

June 3, 1969

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3,447,353

TUBE AND ROD BENDER

Filed Nov. 26, 1965

Sheet 1 of 2

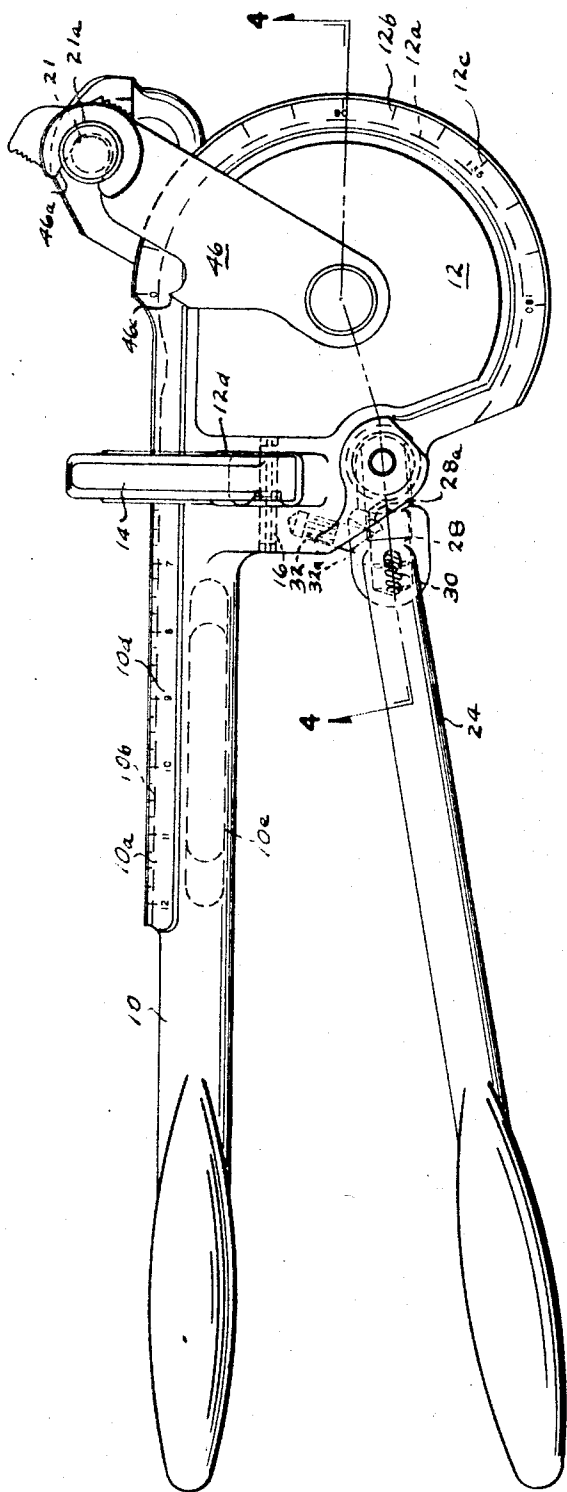


Fig. 1

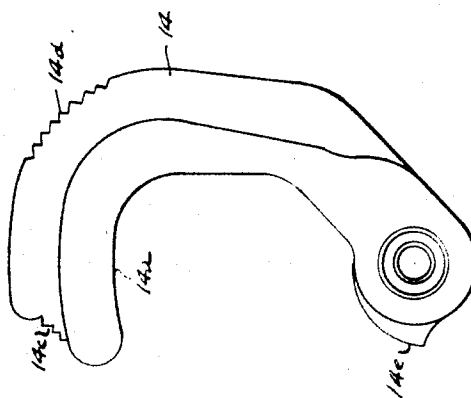


Fig. 2

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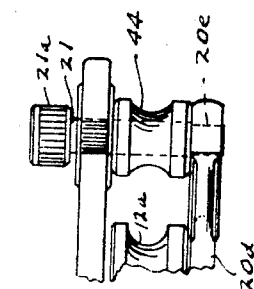


Fig. 5

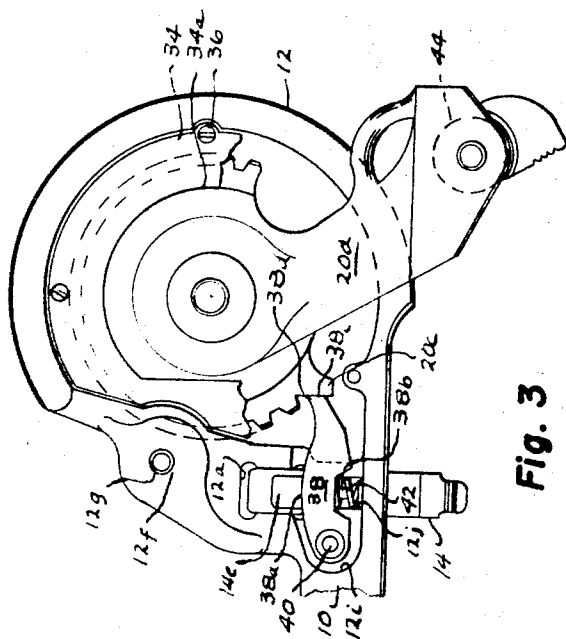


Fig. 3

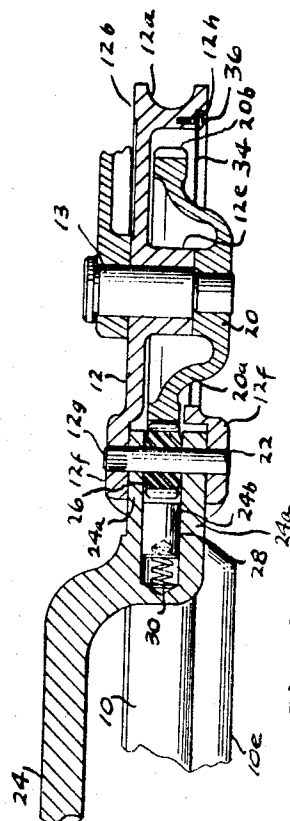


Fig. 4

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TUBE AND ROD BENDER

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8 Claims

ABSTRACT OF THE DISCLOSURE

A tube and rod binder having a handle with a mandrel disposed on the end of the handle, a hook for engaging the tube and forcing it into the mandrel seat, a first large gear pivotally mounted on the mandrel, a second small gear for driving the large gear and a ratchet handle having a ratchet pawl in engagement with the second gear.

This invention relates to tubing and rod benders of the character wherein a tube or rod is secured in a seat on a handle and bent into engagement with a seat in a mandrel disposed on the end of the handle.

A great many tube benders of the above character have been proposed. In most of these benders the bending was effected by a shoe juxtaposed to the mandrel having a groove complementary to that of the mandrel which was moved around the mandrel to force the tube into the mandrel groove. With such a device the bending takes place at substantially the point of tangency of the shoe to the mandrel and partook of a forming operation which, not being a true bending operation, required an amount of force which was greater than in an ordinary bending operation. As a result the larger sizes of tubing and rods were most difficult to bend with this type of tool because of the inherent stiffness of the tubing or rod and the strength required to operate the device. The present invention contemplates a device where a mechanical advantage is obtained because the bending is effected by a roller that is spaced from the mandrel, thus providing a true bending of the tube. A ratchet mechanism provides an additional mechanical advantage enabling bending of more difficult types of tubing by persons of moderate strength.

Still other advantages of the invention and the invention itself will become more apparent from the following description of an embodiment thereof, which description is illustrated by the accompanying drawings and forms a part of this specification.

In the drawings:

FIG. 1 is an elevational view of a bender of the invention;

FIG. 2 is a side elevational view of a tube holding latch and pawl operator used in the invention;

FIG. 3 is a fragmentary elevational view from the opposite side to FIG. 1, with the cover plate broken away to show the interior mechanism and the ratchet handle removed;

FIG. 4 is a fragmentary section on the line 4-4 of FIG. 1; and

FIG. 5 is a fragmentary view of the mandrel, illustrating a bending roller and parts of the supporting links therefor in elevation.

Briefly, the invention contemplates a bender where a handle has a housing on one end, which functions as a housing for a gear and ratchet mechanism, with a bending mandrel integral therewith. A main gear member in the housing carries an arm which in turn carries a bending roller that is moved around the mandrel in spaced relation thereto. A ratchet handle is provided and has ratchet means which operates a pinion gear in mesh with the main gear member to operate that member. A latch means is provided to hold the tube or rod in bending

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position and when moved away from the article-holding position releases a holding pawl, which is a part of the ratchet mechanism. When the ratchet handle is moved to its closed position, a ratchet pawl is automatically moved away from the ratchet pinion, allowing the main gear and its roller-carrying arm to be swung freely to a starting position.

More specifically, the main handle 10 connects at its end to one side of a mandrel and housing 12 of generally semi-circular form. The housing houses the gear mechanism as well as providing a mandrel portion on its periphery about which the tube is bent. The handle is enlarged at 10a, this portion being provided with a shallow tube receiving seat 10b. The housing is provided with a deep tube-receiving seat 12a in the mandrel which extends around the periphery thereof, the seat in the housing being a continuation of the seat in the handle. In cross section the seat in the mandrel portion is generally semi-circular with the side walls extending slightly above the diameter of the groove for engagement with diametrically opposite sides of the tube being bent.

The sides of the handle at 10d are flat and merge with the flat sides 12b of the housing, the outer edge portions of which are marked in degrees as indicated at 12c.

An elongated boss 10e is provided on the side of the handle opposite to the side shown in FIG. 1, whereby the handle may be securely gripped in a vise when desired.

The tube or rod to be bent is placed in the seat 10b and locked in place by a C-shaped latch 14 which is pivotally journaled on a pin 16 in a window 12d which extends through the housing. As best shown in FIG. 2, the latch is provided with a tube engaging surface 14a which is so designed that when it is swung over the tube it forces the tube into the seat 10b. The latch may have serrations at 14c and 14d to provide for good frictional engagement with a finger when operating the same. A cam surface 14e is provided on the hinge end of the latch for releasing a gear holding pawl later described.

The tube or rod is bent the desired degree of bend by a bending roller or shoe which is moved around the periphery of the mandrel in spaced relation thereto by a gear mechanism.

As best shown in FIGS. 3 and 4, the housing 12 is provided with a bearing boss 12e which supports a pivot pin 13 that is rotatably journaled in the boss. A gear member is secured on the end of the pin. The gear element includes a hub 20 with a web portion 20a of S shaped cross-section which carries gear teeth 20b on its periphery. The gear extends around the periphery for approximately 245°, one end terminating in a stop abutment 20c. An arm 20d extends outwardly from the hub 20 over and beyond the edges of the housing. The end is formed with a threaded opening 20e for the reception of a roller support and clamp stud 21. The base of the housing 12 is provided with a pair of outwardly extending walls 12f on opposite sides which are apertured at 12g for the reception of a pin 22 upon which the ratchet operating handle 24 and pinion 26 are mounted. The teeth of the pinion 26 are in mesh with the teeth 20b of the gear member.

The handle 24 is provided with a pair of apertured ears 24a, which are on an offset enlarged end of the handle, through which the pin 22 extends, the ears being disposed on opposite sides of the pinion 26 and between the ears 12f of the housing. The base of the handle enlargement is provided with a blind bore 24b, which opens toward the pinion, and in the bore is a ratchet pawl 28 which is pressed toward the pinion gear by a spring 30 which bottoms in the bore. The pawl 28 is provided with a cam notch 28a and a ratchet release pin 32, pressed into a bore in the housing opposite the pawl, has a slanting surface 32a which engages with the cam

surface 28a when the ratchet handle is moved toward the main handle to withdraw the pawl from engagement with the pinion. A cover plate 34, shaped to conform with the opening in the housing and having a center opening 34a to provide a clearance for the hub 20 of the gear member, is secured to the ledge 12h by screws 36.

As previously stated, the latch 14 is provided with a cam surface 14e which releases a holding pawl or member when the latch is disengaged from the tube or rod. The window 12d, in which the latch is reciprocated, intersects a pocket 12i in the housing adjacent the end of the handle and in which a holding pawl 38 is journaled on a pin 40. The holding pawl is provided with a latch engaging surface 38a and is pressed toward that latch surface by a spring 42 disposed in a pocket 12j and surrounding a locating pin 38b extending from the holding pawl. The end of the holding pawl is provided with a foot portion 38c which, when the latch is released, extends opposite to and acts as a stop for the abutment 20c on the gear member. In FIG. 3 the holding pawl is shown operated by the latch to position the gear. When the latch is engaged with an article to be bent the cam surface 14e is withdrawn from engagement with the holding pawl and the pointed or toe end 38d engages with the teeth 20b of the gear member preventing the gear member from turning in a clockwise direction, as viewed in FIG. 3, while it is being turned by the pinion 26 in a counterclockwise direction.

As previously stated, the gear member 20 has an arm 20d which carries a bending roll 44 on the end by a clamp stud 21. Additional support for the roll is provided, thus enabling the tool to be used for bending very stiff tubing or rods, and comprises a link 46 pivotally journaled on the pivot pin 13 for the gear member and having a slot 46a for engagement around the stem of the clamp stud under the head 21a. The link may be swung out of engagement by loosening the clamp stud and swinging the same around the pivot pin 13 to facilitate insertion of the tube between the roll and the mandrel, for bending. When it is swung back into the position shown in FIG. 1, it provides additional support for the bending roll.

The link is provided with a hook-shaped projection 46c which acts as a pointer for cooperation with the scale 12c on the mandrel to indicate the start of a bend and the degrees of bend.

In operation, the latch 14 is rotated from the position shown in FIG. 1. This causes the holding pawl 38 to be moved by the cam 14e, compressing the spring 42 and removing the point 38d from engagement with the teeth of the gear member 18 and placing the foot 38c in the proper position to be engaged by the stop 20c. The ratchet handle 24 is then moved toward the main handle 10. This movement causes the cam surface 28a of the ratchet pawl 28 to engage with the cam surface 32a on the ratchet release pin 32 and withdraw the ratchet pawl from engagement with the teeth of the pinion 26. The gear member is now released and may be moved counterclockwise, as viewed in FIG. 1, to the position shown where the pointer 46c points to 0 on the scale 12b. The clamp stud 21b may now be loosened, if it is not already loose, and the link 46 swung away from the stud 21.

The tube or rod to be bent is placed in the groove 10b in the handle with the end to be bent extending between the bending roll 44 and the mandrel and with the place where the start of the bend is to be made at the 0 mark on the mandrel. The latch 14 is now sprung over the tube. The surface 14a is so designed that it engages with the tube as it is swung over the tube and further swinging of the latch forces the tube securely into the seat on the handle.

The link 46 may now be returned to the position shown in FIG. 1 and locked by the clamp stud. When the latch 14 was moved into engagement with the tube the holding pawl 38 was released and moved to a place

where it could engage with the teeth, on the gear member 20. The ratchet handle is now moved away from the main handle. This withdraws the ratchet pawl 28 from engagement with the ratchet release pin and the end of the pawl is forced by the spring 30 into engagement with the teeth of the pinion 26. As the ratchet handle is moved further away from the main handle, the pawl turns the pinion and it in turn rotates the gear member 20, causing the arm 20d with the roll 44 to be carried around the mandrel and bending the article into the mandrel groove. The ratchet action is continued until the pointer 46c indicates the desired number of degrees of bend.

When the bend is completed the latch 14 is moved to release the tube and this also releases the holding pawl which was previously cooperating with the ratchet pawl. The ratchet handle is moved toward the main handle which releases the ratchet pawl and the gear member 20 may now be rotated back to the start position and the tube removed. This may be facilitated by disengaging the link 46 from the clamp screw 21.

It is apparent from the foregoing that due to the spacing of the roller 44 from the mandrel that the tube is bent around the mandrel with a true bending operation. Due to the ratchet and gear mechanism a mechanical advantage is obtained which, together with the type of bending described, enables very hard tubing or rods to be bent. In some instances, the main handle 10 may be clamped in a vise, the pad 10e facilitating such clamping and the bending performed.

Having thus described the invention, in an embodiment thereof, it will be understood that numerous and extensive departures may be made therefrom without departing from the spirit or scope of the invention as defined in the appended claims.

I claim:

1. A tubing and rod bender comprising a handle, a mandrel disposed on the end of the handle and having a tube bending seat therein, latch means for holding a tube in the bending position relative to the mandrel, means for engagement with the tube and for forcing it into the seat on the mandrel comprising a first large gear means pivotally mounted on the mandrel and having an arm extending beyond the mandrel seat, a tube engaging member supported by the arm in spaced relation to the mandrel, means to rotate the large gear means comprising a second small gear in mesh with the large gear and a ratchet handle having a ratchet pawl in engagement with the second gear means.

2. A bender as described in claim 1, wherein a link is freely and pivotally mounted on one end coaxial with the gear means and has the other end arranged for detachable engagement with the support for said tube engaging member.

3. A bender as described in claim 1, wherein said handle has an article holding seat and said latch means holds the article in said seat.

4. A bender as described in claim 1, wherein said pawl is formed with a cam surface and means is carried by said mandrel and engages said pawl to withdraw the pawl from the gear when the ratchet handle is moved to a predetermined position.

5. A bender as described in claim 4, wherein a second pawl is in engagement with the teeth of said first gear means and said latch means engages with said second pawl upon a predetermined amount of movement of the latch means to release said second pawl from engagement with the teeth of the first gear means.

6. A bender as described in claim 5, wherein said first gear means is provided with a projection and said second pawl is provided with a portion engaging with the projection to limit the movement of the gear means and position the gear means for the start of a bending operation.

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7. A device as described in claim 1, wherein a housing is provided on the end of the handle and said tube bending seat constitutes a groove in the periphery of the housing and said gear means is disposed within the housing.

8. A device as described in claim 7, wherein a second pawl is in engagement with the teeth of said first gear means and said handle is provided with a tube engaging seat and the latch means is pivotally supported by said housing and has a portion extending over the seat into engagement with a tube and a second portion which, upon movement of the latch means to a tube releasing position, engages with said second pawl to move said second pawl from a tooth engaging position of the gear means to a position for engagement with a stop on the gear means for the start of a bending operation.

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U.S. Cl. X.R.

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