July 31, 1934. A. HOSSFELD 1,968,645

BENDING DEVICE FOR METALLIC TUBES AND THE LIKE

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Fig. 3

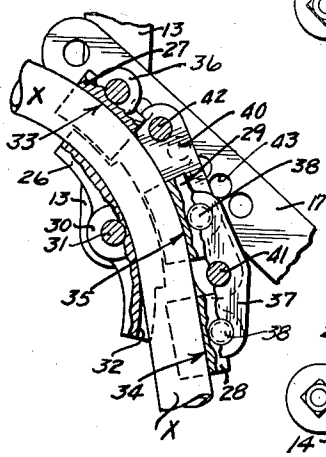


Fig. 1

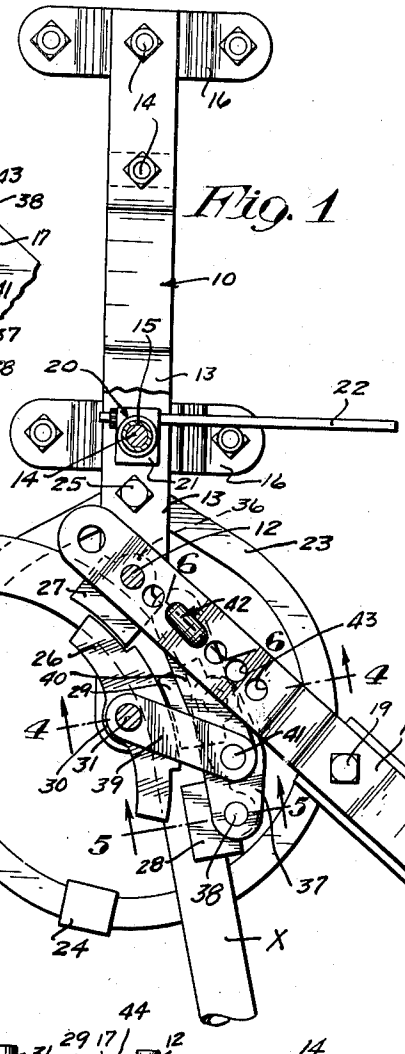


Fig. 4

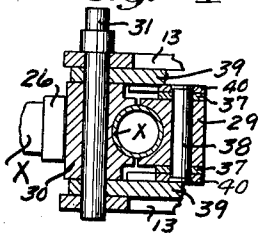


Fig. 5

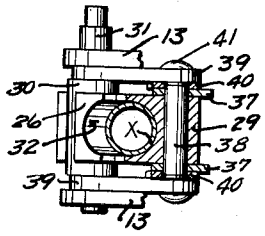
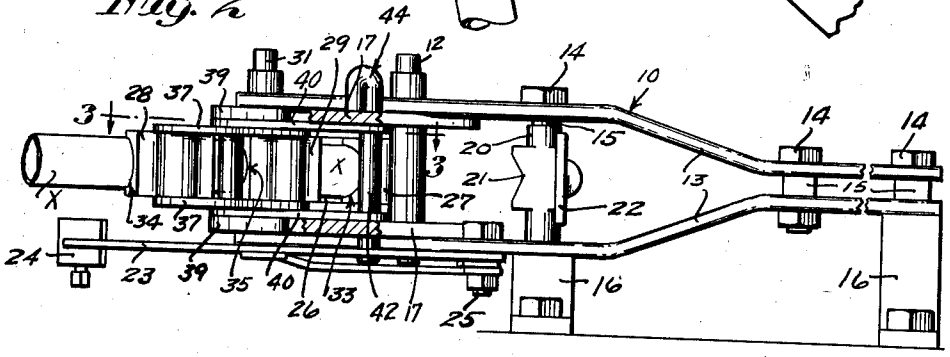


Fig. 6



Fig. 2



INVENTOR
ALBERT HOSSFELD
BY HIS ATTORNEYS
Marshall & Kilgore

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Fig. 7

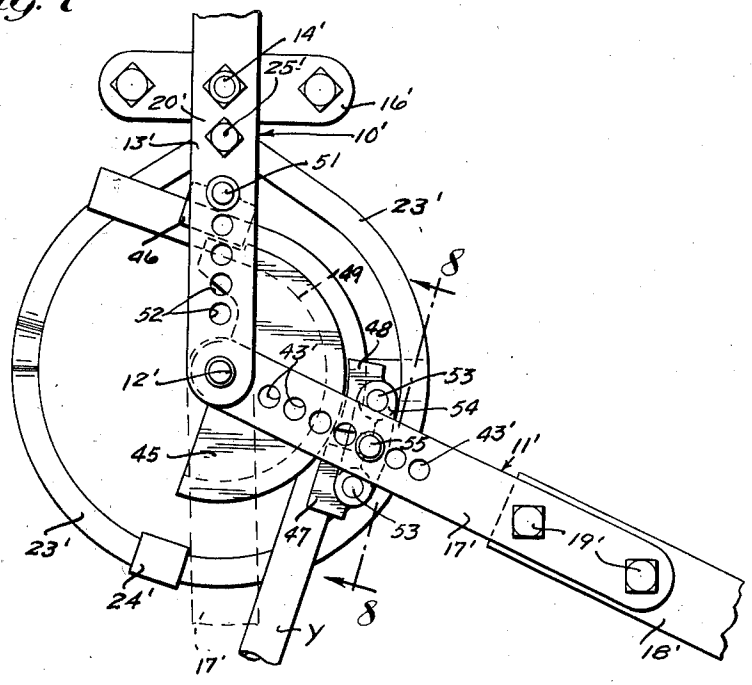


Fig. 9

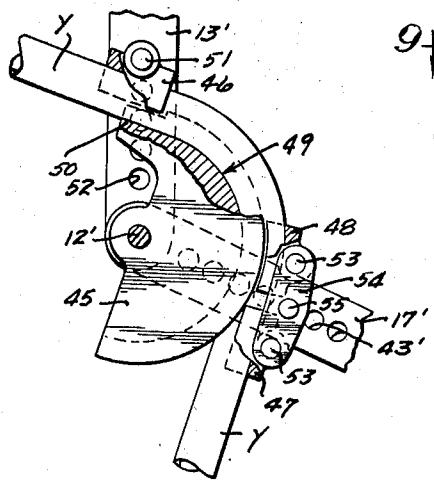
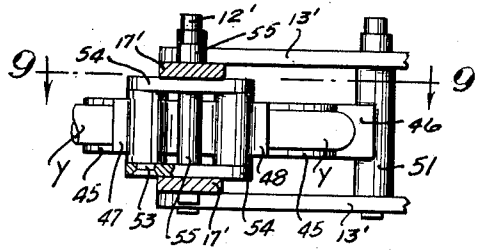


Fig. 8



INVENTOR
ALBERT HOSSFELD
BY HIS ATTORNEYS
Merchant & Gilmore

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BENDING DEVICE FOR METALLIC TUBES AND THE LIKE

Albert Hossfeld, Winona, Minn.

Application February 13, 1933, Serial No. 658,026

10 Claims. (Cl. 153—45)

My present invention relates to metal bending and more particularly to metal bending devices of the same general type disclosed and broadly claimed in my United States Letters Patent 1,473,101 of date November 6, 1923, and 1,325,594 of January 20, 1925.

This invention provides an extremely simple and highly efficient device for bending metallic tubes and the like and may be either manually or power operated.

While the invention is intended for general use it is especially well adapted for use by electricians either in a shop or on a job for bending metallic tubes to be used as conduits in dwellings or other buildings, for holding electric light and power wires. Such tubes, as now generally used, have thin walls and heretofore it has been difficult to bend such tubes without distorting their true cylindrical form and the object of this invention is to bend a thin wall tube, without the use of an inside mandrel, by holding the same against flattening or caving in at its outer or stretching portion and against wrinkling or buckling at its inner or upsetting portion.

While the invention is shown embodied in a bending device of the type heretofore referred to, it is equally well adapted for embodiment in various types of hand and power operated benders or in bulldozer power presses.

To the above end, generally stated, the invention consists of the novel devices and combinations of devices hereinafter described and defined in the claims.

In the accompanying drawings, which illustrate the invention, like characters indicate like parts throughout the several views.

Referring to the drawings:

Fig. 1 is a plan view showing one form of the improved bending device with some parts broken away and other parts shown in section;

Fig. 2 is a right-hand elevation of the bending device as shown in Fig. 1, some parts broken away and other parts sectioned;

Fig. 3 is a view partly in plan and partly in horizontal section taken on the line 3—3 of Fig. 2;

Fig. 4 is a view principally in vertical section taken on the line 4—4 of Fig. 1;

Fig. 5 is a view partly in elevation and partly in section taken on the line 5—5 of Fig. 1;

Fig. 6 is a fragmentary view partly in elevation and partly in section taken on the line 6—6 of Fig 1;

Fig. 7 is a fragmentary plan view showing another form of the invention;

Fig. 8 is a view partly in elevation and partly in vertical section taken on the line 8—8 of Fig. 7; and

Fig. 9 is a view partly in plan and partly in section taken on the line 9—9 of Fig. 8.

Referring first to the improved tube bending device, as shown in Figs. 1 to 6, inclusive. The numeral 10 indicates a main or stationary frame and the numeral 11 indicates a bending frame that is pivotally attached to said main frame by a bearing bolt 12 for horizontal swinging movement about the axis of said bolt. The main frame 10 comprises a pair of upper and lower horizontal flat bars 13 that are rigidly connected and held vertically spaced, the one above the other, by means of front, rear and intermediate bolts 14 and spacing sleeves 15. This main frame 10 further includes front and rear leg brackets 16 on which the lower frame bar 13 rests and is rigidly secured thereto by front and rear bolts 14. By reference to Fig. 2 it will be noted that the frame bars 13, between the front and intermediate sleeves 15, are in forwardly diverging relation so that said bars, at their front end portions, are considerably farther apart than at their rear end portions.

The bending frame 11 comprises a pair of upper and lower horizontal bars 17 that are rigidly connected at one of their ends to a handle bar 18 by a pair of bolts 19. Forward of the handle 18 the frame bars 17 are vertically spread and extend between the frame bars 13 to which they are connected by the bearing bolt 12 and have direct bearing on the corresponding frame bars 13 at their opposing faces.

Turnably mounted on the front spacing sleeve 14 is a loose bearing sleeve 20 with which is formed a V-shaped holding member 21 and attached to said sleeve is a bend-forming member 22.

Below the frames 10 and 11 is a horizontally disposed substantially annular gauge-supporting member 23 on which is mounted a set-screw equipped gauge 24. This gage-supporting member 23 is held in a fixed horizontal position by being frictionally clamped onto the lower frame bar 13, at its under side, by a bolt 25.

The parts thus far shown and described are parts of the machines shown in the patents heretofore identified.

Referring now in detail to the present invention as embodied in the machine above described, the same includes a bend-forming block or die 26, a rear or holding block 27, a front or bending block 28, and an intermediate or compression block 29. The forming block 26 is, as shown, in the form

of a segment pivotally attached to the frame bars 13 by a bearing bolt 31 for horizontal swinging movement therebetween. This bearing bolt 31 extends through aligned holes in the outer end portions of the frame bars 13 and a hub 30 on the back of the block 26 intermediate of its ends.

In the face of the segmental bend-forming block 26 is a groove 32 that extends circumferentially thereof and the bottom of said groove is on an arc having substantially the same radius as that of a curve on the inside of a bend to be made in a tube X. The groove 32 in cross-section is substantially a semicircle, that has substantially the same radius as the external diameter of the tube X. In the faces of the blocks 27, 28 and 29 are grooves 33, 34, 35, respectively, that are circumferentially aligned and in opposing relation to the groove 32 in the forming block 26.

The bottoms of the grooves 33 and 35 are on arcs having substantially the same radii as that of the curve on the outside of the bend to be made in the tube X. The longitudinal bottom of the groove 34 is straight. In cross-section the grooves 33, 34 and 35 are semi-circular and have substantially the same radii as the external diameter of the tube X. All of the blocks 26, 27, 28 and 29 have limited pivotal movements in the same horizontal plane. The block 27 is pivotally connected to the frame bars 13 by the bearing bolt 12 which extends through a hub 36 on the back of said block intermediate of its ends. This hub 36 extends between the frame bars 17 and acts as a spacer and holds said bars laterally spaced and in bearing contact with opposing faces of the frame bars 13.

By reference to Fig. 1 it will be noted that the center of the bearing bolt 12 is substantially on the same radial line as the rear end of the block 26 and thus holds the block 27 with substantially its rear half projecting rearward from the respective end of the block 26. The blocks 28 and 29 are connected by a pair of laterally spaced equalizing levers 37 between which they work. These blocks 28 and 29 are pivotally connected by bearing pins 38, the former to the front ends of the equalizing levers 37 and the latter to the rear ends thereof. Said bearing pins 38 are anchored in the equalizing levers 37 and extend through hubs on the backs of the blocks 28 and 29 intermediate of their ends.

By reference to Fig. 3 it will be noted that the block 28 has substantially the same relation to the front end of the block 26 as the block 27 has to the rear end thereof. The equalizing levers 37 hold the block 29 substantially midway between the blocks 27 and 28 from which it is endwise spaced and substantially at the longitudinal center of the block 26.

The equalizing levers 37 are connected to the main frame 10 by a pair of links 39 and are also connected to the swinging frame 11 by a pair of links 40. These pairs of links 39 and 40 are in the form of a pair of toggle levers that are pivotally connected at their elbows by a common bearing pin 41 to the equalizing levers 37 intermediate of their ends. The other or outer ends of the links 39 are connected to the main frame by the bearing bolt 31 and the other or outer ends of the links 40 are connected to the swinging frame 11 by a wrist pin 42 which extends through any one pair of holes 43 in the frame bars 17. These pairs of holes 43 are spaced equal distances apart from the bearing bolt 12 and longitudinally of the frame bars 17. The toggle-levers 39—40 are arranged to straighten during the rearwardly swinging movement of the frame 11 and to buckle during the forward swinging movement of said frame. The leverage of the toggle levers 39—40 may be changed, at will, by shifting the wrist pin 42 in the different pairs of holes 43 either toward or from the bearing bolt 12.

By reference to Fig. 6 it will be noted that the wrist pin 42 has a yoke-like head 44 the short leg of which normally extends into an adjacent hole 43 and holds said pin from turning about its axis. This head 44 acts as a stop to limit the forward swinging movement of the swinging frame 11 by its engagement with the upper frame bar 13.

It will, of course, be understood that it will be necessary to have, for each size of pipe to be bent, a full set of blocks 26, 27, 28 and 29 in which the face grooves fit the respective tube. It will also be understood that it will be necessary, when bending tubes of the same diameter, but on arcs of different radii, to have a corresponding number of blocks 26 in which the bottoms of their face grooves have corresponding radii.

To bend a tube the bending frame 11 will first be swung rearwardly by means of its handle 18 and which movement will straighten the toggle levers 39—40 and thereby radially separate the blocks 28 and 29 from the block 26. With the bending frame 11 in this position the block 26 is free for a limited swinging movement about the axis of the bearing bolt 31. This limited swinging movement of the block 26 is sufficient to permit the rear end portion thereof to be radially separated from the block 27 to receive therebetween the tube X when inserted endwise into the device from the front end thereof and between the blocks 28 and 29 and the block 26.

After the tube X has been placed in the device with the portion thereof to be bent in the groove 32 of the block 26, the bending frame 11 is swung forwardly which buckles the toggle levers 39—40 and carries the blocks 28 and 29 into contact with the tube X on the opposite side thereof from the block 26 over which said tube is to be bent.

As pressure is applied to the equalizing levers 37 the block 28 will force the tube X into the groove 32 in the block 26 and bend the same over the bottom of said block and into an arc having the same radii as the bottom of said groove. During the bending of the tube X the block 29 and cooperating block 26 extends substantially completely around the tube X and places the same under compression which prevents the tube X from caving in or flattening at its greatest diameter where the stretching takes place during the bending of the tube. These cooperating blocks 26 and 29 also prevent the tube from buckling or wrinkling at its inside diameter or where the upsetting operation takes place during the bending of the tube X and keeps the tube in its true and original cylindrical form.

It will be noted that compression applied to the tube X by the block 29 is directly opposite the bearing pin 31. Bending pressure applied to the tube X by the block 28 tends to rock said block about the axis of its bearing 31 and thereby swings its rear end portion toward the block 27. In this position of the blocks 26 and 27 the bent portion of the tube X is substantially completely around said block and securely holds the same.

As the equalizing levers 37 are pivoted to the toggle levers 39—40 midway between the pivotal connections of the two blocks 28 and 29, equal pressure will be applied to said blocks by the

levers 37. If the bearing pin 41 is shifted to either side of its present position, greater pressure will be applied to one of the blocks 28 and 29 than the other, depending upon which way said bearing is shifted.

The bend of the tube X is accomplished by a plurality of short bites produced by first swinging the frame 11 rearwardly to release the tube X and permit the same to be fed endwise rearwardly in the groove 32 of the block 26 and then by swinging said frame forwardly to bend the tube X, as previously described. It is, of course, understood that the tube X may be bent to form a short arc up to a complete circle.

Referring now in detail to the embodiment of the invention as shown in Figs. 7, 8 and 9, which differs from the embodiment just described, in that a tube may be bent on an arc up to 180° by a single operation of the swinging frame instead of a plurality of short bites as required in the embodiment of the invention, as shown in Figs. 1 to 6, inclusive.

The main and swinging frames are the same as those shown in Figs. 1 and 2 and have the same reference numerals followed by a prime. The die or forming block, the holding block, the bending block, and the compression block, are indicated by the numerals 45, 46, 47 and 48, respectively. The forming block 45 is mounted on the bearing pin 12' for limited swinging movement about the axis thereof and has in its face a groove 49, the bottom of which is on an arc of 180°. This groove 49 also has a short tangential rear end extension 50 in which the bottom thereof is flat. The holding block 46 is pivotally attached to the frame 13 by a bearing pin 51 which may be inserted through any one of a plurality of pairs of aligned holes 52 in said bars. This holding block 46 is arranged to cooperate with the tangential extension 50 on the block 45 and performs the same function as the holding block 27. The blocks 47 and 48 are pivoted at 53 to a pair of equalizing levers 54, which in turn, are directly pivotally connected to the frame bars 17 by a bearing pin 55. This pin 55 may be inserted through any one pair of the holes 43'. The functions of the blocks 47 and 48 are the same as those of the blocks 28 and 29 and have the same general arrangement with respect to each other and the block 45.

The bottom of the groove in the block 47 is flat while the bottom of the groove in the block 48 has the same radius as the outer radius of the tube Y. When blocks 45 having face grooves of different radii are used, the blocks 46, 47 and 48 may be adjusted toward or from the axis of the bearing pin 12' by shifting the pin 51 in the holes 52 and the pin 54 in the holes 43'.

In the embodiment of the invention it is important to note that the bottom of the grooves 49 is on an arc, the center of which is the axis of the bearing 12' so that the relation of the blocks to the bending point of the tubes does not change. In this arrangement the compression block follows the bending block at the exact point where the bending action is taking place and the bending block leads the compression block at an unchanging distance ahead of the bending point of the tube.

The bending device shown in Figs. 1 to 6, inclusive, is especially designed as a simple hand power applying mechanism for bending tubes of relatively large diameter. The bending device shown in Figs. 6 to 9, inclusive, is especially designed as an efficient and quick acting device for bending tubes of small diameter by hand power.

It will be understood that the invention described is capable of various modifications within the scope of the invention herein disclosed and claimed.

What I claim is:

1. In a device of the class described, a relatively fixed frame and a relatively movable frame, a die mounted on the fixed frame, an equalizer connected to the movable frame with freedom for oscillatory movement with respect thereto, and a bending member and a compression member carried by the equalizer with freedom for independent oscillatory movement in respect thereto and for cooperation with the die.

2. The structure defined in claim 1 in which the die is in opposing relation to the bending member and the compression member, and which die and members are pivoted for swinging movement in the same plane and have grooves in their opposing faces.

3. In a device of the class described, a relatively fixed frame and a relatively movable frame, a die on the fixed frame, a toggle lever having one of its links attached to the fixed frame and its other link attached to the movable frame, an equalizing lever intermediately pivoted to the toggle lever, and a bending member and a compression member pivoted one to each end of the equalizing lever for cooperation with the die.

4. In a device of the class described, a main frame, a swinging frame pivoted to the main frame, a die and a cooperating holding member on the main frame, an intermediately pivoted equalizing lever connected to the swinging frame with freedom for oscillatory movement in respect thereto, and a bending member and a compression member carried one on each end of the equalizing lever with freedom for independent oscillatory movement in respect thereto and for cooperation with the die.

5. The structure defined in claim 4 in which the die is in opposing relation to the holding member, the bending member and the compression member.

6. The structure defined in claim 4 in which the die is in opposing relation to the holding member, the bending member and the compression member, said die and members being pivoted for turning movement in the same plane and have grooves in their opposing faces.

7. In a device of the class described, a main frame, a swinging frame pivoted to the main frame, a die mounted to turn about the axis of the pivotal connection between the two frames, a holding member pivotally mounted on the main frame for cooperation with the die, a toggle lever having one of its links attached to the main frame and its other link attached to the swinging frame, an equalizing lever intermediately pivoted to the toggle lever, and a bending member and a compression member pivoted one to each end of the equalizing lever for cooperation with the die.

8. The structure defined in claim 7 in which the toggle link attached to the swinging frame is adjustable toward or from the pivotal connection between the two frames.

9. The structure defined in claim 3 in which the link of the toggle lever at its attachment to the movable frame is adjustable longitudinally of said frame.

10. The structure defined in claim 4 which further includes adjustable means for varying the leverage applied to the equalizer by the movable frame.

ALBERT HOSSFELD.