is a sectional view on the line 3—3 of FIG. 1, partly in elevation, showing further structural details of the invention;

FIG. 4 illustrates a portion of a tube bent to a predetermined length in accordance with this invention;

FIG. 5 is a back view of an alternate form of the invention for bending the hollow tube positioned therein up to 180°; and

FIG. 6 is a front view of the embodiment shown in FIG. 5 illustrating engagement of said invention with the hollow tube prior to bending.

Attention is first directed to FIG. 1 wherein the invention is shown as comprising a body represented generally by the numeral **10** which may be of any suitable extent such as approximately 9 to 12 inches, the body **10** being formed of flat strip material as shown more clearly at **11** in FIG. 3 and having its side edges **13** and **14** tapered inwardly toward each other and relative to the longitudinal axis represented by the line **15** to form a suitable area for grasping in the hand of a user. It will be noted that the wider end of the body **10** is provided with a bent up portion or end **16** that extends at substantially right angles relative to the flat plate-like portion **11** of the body **10**.

The bent end **16** extends laterally relative to the flat portion **11** a suitable extent to accommodate functioning of the device as will be described hereinafter.

The body **10** is provided with a slot **17** which is spaced from the bend end **16** as more clearly seen in FIGS. 2 and 3 of the drawings and extends along the longitudinal axis represented by the numeral **15** as shown in FIG. 2 of the drawings. The slot **17** is formed by the curved end surfaces **18** and **19** at each end thereof which are connected with the parallel spaced side surfaces **20** and **21**.

The slot **17** provides a means for receiving the wheel referred to generally by the numeral **23**. The wheel **23** is provided with an annular groove **24** in the circumference thereof for receiving the hollow tube represented at **25** and positioning relative to the bent end **16** for bending of the tube **25** in a desired manner as will be described hereinafter.

The wheel **23** is positioned on the body **10** by any suitable means and is shown as including a wheel mounting means represented generally by the numeral **26**. Such wheel mounting means **26** includes a portion **27** which, if desired, may be formed integrally with one side of the wheel **23** and extends through the slot **17** as shown in FIG. 3 of the drawings. The portion **27** is of smaller diameter than the width of the slot between the parallel side surfaces **20** and **21** of the slot **17** so that the wheel **27** may freely rotate and move longitudinally relative to body **10**. However, the portion **27** fits snugly in slot **17** so that the wheel **23** moves up and down therein along and in alignment with the longitudinal axis **15** of body **10** for a purpose to be described hereinafter. It will also be noted that the portion **27** is of less longitudinal extent that the distance between the end surfaces **18** and **19** of the slot **17**. This construction enables the tube **25** to be inserted in groove **24** of the wheel and the wheel then moved longitudinally of the body **10** to position the tube **25** adjacent the bent end **16** of plate **11** for bending of tube **25**. Also, since the wheel **23** may rotate freely relative to the body **10**, wear on any one portion or spot on the wheel is reduced so that wear is evenly distributed.

The wheel mounting means **26** also includes the enlarged end **30** which is adapted to engage the rear surface **31** of the flat plate-like member **11** and thereby retain the wheel **23** in position thereto. As a practical matter, the enlargement **30** may be formed by a screw which is adapted to be threadedly received as shown at **33** with the portion **27** of the wheel **23** to lock the wheel in position on the body **10** while permitting free longitudinal movement thereof and free relative rotation between the wheel **23** and the body **10**.

The invention also includes the additional body member represented by the numeral **39** which is also formed of flat plate-like material and is pivotally connected to the body **10** by any suitable means such as the pin **40** which fits through suitable aligned openings **41** in each the body **10** and additional body member **39**, such pin having a groove **42** therein adjacent the surface **43** of the additional body **39** and adjacent the surface **44** of the body **10** for receiving the spring retainer **45** therein to hold the pin in place and thereby retain body **10** and additional body member **39** in proper relationship. Also, such construction enables body **10** and additional body member **39** to be grasped by a user for urging wheel **23** toward bent end **16** as will be described. The body **39** is formed with edges which incline toward each other in a manner similar to body member **10** to facilitate grasping thereof by the user.

Thus, the additional body member **39** is free to move relative to the body **10**, and it will be noted that the additional body **39** is provided with an arcuate end surface or edge **46** which is adapted to engage the periphery of the enlarged end **30** so that when the additional body **39** is moved relative to the body **10** as illustrated in FIG. 2, the wheel **23** is moved longitudinally of the slot **17** to position the tubular member **25** adjacent the bent end **16** so that a hollow tube may be bent.

The depth of groove **24** in wheel **23** as represented at **24*a*** in FIG. 3 is determined by the diameter of tube **25** to be bent. For example, if a tube ⅜ inch O.D. is to be bent, a wheel having a groove depth **24*a*** of 1/32 inch

less than 3/8 inch is most satisfactory. It can be appreciated that a different wheel **23** may be used for each size tube.

The pitch diameter of the groove **24** is represented at **24***b* in FIG. 3 and is the distance from the bottom of groove **24** in wheel **23** to the center of the tube **25** to be bent. Obviously, this will vary for various size tubes and wheel grooves **24**.

As previously noted, wheel **23**, regardless of the depth of groove **24** and regardless of the size of tube **25** within the limits of the present invention, moves up and down in slot **17** in a straight line which coincides with the longitudinal axis **15** of body **10**.

Therefore, a vertical line drawn from the end **50** or **51** adjacent bent end **16** as represented at **52** is tangent to the pitch diameter of the groove **24** regardless of the depth of groove **24** and size tube (within the limits of the present invention).

The above construction and arrangement enables a user to easily and quickly form a bend in a tube **25** of a desired length. For example, assume that it is desired to form a right angle bend in tube **25**, a distance represented at **55** in FIG. 4. This is accomplished by placing a pencil or other suitable mark at **56** on tube **25** and then aligning mark **56** with the edge **50** as shown in FIG. 1 and bending tube **25** as indicated in dotted line to a right angle.

While it is believed that the operation of the invention is apparent from the foregoing description, to further amplify and describe, it will be assumed that the present invention is to be used to bend a hollow tube **25** up to approximately 3/8 inch O.D. A wheel **23** of proper size to match the outer diameter of tube **25** to be bent is positioned on body **10**. The tube **25** is marked as above described to provide a bend of predetermined length. The mark such as mark **56** on the tubing **25** is aligned with the edge **50** of body **10** and the wheel **23** may be moved upwardly to hold the tube **25** against bent end **16** by grasping body **10** and additional body **39** and closing them toward each other. The tubing may be bent manually and then removed by releasing wheel **23** from engaging the tube against the bent end **16**.

It can be appreciated that the wheel **23** can be quickly and easily changed to accommodate the size of tubing **25** to be bent. Also, it a left-handed person is using the invention, the additional body **39** may be easily and quickly removed and turned over, or reversed, so as to engage enlargement **30** on the side opposite to that shown in FIG. 2.

When body **39** is released relative to the body **10** after use of the invention, the wheel **23** may move longitudinally of slot **17**, and during such movement, it is not uncommon for some rotation of the wheel **23** to occur. Thus, the next time that the device is used, the hollow tube **25** will contact another portion of the bottom of the groove **24**, and similarly, the curved surface **45** will contact another portion of the enlargement **30**. This enables the device to be used repeatelly and continued over an extended period of time without causing undue wearing or flattening of any portion thereof.

Attention is directed to FIGS. 5 and 6 which illustrate an alternative embodiment **60** of the present invention which is adapted to bend small diameter tubes or the like up to 180°. The embodiment **60** illustrated in FIGS. 5 and 6 includes a flat plate-like member **61** having a laterally extending portion **62** at the upper end thereof. Portion **62** includes an upturned edge **63** similar to the bent end **16** shown in FIGS. 1 and 2 for receiving small diameter tubing **64** thereagainst. In the preferred form illustrated in FIGS. 5 and 6 of the embodiment **60**, the plate-like member **61** extends at right angles with respect to the lateral projection **62**, and the edges **62***a* and **62***b* are perpendicular to the bent end **63**.

The lateral projection **62** includes a slot **66** similar to the slot **17** formed in the embodiment **10**. The slot **66** includes semicircular ends **66***a* and **66***b* between parallel side edges **66***c* and **66***d* as shown in FIG. 5. The slot **66** accommodates wheel means indicated generally at **70** and provides support therefor in moving same to and from a bending position, permitting relative rotation thereof as will be described hereinafter. The wheel means **70** includes a bending wheel **71** having a peripheral groove **71***a* of a diameter related to the small tube **64** in the same way as the relationship of wheel **23** to tube **25** previously described. The wheel **71** is mounted on a wheel mounting means **72** having a reduced diameter circular portion indicated in dotted line at **73** in FIG. 5 and a larger circular portion **74** extending above the back side of the plate-like member **61**. The reduced diameter portion **73** carried on the wheel means **70** fits between the parallel side edges **66***c* and **66***d* of the slots **66** with sufficient clearance to rotate therein and may reciprocate longitudinally along the slot **66** to either of the semicircular ends **66***a* or **66***b* and transports the bending wheel **71** therewith as will be described. The bending wheel **71** rotates with the wheel mounting means **72** whereby the wheel **71** may rotate relative to the body **61** and move towards or away from bent end **63**.

The embodiment **60** includes an actuating member **80** which is flat and plate-like similar to the member **61** and is joined thereto by connective means indicated generally at **82**. The connective means **82** includes a shaft **83** extending through appropriate openings in the members **61** and **80** which is engaged at its outer ends by flat spring-like washers **84** which fasten the members **80** and **61** together. The washers **84** are engaged with grooves formed on the shaft **83**, and reference is made to FIG. 3 for details illustrating similar structure employed in the embodiment **10**.

The upper end of the plate-like member **80** includes an edge or surface **80***a* which is adapted to contact the circular member **74** carried on the wheel mounting means **72** for translating same relative to the longitudinal slot **66**. Engagement of the edge **80***a* with the wheel means **70** will be described in greater detail hereinafter relative to operation of the embodiment **60** of this invention.

The diameter of the bending wheel **71** having the encirculing groove **71***a* formed therein is related to the length of the bent end **63** whereby the edges **62***a* and **62***b* of the plate-like member **61** define reference points for indicating the extent of tubing **64** included in the bent portion and further defining the straight portion of tubing extending from the arcuately formed curve.

Considering operation of the embodiment **60**, the tubing **64** is engaged with the bent end **63** and positioned relative to either of the ends **62***a* or **62***b* and referenced thereagainst in a manner previously described. The plate-like members **80** and **61** are grasped near the small ends thereof, and relative rotation about the pivotal means **82** is achieved by squeezing or gripping in a manner akin to operating pliers or the like. The edge **80***a* is moved against the wheel mounting means portion **74** and provides a cam action wherein the wheel mounting means indicated at **72** is translated longitudinally of the slot **66** toward the bent end **63** to thereby engage the groove **71***a* with the tubing preparatory to bending. The tubing **64** is bent with reference to either of the edges **62***a* or **62***b* and may even be bent to accomplish a 180° bend as illustrated in the dotted line representative of FIG. 6, again recalling that such bending may be accomplished with respect to reference marks placed on the tube **64**.

As described with respect to the embodiment **10** of this invention, the tube bender of this invention may accommodate various diameter bends on tubing of various small diameters within the limits of the present invention. In accordance therewith, the groove **71***a* carried on the wheel **71** for engaging the tubing **64** may have a diameter slightly larger than the O.D. of the tube to be

bent, and a grooved depth of perhaps 1/32 inch less than the O.D. of the tube to be bent.

The various diameter wheels **71** may be assembled readily by fabricating the wheel mounting means **72** carried on the back side of the plate-like member **61** in the form of an enlarged head having internal threads for engaging in axial projection extending from the bending wheel **71**. By such means, the bending means indicated generally at **70** may be rapidly and readily adjusted to accommodate various sizes.

When the actuating member **80** is released and the edge **80***a* disengaged whereby the bending wheel means indicated generally at **70** is freed to move laterally to the right as illustrated in FIG. **5**, the bent tube **64** may be removed from the device of this invention and additional tubing to be bent may be engaged therewith with ease and facility. In further particular, it should be recognized that engagement and disengagement of the bending wheel means **70** with the tubing to be bent results in slight rotation of a perhaps random nature to engage different arcuate portions of the bending groove **71***a* with the tubing **64** from one operation to the next. This rotation avoids the wearing of flat spots in the embodiment **60** in a manner similar to that described relative to embodiment **10**.

Broadly, the present invention relates to a tube bending device which may be grasped in one hand of a user for bending small diameter hollow tube.

What is claimed is:

1. A device for bending hollow tubes up to approximately 5/8 inch O.D. comprising:

(a) a body having one end bent at approximately 90° relative to the body,

(b) said body having a slot therein spaced from said bent end and extending along the longitudinal axis of said body, said slot having a curved surface at each end and spaced parallel side surfaces joined at each end to said curved surfaces,

(c) a wheel having an annular groove in the circumference thereof for receiving the tube to be bent,

(d) wheel mounting means having a portion extending through said slot and engaged with said wheel for mounting it adjacent said bent end, said wheel mounting means having an enlarged end for abutting said body to position said wheel thereon,

(e) said portion of said wheel mounting means extending through said slot being smaller in diameter than the width of said slot between said parallel side surfaces and being smaller in diameter than the longitudinal extent of said slot between said end curved surfaces whereby said wheel may rotate relative to said body and may move toward and away from said bent end on said body,

(f) an additional body member,

(g) means pivotally mounting said additional body member on said body, and

(h) said additional body member having an arcuate edge for engaging said enlarged end of said wheel mounting means whereby movement of said additional body member relative to said body forces said wheel toward and away from said bent end.

2. A device for bending hollow tubes up to approximately 5/8 inch O.D. comprising:

(a) a body having one end bent at approximately 90° relative to the body,

(b) said body having a slot therein spaced from said bent end and extending along the longitudinal axis of said body, said slot having a curved surface at each end and spaced parallel side surfaces joined at each end to said curved surfaces,

(c) a wheel having an annular groove in the circumference thereof for receiving the tube to be bent,

(d) wheel mounting means having a portion extending through said slot and engaged with said wheel for mounting it adjacent said bent end, said wheel mounting means having an enlarged end for abutting said body to position said wheel thereon,

(e) said portion of said wheel mounting means extending through said slot being smaller in diameter than the width of said slot between said parallel side surfaces and being smaller in diameter than the longitudinal extent of said slot between said end curved surfaces whereby said wheel may rotate relative to said body and may move toward and away from said bent end on said body,

(f) an additional body member,

(g) means pivotally mounting said additional body member on said body,

(h) said additional body member having an arcuate edge for engaging said enlarged end of said wheel mounting means whereby movement of said additional body member relative to said body forces said wheel toward and away from said bent end, and

(i) the pitch diameter of said annular groove in said wheel being in vertical alignment with a line drawn from either end of said bent edge vertically and longitudinally of said body.

3. A device for bending hollow tubes up to approximately 5/8 inch O.D. comprising:

(a) a body having one end bent at approximately 90° relative to the body,

(b) said body having a slot therein spaced from said bent end and extending along the longitudinal axis of said body, said slot having a curved surface at each end and spaced parallel side surfaces joined at each end to said curved surfaces,

(c) a wheel having an annular groove in the circumference thereof for receiving the tube to be bent,

(d) wheel mounting means having a portion extending through said slot and engaged with said wheel for mounting it adjacent said bent end, said wheel mounting means having an enlarged end for abutting said body to position said wheel thereon,

(e) said portion of said wheel mounting means extending through said slot being smaller in diameter than the width of said slot between said parallel side surfaces and being smaller in diameter than the longitudinal extent of said slot between said end curved surfaces whereby said wheel may rotate relative to said body and may move toward and away from said bent end on said body,

(f) an additional body member,

(g) means pivotally mounting said additional body member on said body,

(h) said additional body member having an arcuate edge for engaging said enlarged end of said wheel mounting means whereby movement of said additional body member relative to said body forces said wheel toward and away from said bent end, and

(i) said arcuate edge on said additional body member being formed so that reversal of said additional body member on said body enables the device to be used by a left-handed user.

4. A device for bending hollow tubes up to approximately 5/8 inch O.D. comprising:

(a) a body having one end bent at approximately 90° relative to the body,

(b) said body having a slot therein spaced from said bent end and having a curved edge at each end and spaced parallel side edges joining said curved edges,

(c) a wheel having an annular groove in the circumference thereof for receiving the tube to be bent,

(d) wheel mounting means having a portion extending through said slot and engaged with said wheel for mounting it adjacent said bent end, said wheel mounting means having an enlarged end for abutting said body to position said wheel thereon,

(e) said portion of said wheel mounting means extending through said slot being smaller in diameter than

the width of said slot between said parallel side surfaces and being smaller in diameter than the longitudinal extend of said slot between said end curved surfaces whereby said wheel may rotate relative to said body and may move toward and away from said bent end on said body,

(f) an additional body member,

(g) means pivotally mounting said additional body member on said body, and

(h) said additional body having an edge for engaging said enlarged end of said wheel mounting means whereby movement of said additional body member relative to said body forces said wheel toward and away from said bent end.

5. A device for bending hollow tubes up to approximately ⅝ inch O.D. comprising:

(a) a body having one end bent at approximately 90° relative to the body,

(b) said bent end being on a lateral projection extending from the main portion of said body,

(c) said body having a slot therein extending toward said bent end, said slot having a curved edge at each end and spaced parallel side edges joined at each end to said curved edges,

(d) a wheel having an annular groove in the circumference thereof for receiving the tube to be bent,

(e) wheel mounting means having a portion extending through said slot and engaged with said wheel for mounting it adjacent said bent end, said wheel

mounting means having an enlarged end for abutting said body to position said wheel thereon,

(f) said portion of said wheel mounting means extending through said slot being smaller in diameter than the width of said slot between said parallel side surfaces and being smaller in diameter than the longitudinal extent of said slot between said end curved surfaces whereby said wheel may rotate relative to said body and may move toward and away from said bent end on said body,

(g) an additional body member,

(h) means pivotally mounting said additional body member on said body,

(i) said additional body having cam means thereon for engaging said enlarged end of said wheel mounting means whereby movement of said additional body member relative to said body forces said wheel toward and away from said bent end, and

(j) said groove accommodating bends of up to 180° in the hollow tube.

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WILLIAM W. DYER, JR., *Primary Examiner.*

G. A. DOST, *Examiner.*