March 6, 1962 G. A. SALL 3,023,650

HAND-OPERATED TUBE-BENDING MACHINE

Filed Feb. 1, 1960

Fig. 1

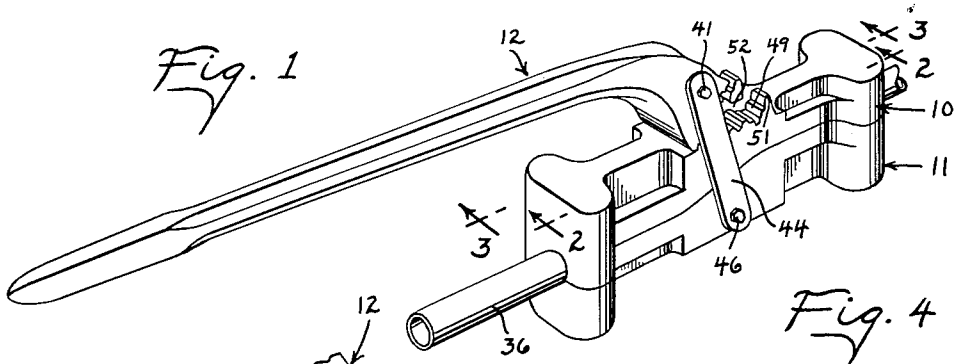


Fig. 2

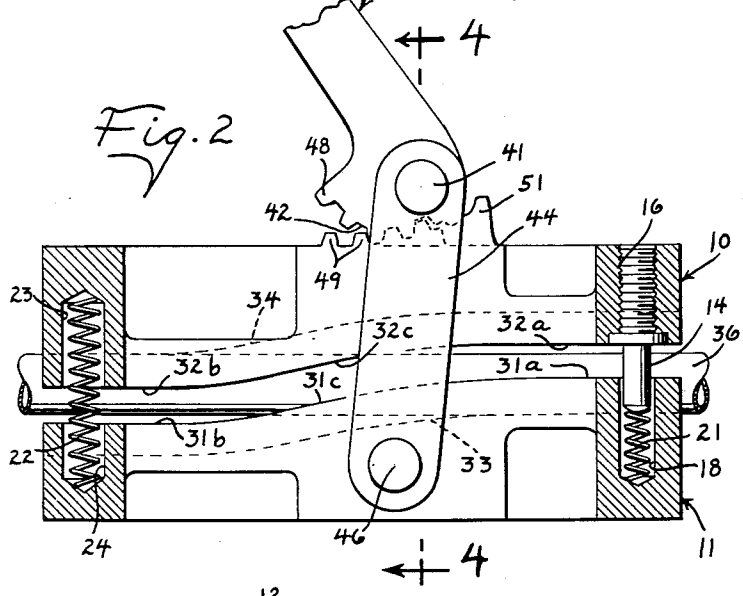


Fig. 4

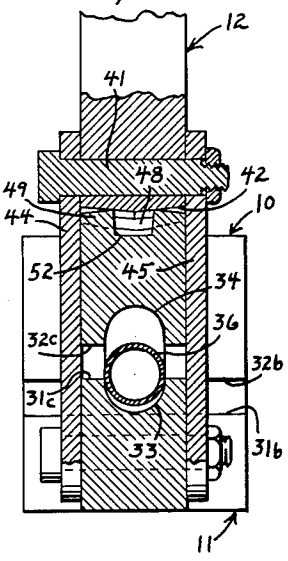
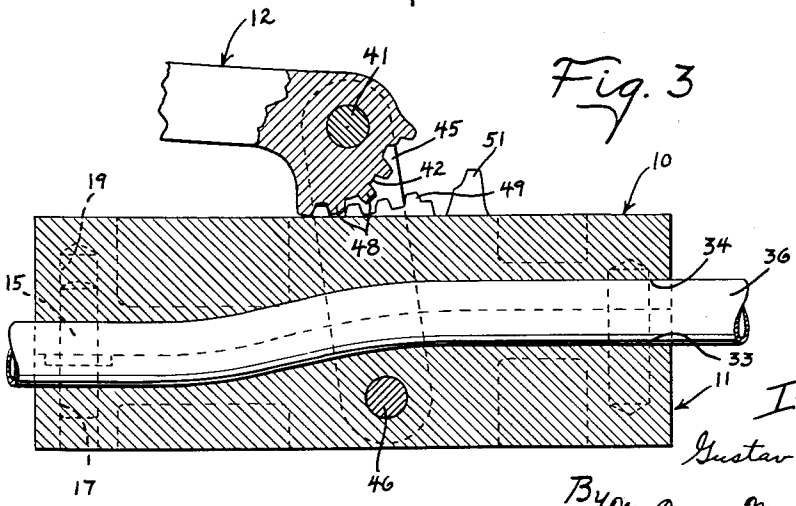


Fig. 3



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HAND-OPERATED TUBE-BENDING MACHINE

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This invention relates to a hand bending machine and particularly to a machine for bending conduit and the like.

An important object of this invention is to provide a hand bending machine which will rapidly and accurately produce an offset or reverse bend in a section of conduit.

Another object of this invention is to provide a hand bending machine having a lever operated eccentric cam for moving one die block toward and away from the other die block and having an improved arrangement for mounting the cam lever so as to minimize wear and frictional resistance to movement of the cam lever between its release and clamping positions.

A more particular object of this invention is to provide a hand bending machine having a lever operated eccentric cam for moving one die block toward and away from the other, in which the lever operated cam is mounted by links on one die block so as to permit the pivot point of the eccentric cam to shift longitudinally of the other die block as the lever is moved between its clamping and release positions.

Yet another object of this invention is to provide a hand bending machine which is of simple construction and which can be easily and economically manufactured.

These, together with various ancillary objects and advantages of this invention will be more readily appreciated as the same becomes better understood by reference to the following detailed description when taken in connection with the accompanying drawings wherein:

FIGURE 1 is a perspective view of the hand bending machine;

FIG. 2 is a sectional view through the bending machine taken on the plane 2—2 of FIGURE 1 and showing the lever in its release position;

FIG. 3 is a longitudinal sectional view taken on the plane 3—3 of FIGURE 1 and showing the lever in its clamp position; and

FIG. 4 is a transverse sectional view taken on the plane 4—4 of FIG. 2.

In electrical outlet and junction boxes, the side openings in the boxes are offset from the rear face of the box and when installing the conduit, it is frequently necessary to provide an offset or reverse bend in the end of the conduit such that the conduit will extend flush along the supporting surface when the offset end is inserted into a side opening in the box. At present these offsets or reverse bends of the conduit are made in two separate bending operations and considerable skill is required to provide two equal but oppositely facing bends of proper magnitude and at the proper distance apart to achieve the desired offset. Even with skilled operators the bends initially made in the conduit do not always accurately produce the desired offset and it is frequently necessary to partially straighten or rebend the initial bends in the conduit to correct the offset. This is time consuming and, moreover, does not produce the uniformly consistent offsets necessary to a neat appearing installation.

The hand bending machine of the present invention is arranged to produce a preselected offset or reverse bend at any desired point in a conduit and includes upper and lower die blocks 10 and 11 and a cam operating lever 12 for selectively moving the die blocks toward each other to bend an offset in a conduit. The die blocks 10 and 11 are guidably mounted on each other by means of pins 14 and 15 which are threadedly mounted in openings 16 and 17 in the upper and lower die blocks, respectively, and at diagonally opposite corners thereof. The pins are guidably received in bores 18 and 19 in the lower and upper die blocks respectively and springs 21 are preferably disposed in the bores 18 and 19 to engage the guide pins and yieldably urge the die blocks apart. Additional springs such as 22 are disposed in registering bores 23 and 24 in the die blocks 10 and 11, at the corners opposite the guide pins 14 and 15. As is apparent, the springs 21 and 22 yieldably urge the die blocks 10 and 11 apart, to the position shown in FIGS. 2 and 4.

The lower die block 11 has an upper face formed with relatively parallel end portions 31*a* and 31*b* which are offset from each other and are connected by a reverse bend portion 31*c* that merges smoothly with the end portions. The upper die block 10 is formed with a lower face complementary to the upper face of the lower block and having relatively parallel end portions 32*a* and 32*b* connected by a reverse bend portion 32*c*. The off-set between the end portions of the registering faces of the die blocks is made equal to the offset desired to be produced in the conduit. Complementary grooves 33 and 34, each having a semi-circular cross-section are formed in the registering faces of the die blocks and, when the die blocks are closed, define an offset passage for receiving and shaping the conduit 36. In the specific embodiment illustrated, the device is arranged to bend half-inch conduit and produces a one-half inch offset in the conduit, it being understood that different die blocks or at least different die faces would be used for different size conduit or pipe. As will be noted, the sides of the grooves 33 and 34 serve to confine the conduit 36 therebetween and thus inhibit and effectively prevent lateral spreading or flattening of the conduit during the bending operation. As a result, the offset bend in the conduit 36 retains the circular configuration of the conduit and does not materially inhibit the passage of the electrical conductors through the conduit.

The lever 12 has a pin 41 extending therethrough defining a pivot axis for the lever, and a nose portion 42 which is eccentric to the pin 41 and arranged to engage the upper die block 10. In accordance with the present invention, the lever is mounted so that the nose portion may move along the upper die block as the lever is moved from its raised position shown in FIG. 2 to its lowered position shown in FIG. 3, to minimize wear and frictional resistance to turning of the cam lever. For this purpose, links 44 and 45 are pivotally mounted by a pin 46 on the lower die block 11, and the upper pin 41 extends through the links to support the cam lever on the upper end thereof. Thus, the pivot axis of the

lever is free to shift in a direction longitudinally of the upper block, as the lever 12 is raised and lowered. In order to inhibit relative sliding between the eccentric nose portion 42 and the upper die block 10, the nose portion 42 has transversely extending teeth 48 which form an eccentric sector-type gear adapted to mesh with rack teeth 49 formed on the upper die block 10. The springs 21 and 22 urge the upper die block 10 upwardly and press the upper die block against the eccentric nose portion 42 of the lever so that the lever normally remains in an upright position. Stop dogs 51 are provided adjacent the end of the rack teeth 49 on the upper die block to prevent the cam lever from moving past an overcenter position.

The bending tool is advantageously arranged so as to facilitate casting of the rack teeth 48 and 49 on the lever 12 and upper die block 10 respectively. As best shown in FIG. 4, the rack teeth 48 on the lever have a slight taper or draw essential to enable removal of the molds, and the rack teeth 49 on the upper die block similarly have an outward taper or draw. In order to improve the contact between the sector teeth 48 and the rack teeth 49, the rack teeth have a longitudinal groove or slot 52 milled or cut therein so as to separate the rack teeth into spaced rows of teeth.

From the foregoing it is thought that the operation and construction of the hand bending device will be readily understood. The links 44 and 45 extend alongside the upper and lower die blocks 10 and 11 and aid in guiding the die blocks into and out of registry with each other. When the lever 12 is in its raised position, the springs 21 and 22 open the die blocks and permit a straight section of the conduit 36 to be inserted into the registering grooves 33 and 34 in the die blocks. As the lever is moved downwardly, in a counterclockwise direction as viewed in FIGS. 2 and 3, the eccentric nose 42 on the lever presses the upper die block downwardly toward the lower die block. The links 44 and 45 permit the pivot pin 41 and hence the pivot axis of the lever 12 to shift longitudinally of the upper die block so that there is no relative sliding between the eccentric nose and the upper die block during operation of the bending machine. This is advantageous in that it eliminates the friction and wear between the nose portion and the upper die block. It will additionally be noted that this arrangement is such that the point along the upper die block, at which pressure is applied by the eccentric nose portion, will shift along the upper die block as the lever is moved toward its lower position so as to apply pressure along the upper die block in a progressive fashion. The pivot point of the lower end of the links 44 and 45 on the pin 46 is preferably located at a point intermediate the ends of the reverse curve on the lower die block and, preferably such that the links will move to an overcenter position such as shown in FIGS. 1 and 3 when the lever is in its lower position. With this arrangement, the eccentric nose portion is operative to press the upper die block 10 downwardly and in a direction to the right as viewed in FIG. 3 to oppose the endwise pressure exerted on the upper die block by the conduit 36 during bending of the offset.

Since the offset in the conduit is bent in a single operation, the offset can be rapidly formed and the amount and position of the offset accurately controlled to produce uniform results. Moreover, the sides of the shaping grooves 33 and 34 in the die blocks confine the tube so as to prevent lateral spreading or flattening of the tube.

I claim:

1. A hand conduit bending machine comprising first and second elongated blocks mounted in side-by-side relation for movement toward and away from each other and having longitudinally extending undulated channels in the registering side faces thereof for receiving and shaping a conduit section, a link pivotally mounted on said first block and extending alongside said second block for movement in a plane disposed longitudinally of said second block, a lever pivotally mounted on the end of said link remote from said first block and having a nose portion eccentric to its pivot axis on said link and engageable with said second block for moving the second block toward the first block, means on said nose portion and the side of said second block engaged by the nose portion for preventing sliding movement therebetween as the lever is pivoted relative to said link, said link pivoting relative to said first block as the lever is pivoted relative to the link whereby the point of contact between the nose portion and the second block shifts along the second block.

2. The combination of claim 1 wherein said means for preventing sliding movement includes rack teeth formed on said block and intermeshing teeth on the eccentric nose portion of the lever.

3. The combination of claim 1 wherein said means for preventing sliding movement includes spaced rows of rack teeth on said second block and intermeshing teeth on the eccentric nose portion of the lever.

4. A hand bending machine for producing offset bends in conduit comprising, upper and lower elongated blocks mounted for movement toward and away from each other, said lower block including an upper face having relatively parallel end portions offset from each other and connected by a reverse curve portion merging with the end portions, said upper block having a lower face complementary to said upper face on the lower block and adapted to register therewith, the registering faces on said upper and lower blocks having opposed channels therein for receiving a section of conduit, a link pivotally mounted on the lower block intermediate the ends of the reverse curve portion for movement relative to the lower block in an upright plane, and a lever pivotally mounted on the upper end of the link and having a nose portion eccentric to its pivot axis for urging the upper block toward the lower block.

5. A hand bending machine for producing offset bends in conduit comprising, upper and lower elongated blocks mounted for movement toward and away from each other, said lower block including an upper face having relatively parallel end portions offset from each other and connected by a reverse curve portion merging with the end portions, said upper block having a lower face complementary to said upper face on the lower block and adapted to register therewith, the registering faces on said upper and lower blocks having opposed channels therein for receiving a section of conduit, a link pivotally mounted on the lower block intermediate the ends of the reverse curve portion for movement relative to the lower block in an upright plane, a lever pivotally mounted on the upper end of the link and having a nose portion eccentric to its pivot axis for urging the upper block toward the lower block, and interengaging teeth formed on said upper block and on said nose portion to inhibit sliding movement between the lever and the upper block in a direction longitudinally of the upper block.

6. A hand conduit bending machine comprising first and second elongated blocks disposed in side-by-side relation and having longitudinally extending undulated channels in the registering side faces thereof for receiving and shaping a conduit section, said blocks having slidably interfitting pins and sockets on the registering faces thereof adjacent each end of the blocks and at opposite sides of the channels therein supporting the blocks for movement toward and away from each other, a link pivotally mounted on said first block and extending alongside said second block for movement in a plane disposed longitudinally of said second block, a lever pivotally mounted on the end of said link remote from said first block and having a nose portion eccentric to its pivot axis on said link and engageable with said second block for moving the second block toward the first block, means on said

nose portion and the side of said second block engaged by said nose portion for preventing sliding movement therebetween as the lever is pivoted relative to said link, said link pivoting relative to said first block as the lever is pivoted relative to the link whereby the point of contact between the nose portion of the lever and the second block shifts longitudinally of the second block.

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