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[54] WIRE BENDING APPARATUS
8 Claims, 7 Drawing Figs.

[52] U.S. Cl. 72/321,
72/216, 72/453, 72/458

[51] Int. Cl. B21d 11/04

[50] **Field of Search**..... 72/317,
321, 322, 387, 319, 389, 157, 159, 217, 216, 297,
298, 316, 453, 458

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ABSTRACT: A wire bending apparatus for bending electrical cables and the like, in narrow confines such as panel boxes. A supporting block is provided for supporting a cable during a bending operation and a hydraulically operated lever moves the wire on a guide connected to the supporting block. The apparatus is flexibly mounted to a hydraulic cylinder or the like, for operation in narrow confines requiring bends of specific degrees and locations.

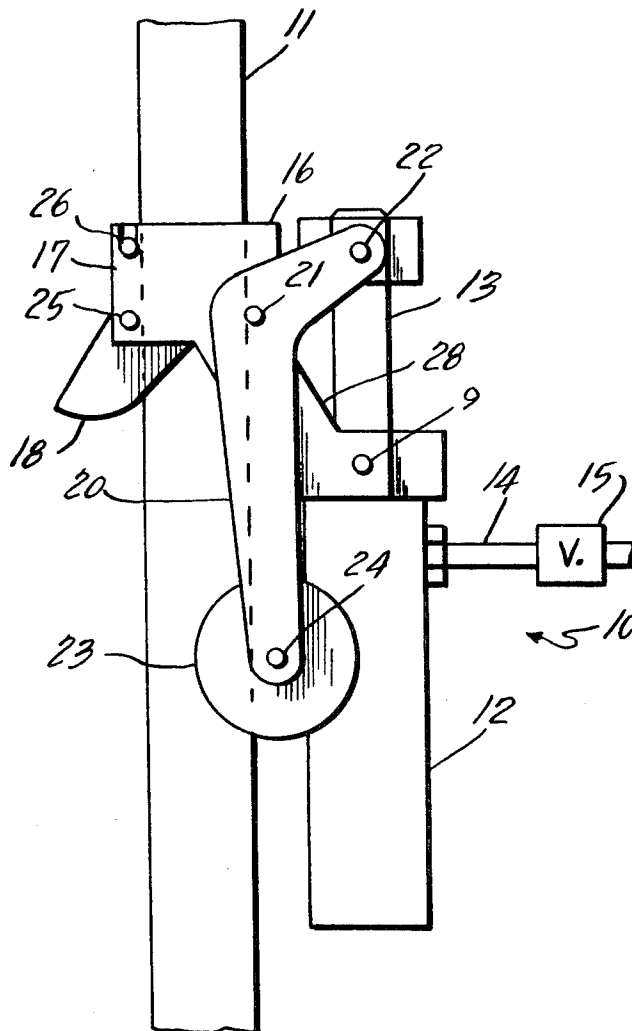


FIG. 1

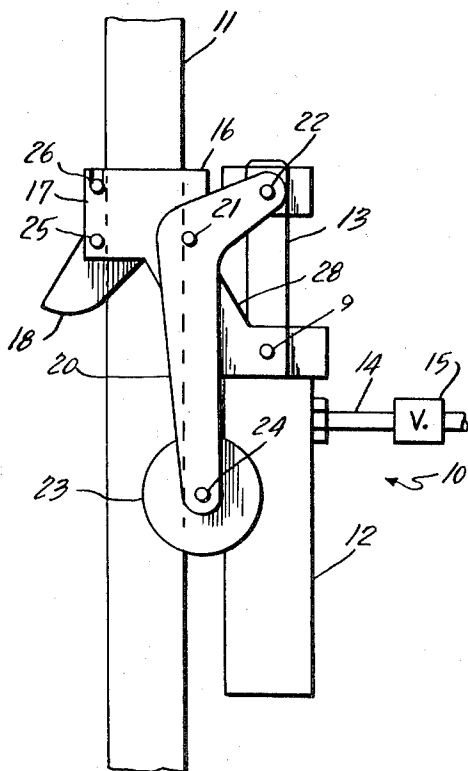


FIG. 2

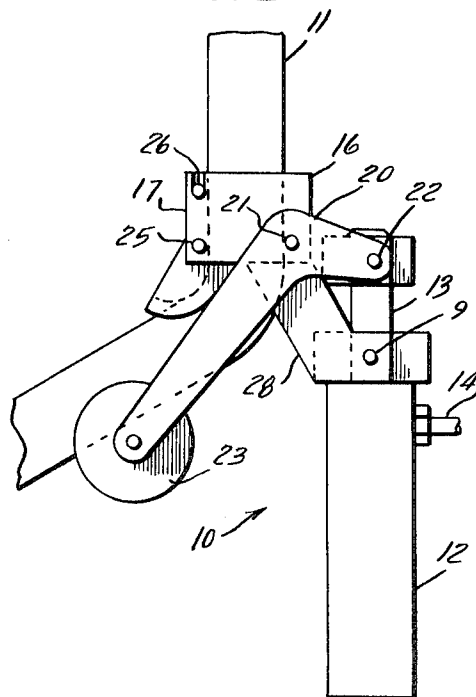
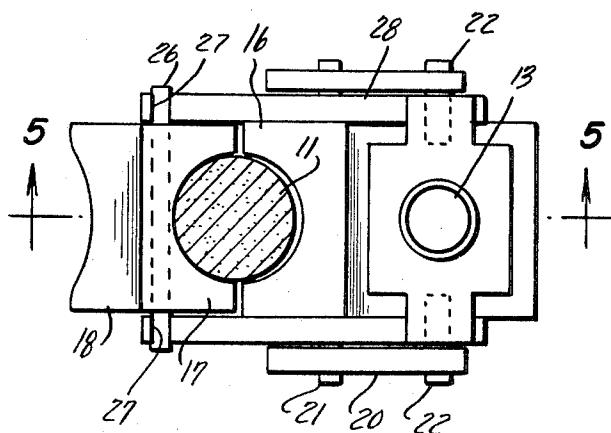


FIG. 3



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FIG. 4

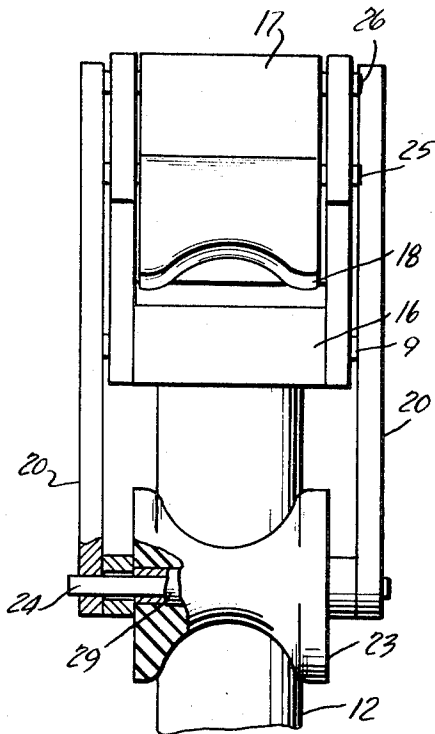


FIG. 5

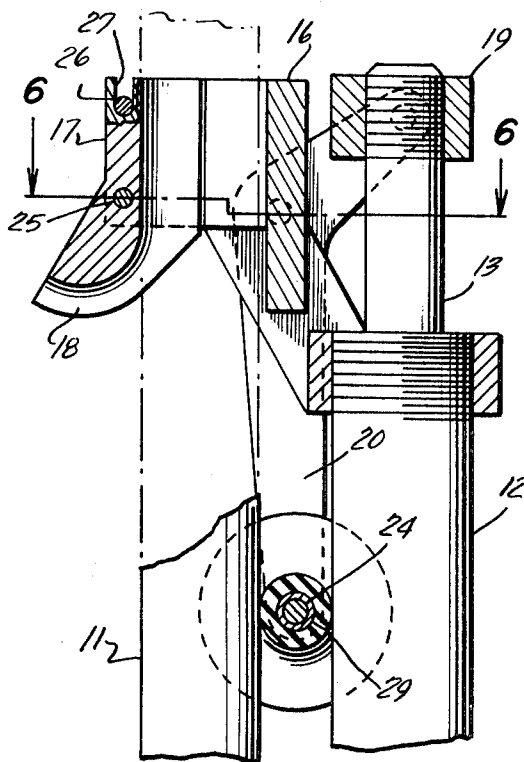


FIG. 7

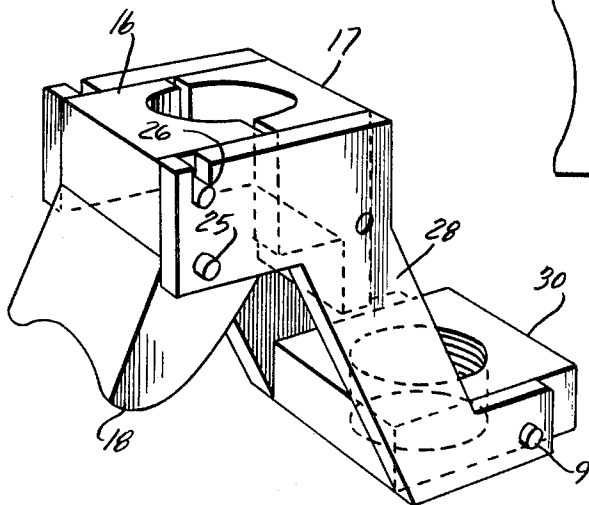
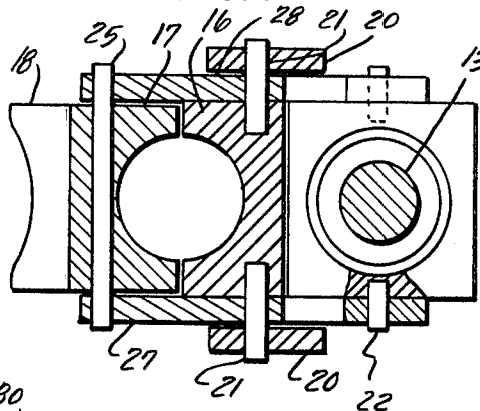


FIG. 6



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WIRE BENDING APPARATUS

BACKGROUND OF THE INVENTION

This invention is an improvement to my copending application, Ser. No. 727,773 filed May 9, 1968 and entitled Wire Bender.

1. Field of the Invention

The present invention relates to wire benders and more particularly to a hydraulic actuated electrical conductor bender adapted to bend an electrical conductor inside a panel box, junction box, switchboard, or the like.

In electrical contracting work after panel boxes, and the like, are installed and connected to conduit, or the like, the electrical wire or cable is pulled taut and fastened to the box. When heavy conductors are used, a steel fish tape may be needed to draw the cable through the conduit. Conductors may also be pulled tight using block and tackle or special machines including winches for pulling the cable tight. Once the cable is fastened to the junction box, panel box, or the like, it may be bent to the desired degree and into proper position, and then cut to length for fastening to terminals within the box. When heavy cable is being used, it becomes very difficult to bend it within a box, or the like, in narrow confines. This in turn results in damage to cable, waste in time, expensive cable and strenuous working conditions.

2. Description of the Prior Art

In the past various types of hickies and benders have been used to bend thin-walled and rigid conduits. These benders are sometimes bench types and may be hydraulically operated to bend the conduit for installation. These devices, however, are not generally useful for bending the ends of heavy conductor cables for connection to various types of connectors. For instance, the benders are big, relatively bulky devices that cannot be used in tight quarters such as in working inside panel and junction boxes, and the like. These benders generally are made for inserting a piece of conduit prior to installation, then gripping it in some manner at one point and applying force to another point on the pipe to bend it around a curved guide having a predetermined radius to bend the pipe at a desired curvature which must be large enough to prevent coupling of the pipe at the bend.

Machines have also been suggested in the past for bending metal rails, beams, bars, and the like. One such machine is used in the manufacture of chain links and is, of course, bulky and for use only in a manufacturing plant. Another such device is used in the manufacture of springs and yet another such machine is used to bend rails as used in train tracks and other very heavy metal stock.

SUMMARY OF THE INVENTION

The present invention is a wire bending apparatus for bending electrical cables, and the like, in tight spots such as panel boxes and has an actuating means such as hydraulic cylinder with a pulling rod. The cylinder has supporting members connected thereto and a lever fulcrummed on the supporting members and driven by the cylinder rod to one end to rotate a wire guide on the other end of the lever. The support members have a two-piece wire supporting block connected thereto for holding the wire to be bent with one of the supporting block pieces being easily disconnected as well as reconnectable and also having a wire guide thereon for bending the wire held in the block to the desired shape. Movement of the lever forces the wire around the guide on the block. The support members are advantageously pivotally connected to the hydraulic cylinder for more flexible location. The invention is light and portable and especially adaptable for working in narrow working confines.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of this invention will be apparent from a study of the written description and the drawings in which:

FIG. 1 is a side elevation view of an embodiment of the present invention with the wire installed preparatory to bending;

FIG. 2 is a view similar to FIG. 1 with hydraulic piston actuated operating the bending element about its pivot point initiating the bending of the wire;

FIG. 3 is a top plan view with the wire shown in section;

FIG. 4 is a front elevation, with parts broken away and shown in section seen from the left side of FIG. 3;

FIG. 5 is a sectional view taken on the line 5-5 of FIG. 3;

FIG. 6 is a sectional view taken on the line 6-6 of FIG. 5 with additional parts broken away and shown in section; and

FIG. 7 is a perspective view of the bending element support assembly with the bending arm removed for clarity and the hydraulic cylinder removed.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1 and 2 show a preferred embodiment 10 having a wire or cable 11 placed therein. A hydraulic cylinder 12 has a pulling rod 13 and inlet hose 14 which may have a valve 15. A cable supporting block 16 is held by frame members 28 connected by pins 9 to cylinder 12 and has a disconnecting or removable upper portion 17 also connected to members 28 and to be described in more detail later. The upper disconnecting support block 17 has a wire guide 18 forming a part thereof to guide the wire or cable 11 to the desired bend.

A pair of levers 20 is fulcrummed on the lower support block 16 by a pin 21 or by any other desired means. The levers 20 are elbow-shaped and are movably pinned to rod 13 by pin connections 22 at one end of the levers. The other end of levers 20 have a roller or guide shoe 23 connected therebetween by a pin 24. It should, of course, be clear that guide 23 could be other than a roller and would not have to be movable without departing from the spirit and scope of the invention. An inside threaded member 19 is threaded to the rod 13 and has pins 22 connected thereto.

As can be seen from FIGS. 1 and 2 the hydraulic cylinder 12 is actuated, pulling the rod 13 thereinto, thereby moving the levers 20 on fulcrum 21 and forcing the supported wire 11 around the guide 18. The wire 11 is shown being bent around guide 18 by the bender 10 in FIG. 2 which figure is the same embodiment as FIG. 1. The frame members 28 can pivot on pins 9 for adaptability in working in narrow confines.

Referring now to FIG. 3, a sectional plan view shows the wire 11, cylinder rod 13, lower support block 16, levers 20 and pins 21 and 22. The upper section of support block 17 with guide 18 can be seen to be separable from the lower section of the support block 16 and from frame members 28. The upper block 17 is held to the members 28 by pins 25 (FIGS. 1, 2 and 7) which may be slipped in and out to connect or disconnect the upper block 17 to the lower block 16.

FIG. 4 shows yet another view with parts broken away and shows roller 23 held by cylinder 12, pins 25, levers 20 and pin 24 sliding in a bushing 29, and connected to the levers 20. Upper block 17 and guide 18 can be seen as can a portion of the lower block 16. FIG. 5 is taken along line 5-5 of FIG. 3 and shows more clearly how member 19 is threaded to rod 13 and how lower block 16 is threaded to cylinder 12, it being understood that these connections could be made otherwise than by threads. Guide 18 and upper block 17 can be seen along with pin 25 and fixed pins 26. When pin 25 is removed, upper block 17 can be removed from lower block 16 by sliding the block away from pin 26 along notches 27 located in frame members 28. This is normally done in inserting a new cable end into the block and after the bend has been made. However, the new cable end may be slipped through the support block without removing the upper portion if there is sufficient working room. This removable upper portion desirably provides for easy change of upper block 17 and guide 18 for use with a different type of cable or for a different amount and shape of the bend. The wire is seen in broken lines as is the hidden portion of one of the levers 20.

FIG. 6 is a view taken along lines 6-6 of FIG. 5 and shows cutaway sections of upper block 17, lower block 16, levers 20, and members 28. Pin 25, and pin 21 can be seen as can guide 18 and rod 13.

FIG. 7 is a perspective of the support block showing lower support block 17, upper support block 16, guide 18, pin 25 and 26, and block frame members 28. A threaded member 30 is attached to the hydraulic cylinder 12 and has pins 9 for pivoting frame members 28 thereon for ease in locating the blocks 16 and 17 and guide 18 to obtain a desired bend in the desired degree and location while working in narrow confines.

At this point it will be clear that a wire bender has been provided which is adapted to bend heavy electrical cables, and the like, in locations where the working space is limited, such as the ends of cables to be connected in panel boxes. The invention is not, however, to be construed as limited to the uses and embodiments illustrated since other uses, especially those requiring bending operations in tight working space or where easy portability and lightweight may be desired. One variation, for instance, might use pneumatic or other actuating means rather than a hydraulic cylinder, a hydraulic cylinder being used because of its commercial availability. Another variation might include a sleeve to slide over the wire to be bent to adapt the support block for different size wires. The sleeve could be made of teflon for ease in sliding onto and off the wire.

This invention is not to be construed as limited to the particular forms disclosed herein, since these are to be regarded as illustrative rather than restrictive.

I claim:

1. A wire bending apparatus comprising in combination:

- a. actuating means having an extendable and retractable rod means;
- b. frame means attached to said actuating means;
- c. lever means having at least two end portions, one said end portion being movably connected to said actuating rod

means;

d. fulcrum means connected to said lever means between the end portions thereof, said fulcrum means also being attached to said frame means;

e. first guide means connected to the other end portion of said lever means;

f. support block means connected to said frame means and adapted for supporting a wire therein during bending of the wire; and

g. second guide means connected to said support block means for guiding the bending of said wire being supported by said block means whereby a wire may be bent in accordance with the shape of said guide means.

2. The cable bending apparatus according to claim 1, in which said support block means has a pair of sections, one said section being disconnectable from the other said section, whereby said support block may be connected to a cable between the ends thereof.

3. The cable shaping apparatus according to claim 2 in which said one section of said support block means has second guide means fixedly connected thereto.

4. The apparatus according to claim 3 in which said frame means is pivotably connected to said actuating means.

5. The apparatus according to claim 3 in which said lever means are elbow-shaped.

6. The bending apparatus according to claim 4 in which said one section of said support block means is interchangeable with sections of different shapes.

7. The wire bending apparatus according to claim 5 in which said first guide means is a roller with a concave shoe on its outer periphery.

8. The bending apparatus according to claim 7 in which said actuating means includes a hydraulic cylinder having a pulling rod.

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