Feb. 25, 1941. J. H. ABRAMSON ET AL 2,232,819

TUBE BENDER

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Fig. 1

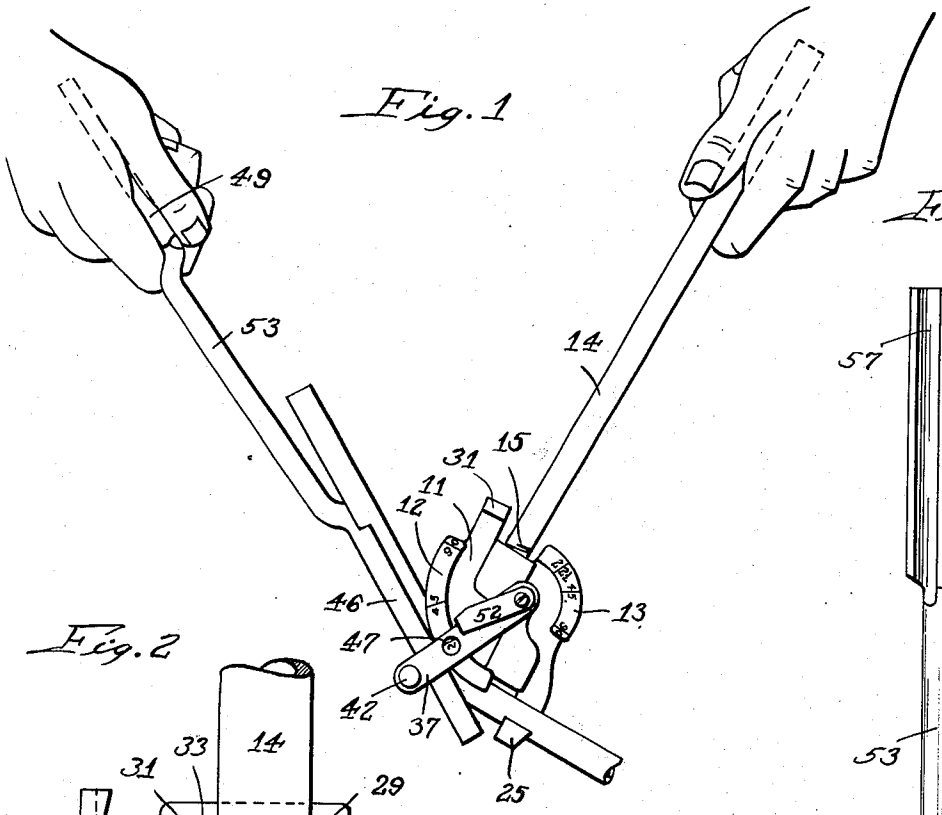

Fig. 2

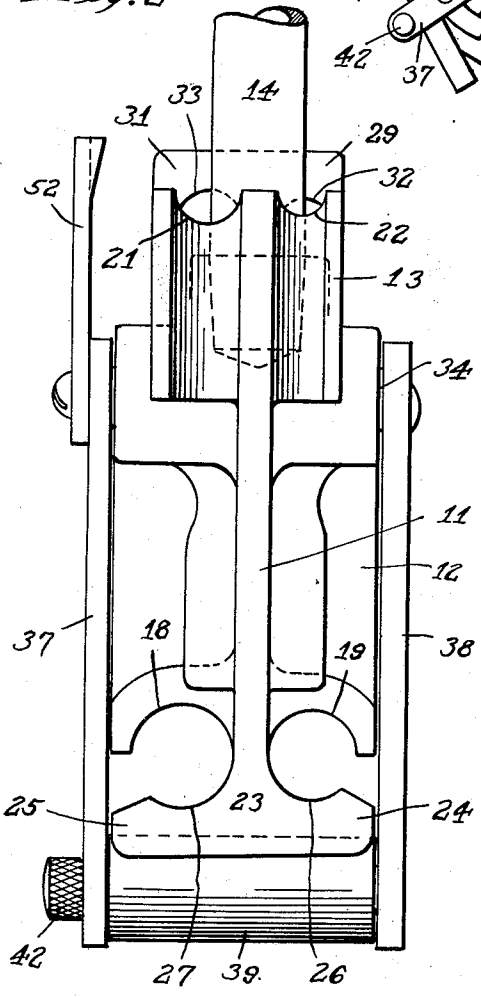

Fig. 3

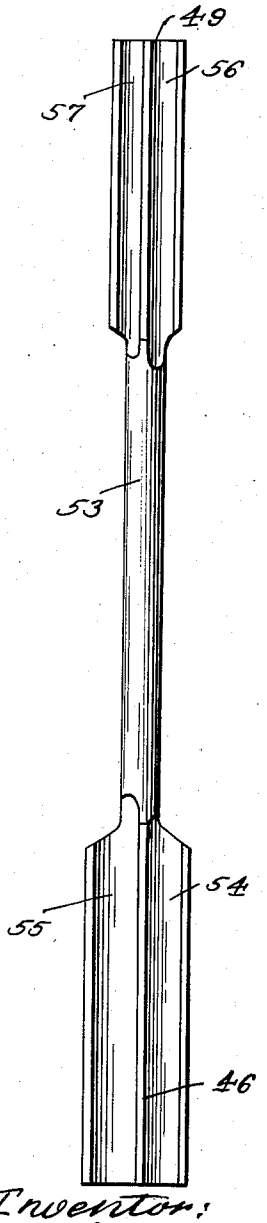

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Fig. 4

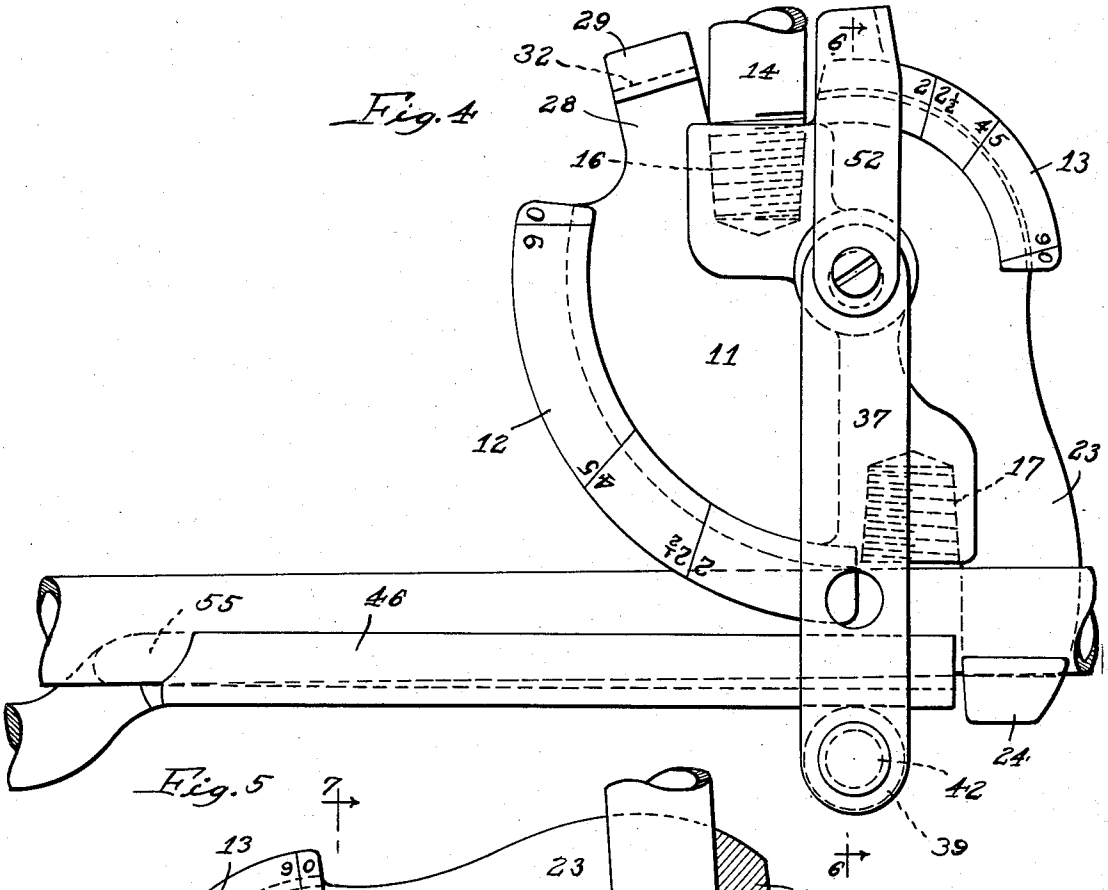

Fig. 5

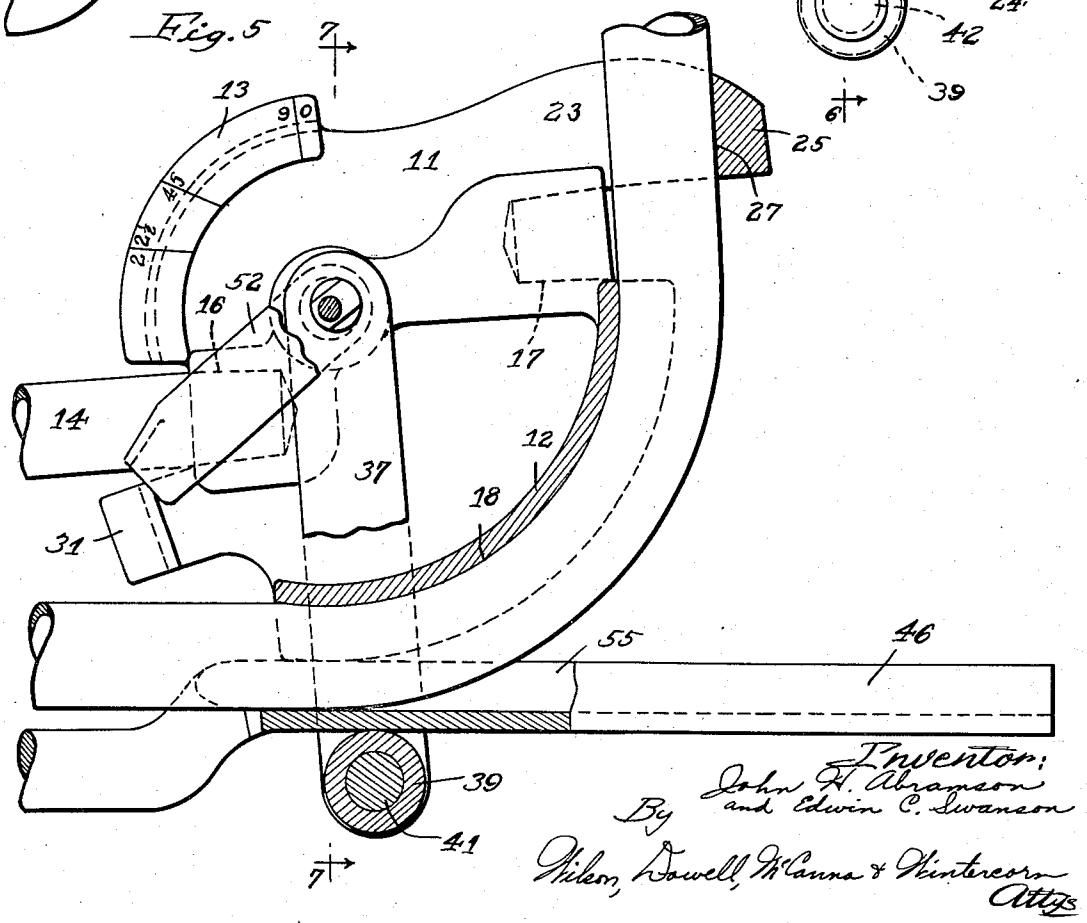

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Fig. 6

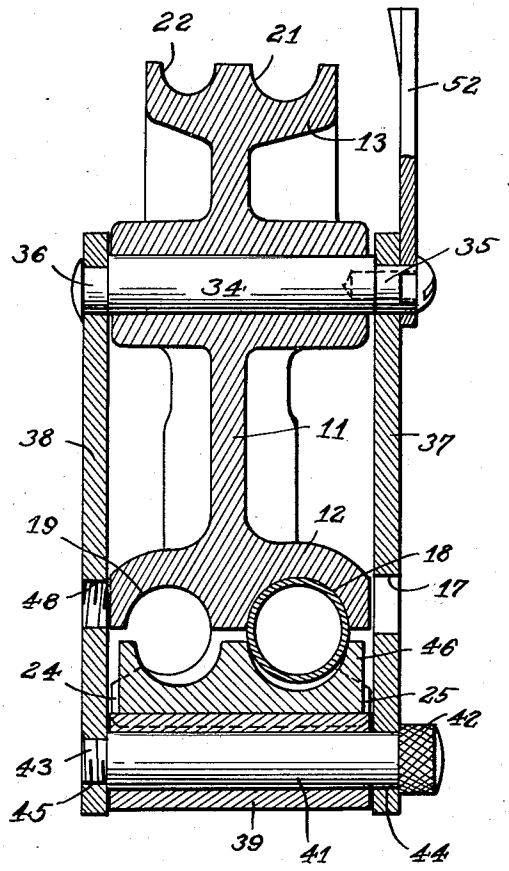


Fig. 7

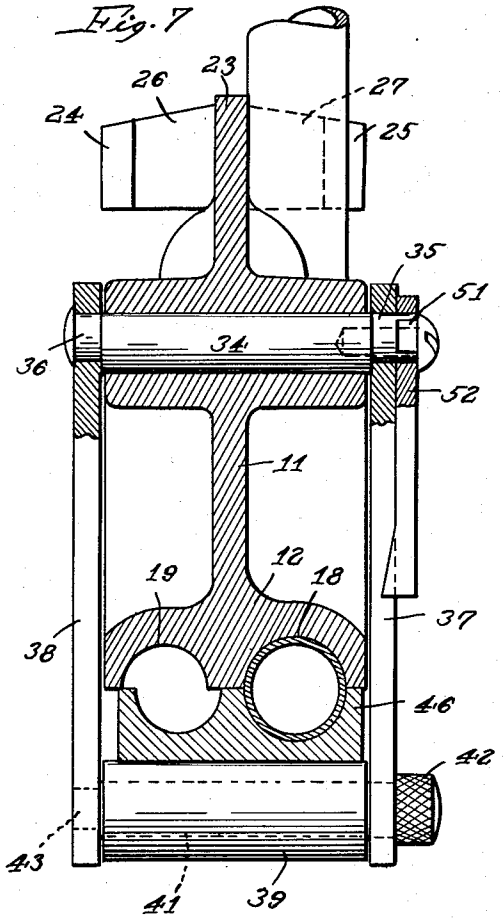
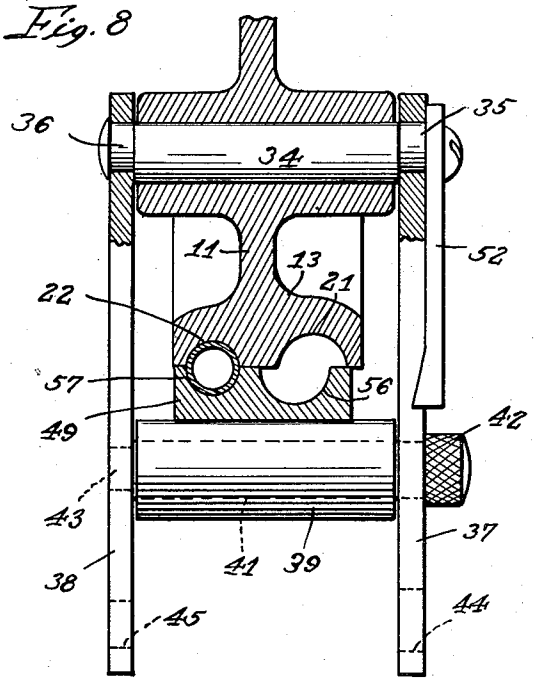


Fig. 8



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UNITED STATES PATENT OFFICE

2,232,819

TUBE BENDER

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Application July 22, 1937, Serial No. 154,982

4 Claims. (Cl. 81—15)

This invention relates to tube benders and has special reference to a bender adapted for hand operation, and in one aspect thereof particularly adapted for the bending of thin walled tubes and tubes of soft metal.

An object of the invention is the provision of a generally improved tube bending device.

Another object of the invention is the provision of a bender having a novel arrangement of bending segments and for supplying members to provide a more useful and efficient hand tool.

A still further object of the invention is the provision of a tube bending device having improved means for applying force to the tube during the bending operations.

We have also aimed to provide a bending device wherein the walls of the tube are subjected to a confining and compressive force while the metal is being distorted.

A further object of the invention is the provision of a bending device wherein the tube is simultaneously bent and annularly confined and reduced in a progressive manner.

A still further object of the invention is to provide a bending tool having a shoe and follow-bar upon which the metal is bent, wherein the bending forces are applied solely by manipulation of the shoe and follow-bar.

An important object of the invention is the provision of a tube bending device for bending thin walled or soft metal tubes through curves of relatively short radius without flattening or rippling the tube.

Other objects and advantages will be apparent from the following description and the accompanying drawings, in which—

Figure 1 is a side view of the bender showing the manner of its use;

Fig. 2 is an edgewise view of the body member and roller;

Fig. 3 is a face view of the follow-bar;

Fig. 4 is a full sized side view of the bender showing the parts in the position for starting a bend;

Fig. 5 is a view similar to Fig. 4 showing the relative positions of the parts at the end of the bending operation;

Fig. 6 is a section on the line 6—6 of Fig. 4;

Fig. 7 is a section on the line 7—7 of Fig. 5, and

Fig. 8 is a section similar to Fig. 7 showing the roller moved for cooperation with the opposite segment to bend a pipe of smaller size.

The invention contemplates a tool or device for the bending of tubes which is particularly adapted for the bending of thin walled tubes or tubes made of soft metal such as copper without flattening or producing ripples in the tube due to the bending operations. In another aspect the invention contemplates a light weight tool adapted for manual manipulation such as may be carried about by the workman from place to place and used directly on the job, the tool having a minimum of weight and a maximum of adaptability to different sizes of tubes.

Referring first to Figure 1, the bender includes a body member 11, in this instance of cast metal, having a segment or shoe 12 of relatively large radius, and a segment or shoe 13 diametrically opposed to the segment 12, the segment 13 being of relatively small radius as shown in the figure. The radii of the segments 12 and 13 corresponding to the radii of the bends to be formed in tubes of the prescribed range as will presently become apparent, numerals being applied to the sides of the segments to designate the angularity as shown in Figure 1. The body 11 is carried on a handle 14 having a threaded end 15 arranged for reception in either of two diametrically opposed threaded sockets 16 and 17 on the edge of the body member 11.

Referring now more particularly to Figs. 6 and 7, the segment 12 has a pair of annular grooves 18 and 19 of semi-circular cross-section, the diameter corresponding to the diameter of two standard sized tubes, while the segment 13 has a pair of grooves 21 and 22 of semi-circular cross-section which likewise corresponds to the diameter of two smaller standard sized tubes, the two shoes or segments thus permitting bending operations to be performed on four sizes of tubes, in this particular instance, the tubes being of 3/4", 5/8", 1/2" and 3/8" outside diameter. Spaced from the leading end of segment 12 is an abutment member 23 having abutments 24 and 25 projecting laterally thereof in the planes of the grooves 18 and 19, the abutments having arcuate surfaces 26 and 27 spaced radially from the arc of the segment 12, as best shown in Fig. 5, for the reception thereagainst of the side wall of tubes to be bent in the grooves 18 and 19. An abutment member 28 likewise having abutments 29 and 31 provided with arcuate surfaces 32 and 33 is spaced beyond the leading end of the segment 13 and radially outward so as to receive pipes under the abutments in alignment with the grooves 21 and 22.

A shaft 34 extends through the body member 11 on the center of curvature of the segments 12 and 13 which are coincident. The shaft 34 has eccentric trunnions 35 and 36 at opposite

ends thereof which carry links 37 and 38 extending along the sides of the body member and of such length as to extend beyond the segment 12. A roller 39 is carried between the links 37 and 38 on a pin 41 which has a knurled head 42 and a threaded end 43, the pin passing through openings 44 and 45 in the links 37 and 38 as shown in Fig. 6, the threaded end 43 of the pin engaging threads in the opening 45. The pin 41 and roller 39 are positioned to leave a space between the segment 12 and the roller for the reception of a follow-bar 46 presently to be described more in detail. The links 37 and 38 also have openings 47 and 48 similar to the openings 44 and 45 for reception of the pin 41 in the manner shown in Fig. 8 so as to receive a follow-bar 49 between the roller and the segment 13. The trunnion 35 extends beyond the link 37 and is squared as shown at 51 to receive a lever 52 which functions through manual rotation to adjust the relative positions of the pin 34 and the links 37 and 38 and to thereby vary within limits the distance between the roller 39 and the segments 12 or 13 as the case may be.

A follow-bar, shown in Fig. 3, has at opposite ends the head portions 46 and 49 adapted for cooperation with the segments 12 and 13, respectively, the head portions being connected by a bar 53. The head portion 46 has grooves 54 and 55, and the head portion 49 has grooves 56 and 57 of a curvature corresponding to the outside radius of standard pipe sizes and corresponding to the curvature of the grooves 18, 19, 21 and 22 of the segments 12 and 13, the depth of the grooves being such that the follow-bar grooves in combination with the segment grooves substantially completely enclose the pipe as shown in Figs. 7 and 8. The head portions 46 and 49 have a length substantially equal to the distance from the abutment members 23 and 29 to the trailing end of the segments 12 and 13, respectively, so as to roll along the full length of the segments during the bending of a tube. It will be noted from Figs. 6 to 8, inclusive, that the width of the follow-bar head portions is somewhat less than the width of the segments 12 and 13, and while this is not necessarily true, this construction is adopted to keep the weight and size of the follow-bar to a minimum. The follow-bar thus will shift from side to side depending upon the size of tube being bent.

To bend a tube utilizing this bending device, the tube is inserted under one of the abutments conforming to the tube size as shown in Fig. 4 in which a tube of ¾" outside diameter is inserted under the abutment 24. The follow-bar is then inserted between the tube and the roller 39 with the groove 55 thereof seated over the tube and the tube resting in the groove 18 at the leading end thereof, the end of the follow-bar substantially abutting against the abutment member 23 in the position shown in Figs. 4 and 6. Preferably during this operation the lever 52 is swung to the position shown in Figs. 4 and 6 to allow of a maximum amount of space between the roller 39 and the segment 12. When the tube and follow-bar have been positioned, the lever 52 is rotated to the position shown in Figs. 5 and 7 so as to draw the roller toward the segment 12 and pull the follow-bar up until it approaches contact with the segment 12. The handle 14 and the free end of the follow-bar are then grasped by the operator as shown in Figure 1 and moved toward each other. As a result, the follow-bar is pressed against the segment 12 in the manner shown in Figs. 5 and 7 slightly ahead of the longitudinal center line through the links 37 and 38, compressing the tube in this area and at the same time bending the tube in the same area. As the follow-bar moves along the segment 12, the roller 39 simultaneously moves along so as to maintain the point of maximum pressure slightly ahead of the roller and in the bending area. The lever 52 should be adjusted so that this condition prevails; in other words, so that the roller is as close to the fulcrum of the follow-bar as possible and yet is not directly on the fulcrum. The closer the roller comes to this condition the more difficult it will be to roll the follow-bar along the segment, but in general the more perfect will be the bending result. Through this close adjustment of the point of bending and the application of forming pressure which serves to confine the walls of the tube within the area in which the bending occurs, flattening, crimping or rippling of the tube is prevented even in thin walled and soft metal tubes. For the bending of smaller tubes the handle 14 is screwed into the socket 17, the roller 39 is moved to the holes 47 and 48, and the bending operations are carried out in like manner against the segment 13 as shown in Fig. 8 employing the opposite end of the follow-bar with the head 49 cooperating with the segment 13 and the head 46 being used as the grip or handle for the purpose of rotating the follow-bar.

It will be seen that we have provided a light weight, small and efficient bending device for hand operation. By employing two oppositely spaced segments on the same body member, each of which have two grooves in parallel planes, we are enabled to bend four different sizes of tubes and yet maintain the body light in weight and comparatively thin. This structure of the device is of merit in any manually operated tube bending mechanism. On the other hand, in the provision of a follow-bar of the character described and the utilization of a roller and shoe cooperating therewith in the manner set forth, we are enabled to bend thin walled and soft metal tubes with an ease and convenience heretofore unknown. Through this arrangement we are enabled to provide a bender for thin walled tubes of such simplicity and efficiency that the tool may be carried about on the work by the workman in the same manner as any other tool and through which perfect bends may be formed in such tubes. An important part of the invention is the eccentric mounting of the links 37 and 38 which permits of adjustment of the position of the roller so as to predetermine the length of the work arm on the lever.

While we have thus described and illustrated a specific embodiment of the invention by way of illustration, we are aware that the principles thereof may be incorporated in specifically different embodiments, and we do not wish to be limited except as required by the prior art and the scope of the appended claims, in which we claim:

1. The combination in a tube bender of a body member having a handle for supporting the bender in the hand of the operator and an arcuate bending segment fixed thereon provided with an annular groove for receiving a tube, a round roller carried on said body member in spaced relation to the periphery of said segment and adapted to move therealong in concentric relationship, a follow-bar having a handle portion and a head portion shaped for reception be-

tween the roller and the segment in tangential relation to the segment, said head portion having a groove for registration with the groove in the segment to receive a tube therebetween and shaped to abut against the segment upon compression of the tube, said head portion having an outer surface for movement of the roller thereover in response to movement of the follow-bar to compress and bend the tube in a shifting area of contact forwardly of the roller between the bar and the segment as the handles are moved together.

2. The combination recited in claim 1 wherein means are provided for adjusting the radial position of the roller.

3. The combination in a hand operated tube bender of a body member having a handle for supporting the bender in the hand of the operator and an arcuate bending segment provided with an annular groove for receiving a tube, links journaled on opposite sides of said body member at the center of curvature thereof and projecting beyond said segment, a roller pivotally carried between said links in spaced relation to said segment, a follow-bar having a head portion including a flat outer side and an inner side provided with longitudinal grooves for the reception of that portion of the tube projecting from the groove in said segment and having a relatively long handle adapted to act as a lever, said head portion being shaped for reception between the roller and the segment in tangential relation to the segment, said roller serving as a fulcrum for compression of the tube upon movement of the handle on said follow-bar to move over the outer side of the follow-bar with movement of the latter to move the point of contact progressively along the segment forwardly of the roller and bend the tube without relative sliding movement of the segmental follow-bar against the tube, and eccentric means for moving the point of support of said links to vary the distance between the segment and the roller.

4. The combination recited in claim 3 wherein said eccentric means includes a pin positioned in said body substantially at the center of curvature of said segment having eccentric trunnions at its ends for reception of said links, and means for rotating said pin to move the trunnions and thereby vary the distance between the roller and the segments in any position of the roller.

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