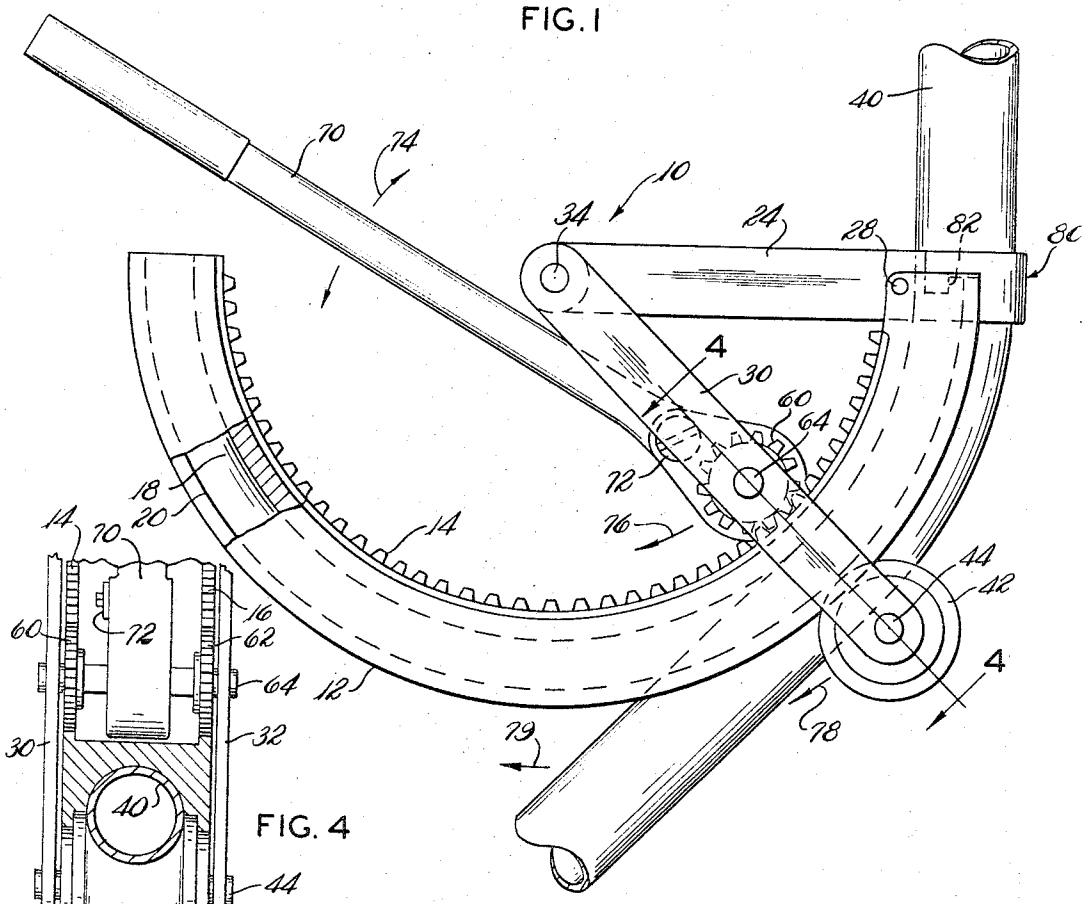
Aug. 22, 1967 W. J. SCHALL 3,336,779

PORTABLE TUBE BENDER

Filed Oct. 8, 1964

FIG. 1



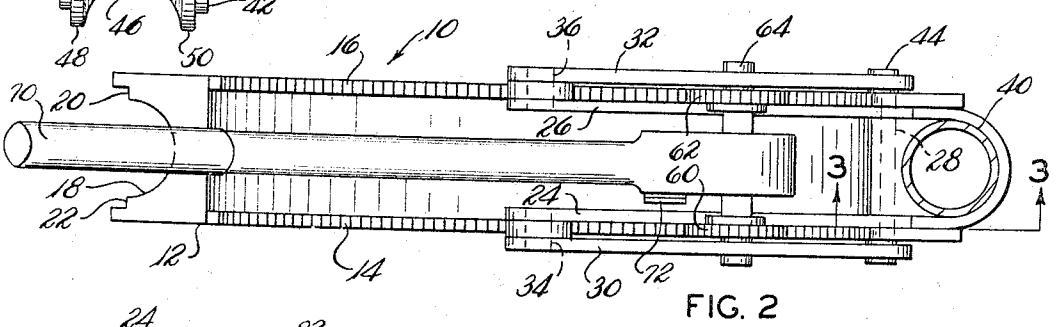


FIG. 2

FIG. 4

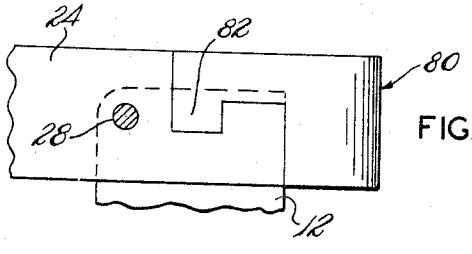


FIG. 3

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PORTABLE TUBE BENDER

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4 Claims. (Cl. 72—217)

This invention relates to a portable tube bender, and more particularly to a tube or pipe bending apparatus which utilizes a positive rack and gear drive arrangement on a portable bending frame and associated with a pivotal linkage carrying a bending roller around the frame.

Heretofore the art of tube and pipe bending has been a well worked art as shown by the large number of patents relating thereto. These patents relate to the bending of pipe or tubing to various shapes, and more particularly to bending of hollow tubing or pipes without causing some distortions, bending or cracking along the path of the bend. However, efficient prior art apparatus of this type have always required some power driven apparatus including a fixed and secure stationary table mounting, such as in a machine shop or the like, and which apparatus are not at all convenient for portable or field operation. Further, any prior art apparatus proposed for portable, or field operations has been cumbersome and not inherently reliable. A heavy duty, extremely accurate, tube or pipe bender which is portable and easily used in the field, but which will provide good bending performance and service, is needed by the art.

Therefore, it is the general object of the present invention to avoid and overcome the foregoing and other difficulties of and objections to prior art practices by the provisions of a tube bender which is portable, and which provides extremely accurate bending in a simplified manner with reliable performance.

Another object of the invention is to provide a portable tube bender which utilizes a heavy-duty arcuate, or semi-circular shaped base frame with an associative pivotal linkage mounting a forming roller along with driving gears which engage a rack or chain on the inner circumference of the base frame.

A further object of the invention is to provide a portable tube bender which utilizes an extremely simple and yet very efficient semi-circularly shaped clip which is removably interlocked with the frame to hold a tube in position as it is being bent to the desired shape.

A further object of the invention is to provide a portable tube bender which utilizes a gear drive associated with an engaging rack or chain, which gear can be rotated by a leverage handle connected thereto through a ratchet arrangement.

A further object of the invention is to provide a sturdy, portable tube bender which is extremely efficient, highly reliable in operation, and yet low in cost, but yet which will bend a tube progressively without impairing the smoothness of the inner wall of the bent tube.

The aforesaid objects of the invention and other objects which will become apparent as the description proceeds are achieved by providing in a portable tube bending apparatus the combination of an arcuate shaped frame having a gear rack on the inner circumference thereof and a semicircularly shaped recess around the outer circumference thereof, a two piece pivotal linkage means pivotally mounted to one end of the frame and pivotal

in the plane thereof, a roller rotatably mounted at the free end of the linkage means so as to rollably engage the outer circumference of the frame, the roller having a semi-circularly shaped recess therearound which mates with the recess in the frame to define a substantially circular shape, gear means rotatably mounted by the linkage means so as to engage the gear rack on the inner circumference of the frame and hold the roller in position on the outer circumference of the frame, and means to rotate the gear means whereby the roller is moved around the circumference of the frame.

For a better understanding of the invention reference should be had to the accompanying drawings wherein:

FIGURE 1 is a side elevation partially broken away of a preferred embodiment of the portable tube bender shown in operating position bending a section of hollow tubing;

FIGURE 2 is a plan view of the tube bender of FIGURE 1 with a section of pipe in position and being bent to shape;

FIGURE 3 is an enlarged broken away cross-sectional view of the interlocking clip used to hold a piece of tubing in position while it is being bent to shape, as taken on line 3—3 of FIGURE 2; and

FIGURE 4 is a broken away cross sectional view of the rack and gear drive associated with the bending roller, as taken on line 4—4 of FIGURE 1.

While it should be understood that the tube bender of the invention might be permanently mounted at some fixed location for some specific purpose, it is most readily adaptable to function as a portable tube bender with high accuracy and reliability for all tube bending operations, and hence it has been so illustrated and will be so described.

With reference to the form of the invention illustrated in FIGURE 1 of the drawings, the numeral **10** indicates generally a portable tube bender comprising an arcuate, or semi-circularly shaped base frame **12** having a pair of parallel spaced gear racks **14** and **16** around the inside circumference thereof. The base frame **12** also has a semi-circularly shaped recessed portion **18** extending completely around its outer circumference. The recessed portion **18** terminates on both sides in flat shoulders **20** and **22**, respectively, as best seen in FIGURE 2. The cut away and cross section portion of FIGURE 1 illustrates the depth of the semi-circularly shaped recess **18** and the thickness of the supporting base **12** at the bottom of the recess.

In order to mount the desired tube bending equipment to the base frame **12**, a pair of links **24** and **26** may be pivotally mounted at one end of the base frame **12** by a pin **28**. In actually, the links **24** and **26** are designed to be interlocked relative to the end of the base frame **12** so that they will not pivot but remain fixed in substantially parallel spaced relationship directed radially inwardly and terminating at a point which represents substantially the center of an imaginary semi-circle defining the base frame **12**. In other words, the links **24** and **26** are generally anticipated to be in a fixed relationship with reference to the base frame **12**, and in the radial position, as most specifically indicated in FIGURE 1. However, in order to allow for any slight variations in the semi-circular shape of the base frame **12**, or extreme pressure brought to bear when bending a particular sec-

tion of tubing, by means of the pivotal mounting pin **28** the links **24** and **26** might be made to fit in a slightly sloppy relationship with reference to the base frame **12** so that there is a slight pivotal movement therebetween.

A pair of link extension arms **30** and **32** are pivotally mounted at one end to the free ends of the links **24** and **26** by separate pins **34** and **36**. The length of the arms **30** and **32** is greater than a radius distance so that they extend beyond the outside circumference of the base frame **12**.

In order to affect the bending action on a tube **40**, a roller **42** is rotatably journalled at each end to a respective link extension arm by a pin **44**. The roller **42** is formed with a semi-circularly shaped recess **46** therearound which mates with the recess **18** in the base frame **12**, as best seen in FIGURE 4, to define a substantially circular-shaped opening. Further, the roller **42** has flanges **48** and **50** which ride on the shoulders **20** and **22** in the base frame **12**, again as most clearly seen in FIGURE 4. Thus, it can be seen that since the link extension arms **30** and **32** pivot around pins **34** and **36**, the roller **42** will roll around the outside circumference of the base frame **12**.

The means to effect a positive movement of the roller **42** around the base frame **12** may be supplied by a pair of gears **60** and **62** mounted in fixed relationship to a pin **64** which is journalled for rotatable movement by the link extension arms **30** and **32**. The gears **60** and **62** will then mesh with the gear racks **14** and **16** around the inner circumference of the base frame **12**. A substantially conventional handle, or wrench **70** having a ratchet head controlled by a dial **72** is operatively mounted so that it is in fixed relationship to the shaft **64**. Thus, movement of the handle of the wrench **70** in either direction, as indicated by the double ended arrow **74**, will cause rotation of the gears **60** and **62** in a one way movement depending upon the position of the ratchet control dial **72**. Thus, the roller **42** will move around the outside circumference of the base frame **12**. For example, the dial **72** may be positioned so as to allow the gears to move in a direction indicated by an arrow **76** which thus moves the roller **42** in a direction indicated by an arrow **78** thereby bending the tube **40** around the outer circumference of the base frame **12** in a direction indicated by an arrow **79**. It should be noted that the head of the wrench **70** fits between the raised gear racks or chains on the inner circumference of the base frame **12**, and will be positioned approximately midway therebetween. Any suitable means could be utilized to hold the wrench head in fixed relation to the center of the pin, or shaft **64**, which usually is square in section but has round ends engaging the arms **30** and **32**.

Another important feature of the invention resides in a tube holding clip, or clamp means, indicated by the numeral **80**, which contains extending tab portions **82** on at least both sides thereof, as best seen in FIGURES 1 and 3, to fit in removable interlocking relationship with respect to the link arms **24** and **26** and the base frame **12** at the end thereof. The clip **80**, as best seen in FIGURE 2, is semi-circularly shaped so that it securely and snugly holds the tube **40** in position as it is being bent to the desired shape. Yet the clip can easily be removed to remove a bent tube from the apparatus.

Thus, it is seen that the objects of the invention have been achieved by providing a portable tube bender which utilizes a semi-circularly shaped base frame having a pair of spaced gear racks on the inner circumference thereof and a semi-circularly shaped recess along the outer circumference thereof with link extension arms mounting a roller for rolling contact with the outer circumference of the base frame to define a substantially circular shape therewith. A pair of links mounted in fixed relation to the frame pivotally mount the link extension arms at the imaginary center of the semi-circle defining the frame. Gear drive means are also mounted by the link extension arms and the gear racks are driven by a substantially conventional ratchet wrench to effect movement of the roller relative to the outer circumference of the base frame. A holding clip is provided to hold a tube being bent in position. The clip is positioned in interlocking relationship with respect to the base frame. This unit is quite easy to handle on a portable tube bending basis and provides a positive drive to achieve a highly reliable contoured bend with minimum effort, minimum cost, and minimum time.

While in accordance with the patent statutes only one best known embodiment of the invention has been illustrated and described in detail, it is to be particularly understood that the invention is not limited thereto or thereby, but that the inventive scope is defined in the appended claims.

What is claimed is:

1. In a tube bending apparatus the combination of

a semi-circular shaped base frame having a semi-circularly shaped recess around the outer circumference thereof,

a pair of parallel spaced gear racks fixedly positioned around the inner circumference of the frame,

a pair of link arms mounted for slight pivotal movement on both sides of said frame at one end thereof and directed in parallel spaced relation inwardly along a radius to the imaginary center of the frame,

a pair of link extension arms each pivotally mounted to the end of a respective link arm, said link extension arms having a length greater than a radius of said base frame,

a roller rotatably mounted at each end to the ends of the link extension arms so the roller will ride around the outer circumference of the frame, said roller having a semi-circularly shaped recess therearound which mates with the recess around the outer circumference of the frame to define a substantially circular shape,

a pair of gears mounted in spaced relation on a shaft rotatably journalled between the link extension arms so that each gear engages with a gear rack around the inner circumference of the frame, so that the forces on the roller in the bending of the tube are transmitted radially inwardly through the link extension arms to the gears riding on the gear racks to move the gears tighter against the racks and are therein absorbed, and

handle means operatively connected in a ratchet arrangement to the gear carrying shaft between the gears to provide rotation of the gears whereby the roller is moved around the outside circumference of the frame.

2. A tube bender according to claim **1** wherein a semi-circularly shaped clip removably interlocks with the base frame on the outer circumference thereof near one end to define a substantially circular shape with the recess in the base frame.

3. In a tube bending apparatus the combination of

a semi-circularly shaped frame having a semi-circularly shaped recess around the outer circumference thereof,

a gear rack operatively affixed to and extending around the inner circumference of the frame,

a two piece pivotal linkage means pivotally mounted to one end of the frame and pivotal in the plane thereof,

a roller rotatably mounted at the free end of the linkage means so as to rollably engage the outer circumference of the frame, said roller having a semi-circularly shaped recess therearound which mates with the recess in the frame to define a substantially circular shape,

gear means rotatably mounted by the linkage means so as to engage the gear rack on the inner circumference of the frame and hold the roller in position on

the outer circumference of the frame, so that the forces on the roller in the bending of the tube are transmitted radially inwardly through the linkage means to the gear means riding on the gear rack and are therein absorbed, and

means to rotate the gear means whereby the roller is moved around the outer circumference of the frame.

4. A tube bending apparatus according to claim 3 wherein a semi-circularly shaped clip removably interlocks with the base frame on the outer circumference thereof near one end to define a substantially circular shape with the recess in the base frame.

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