

[54] PRESS FOR PUNCHING HOLES IN TUBULAR MEMBERS

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[51] Int. Cl. B23d 21/14

[58] Field of Search 83/188, 192, 618, 620, 83/193, 195, 124, 125

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[57] ABSTRACT

The press includes a reciprocable ram carrying a movable tool element which punches a slug from the side of a tubular member upon mating with an underlying fixed tool element mounted on a horn projecting beneath the ram. The lower surface of the movable tool element and the upper surface of the fixed tool element are curved to conform with the outer and inner surfaces, respectively, of the tubular member to keep from deforming the slug as the latter is punched from the tubular member so the slug may be reused to cover the hole formed in the side of the member. A small punch also is carried by the ram and mates with a small hole in the fixed tool element to punch a small hole in the slug as an incident to punching out the slug.

8 Claims, 6 Drawing Figures

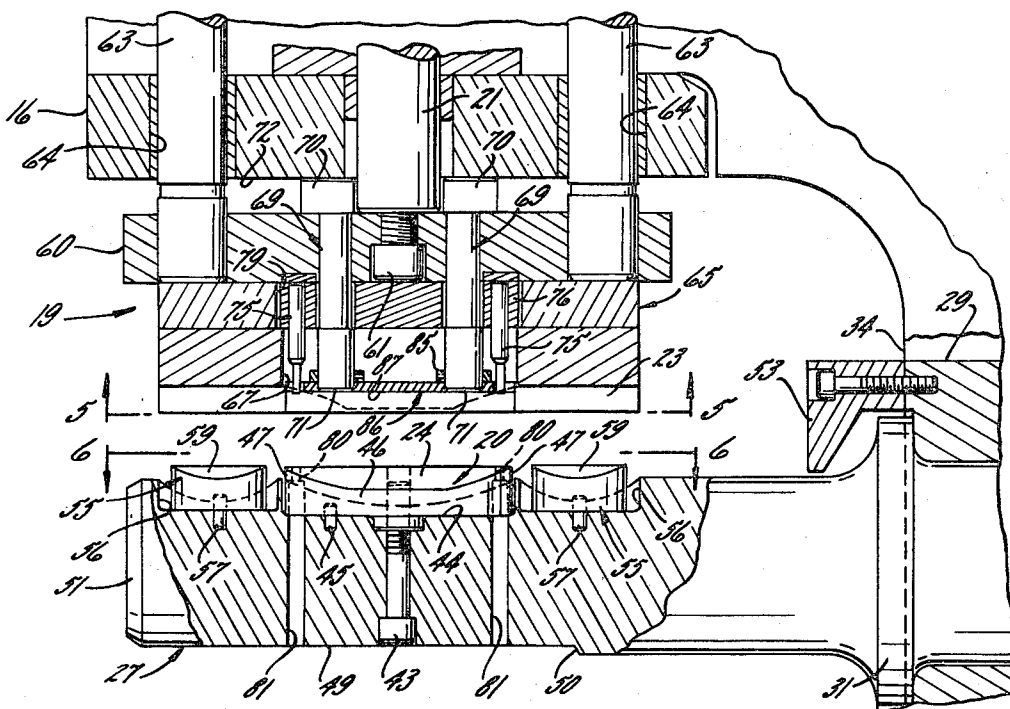


FIG. 1

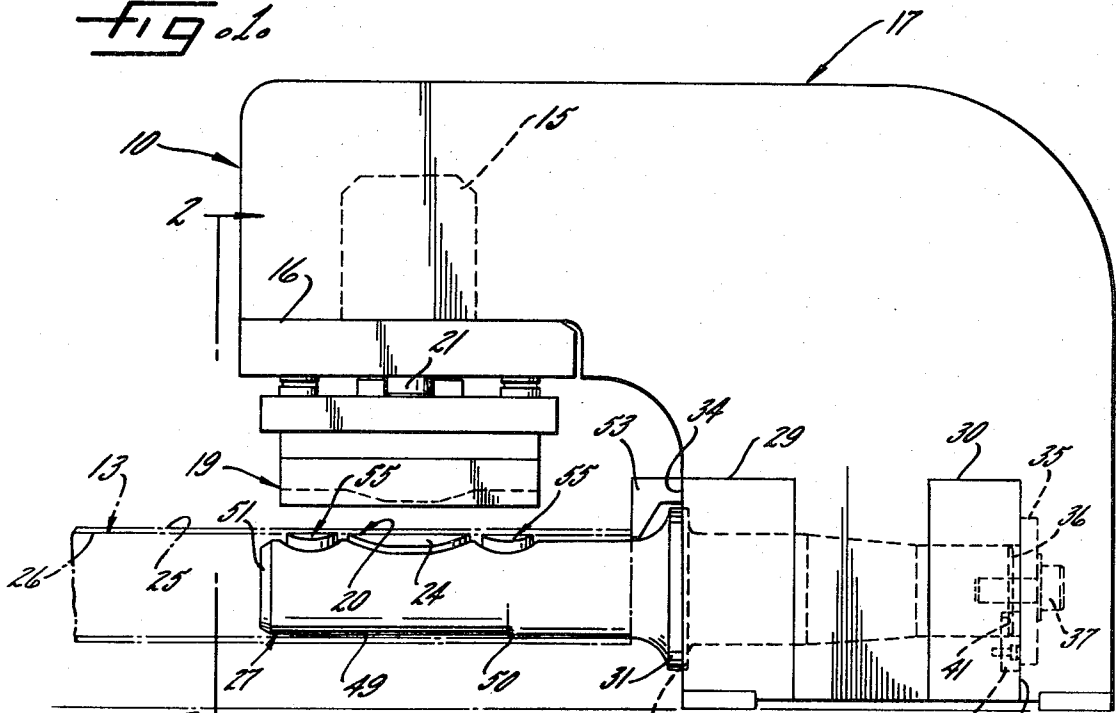


FIG. 2

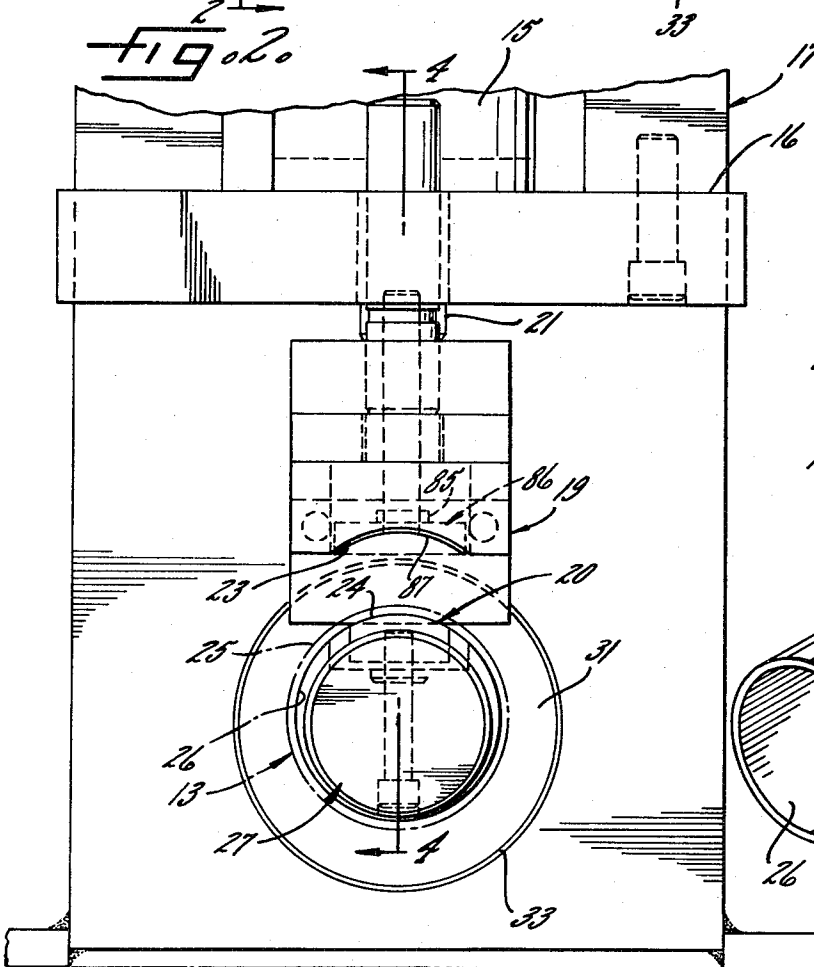
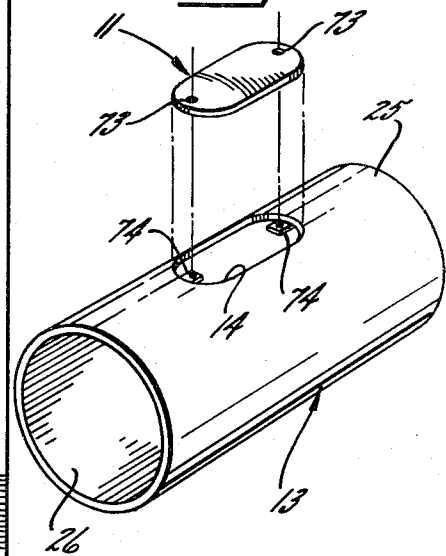
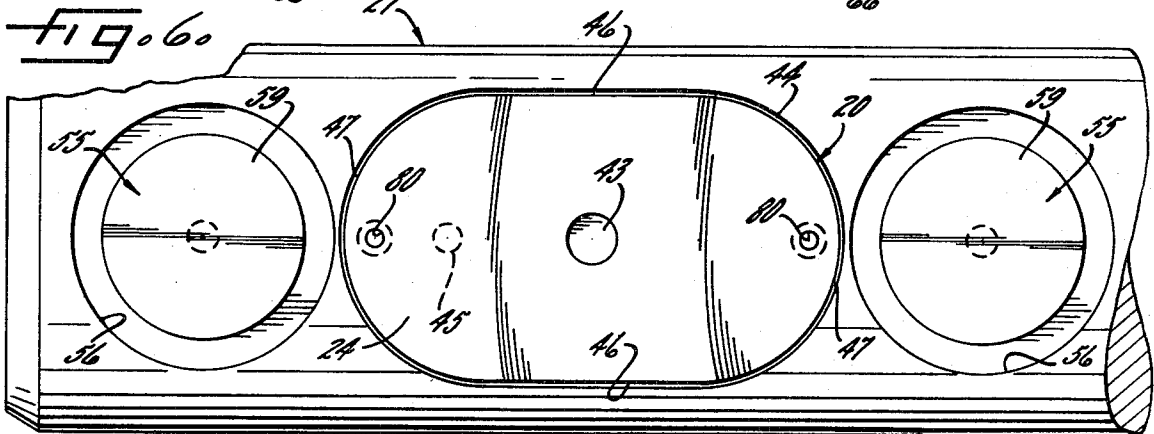
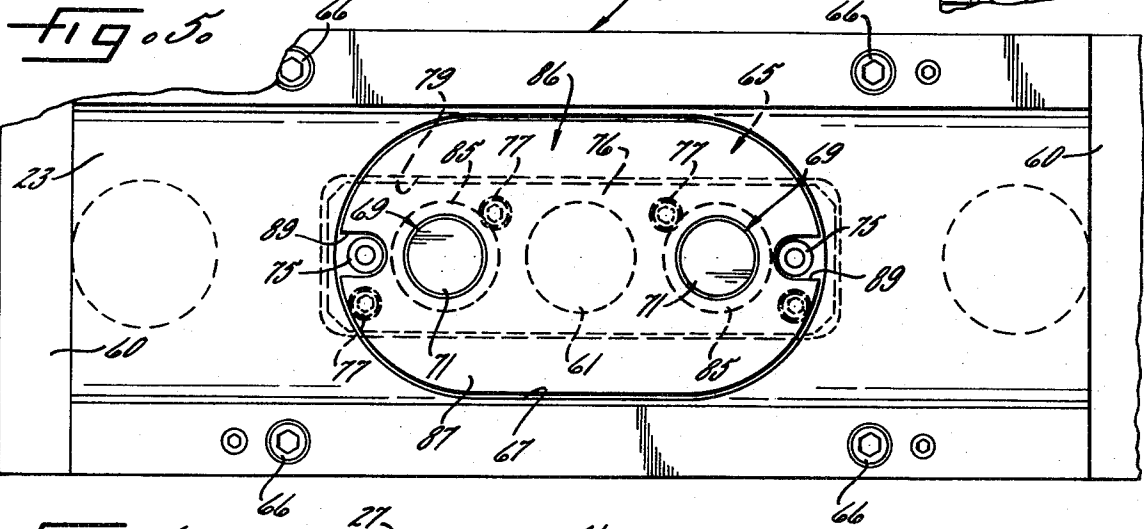
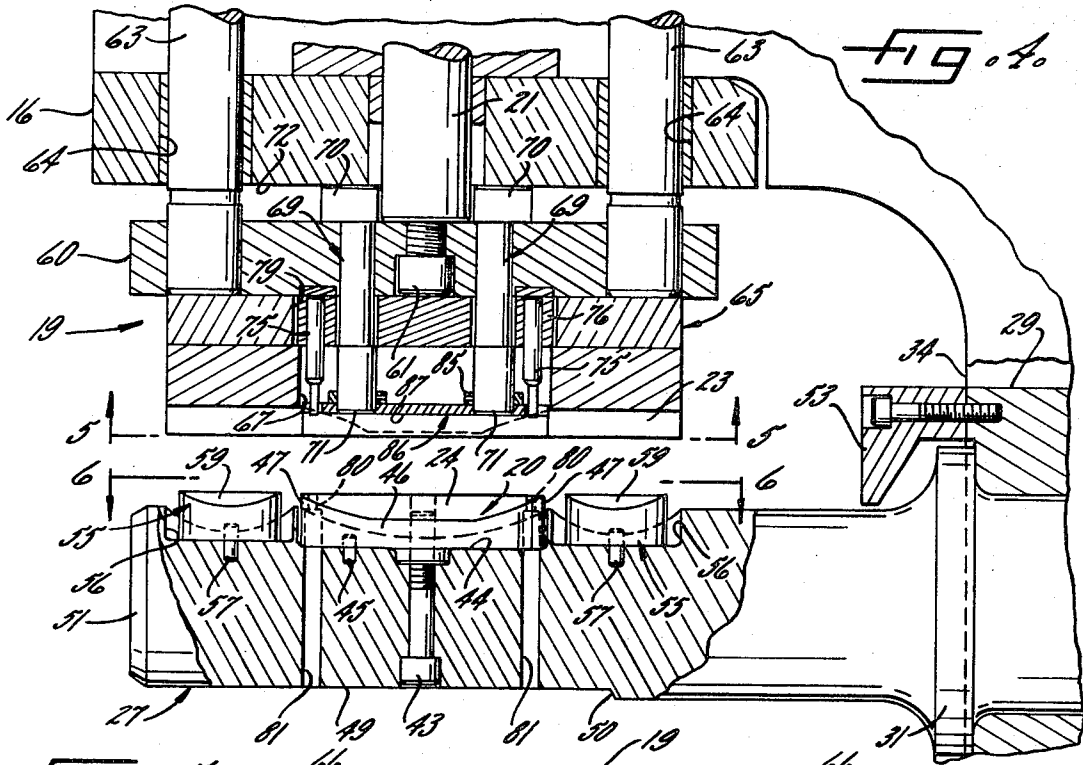


FIG. 3





PRESS FOR PUNCHING HOLES IN TUBULAR MEMBERS

BACKGROUND OF THE INVENTION

This invention relates generally to a punch press and, more particularly, to a punch press adapted for punching holes in a tubular member.

SUMMARY OF THE INVENTION

The primary object of the present invention is to provide a new and improved punch press of the foregoing character which is adapted to punch a hole in a tubular member and thereby remove a slug without deforming the slug so that the latter may be refitted within the hole for use as a cover. A more detailed object is to accomplish the foregoing through the use of a novel movable tool element adapted to form small holes in the slug as an incident to punching the hole in the tubular member so the slug may be secured easily back onto the tubular member to close the hole.

The invention also resides in the provision of auxiliary small punches in the movable tool element for forming the small holes in the slug and in the use of novel resiliently yieldable strippers for lifting the tubular member free from the fixed tool element after the slug has been punched.

The invention is still further characterized by the novel construction of the movable tool element for removing the slug from such element without bending the slug or causing it to jam within the movable tool element.

These and other objects and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a press embodying the novel features of the present invention.

FIG. 2 is an enlarged fragmentary view taken substantially along line 2—2 of FIG. 1.

FIG. 3 is a fragmentary exploded perspective view of the tubular member and the slug removed by the press.

FIG. 4 is a fragmentary cross-sectional view taken substantially along line 4—4 of FIG. 2.

FIGS. 5 and 6 are enlarged fragmentary views taken substantially along lines 5—5 and 6—6, respectively, of FIG. 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in the drawings for purposes of illustration, the present invention is embodied in a punch press 10 particularly adapted for removing a slug 11 from one side of a tubular member 13, such as a hollow metal light pole, to leave a hole 14 through which access may be gained to the interior of the pole 13 for splicing electrical wires leading to a lamp (not shown) on top of the pole. Herein, the press includes a fluid operated actuator 15 supported on a horizontal mounting plate 16 included within an L-shaped frame 17. The actuator is operable to reciprocate a movable tool element 19 through advance and return strokes relative to an underlying fixed tool element 20 cooperating with the movable tool element to punch the slug 11 from the side of the pole. The movable tool element 19 is a fe-

male die member and is carried on the lower end of the ram 21 of the actuator. The female die member 19 is vertically aligned with the fixed tool element or male die member 20 so that, when the ram is reciprocated, the dies mate to punch the slug from the pole.

As shown in FIGS. 2 and 4, the movable and fixed tool elements 19 and 20 are constructed to cooperate in punching out the slug 11 from the tubular member 13 without deforming the slug so the latter may be refitted into the hole 14 and used as a cover. For this purpose, the movable and fixed tool elements include curved lower and upper surfaces 23 and 24, respectively, conforming to the outer and inner surfaces 25 and 26 of the tubular member. Accordingly, when the ram 21 is reciprocated to cause the two tool elements to mate, the lower surface 23 of the movable element engages the outer surface 25 of the tubular member around that portion of the tubular member from which the slug is removed. At the same time, the fixed tool element is in engagement with the inner surface 26 of the tubular member and keeps the slug from being deformed as the two elements mate to punch out the slug. Thus, the slug is kept from being deformed during punching and may be reused as a cover for the hole 14 remaining in the side of the tubular member.

More particularly, the fixed tool element or male die member 20 is mounted on the outer end portion of an elongated horn 27 which extends outwardly in cantilever fashion from the rearward portion of the frame 17. The inner end portion of the horn is telescoped through two support blocks 29 and 30 which are spaced from each other within the rearward portion of the frame (see FIG. 1). As shown in FIG. 2, the horn is generally circular in cross-section and its diameter is substantially less than the inner diameter of the tubular member or pole 13. Intermediate the ends of the horn is a radial flange 31 which extends around the periphery of the horn. The flange seats within an annular recess 33 in the front wall 34 of the forward support block 29 and is held within the recess by a locking plate 35 (FIG. 1). Herein, the locking plate is secured to the rearward end 36 of the horn by a screw 37 so as to abut the back wall 39 of the rearward support block 30 and thus clamp the horn to the two support blocks. To prevent the horn from turning about its axis, a key 40 fastened to the back wall fits within a keyway 41 notched in the rearward end of the horn.

As shown in FIGS. 4 and 6, the male die member 20 is secured by a screw 43 within an oblong recess 44 formed in the top of the horn 27. The screw extends upwardly through the horn from its underside and cooperates with a set pin 45 which projects upwardly from the bottom of the recess 44 to keep the die from turning relative to the horn. In horizontal cross section, the shape of the male die member is generally the same as the shape of the recess 44, having straight and parallel opposite sides 46 and rounded opposing ends 47. The horizontal cross-sectional shapes of the recess and the male die member, however, may be of virtually any shape desired. Advantageously, the upper surface 24 of the die is curved upwardly (see FIGS. 2 and 4) so as to conform to the inside surface 26 of the pole 13. Accordingly, during punching, the entire upper surface engages the inside surface of the pole to keep the slug from being deformed upon being punched from the upper side of the pole.

To facilitate placing the pole 13 on the horn 27, the latter includes a reduced diameter bottom portion 49 which is located forwardly of a bevel 50 and the outer end of the horn is chamfered as at 51 in FIG. 4. This enables the pole initially to be slid easily onto the horn to engage a stop 53 fastened to the front wall 34 of the forward support 29. As shown in FIG. 4, the stop hooks around the flange 31 to engage the end of the pole and thus serves to position the pole so the slug 11 is punched out at a predetermined distance from the end of the pole.

In accordance with one of the novel features of the present invention, the pole 13 initially is supported in a vertically spaced relation from the male die member 20 by two generally cylindrical strippers 55 which are secured to the upper side of the horn 27 within generally circular cavities 56 by pins 57 (FIG. 4). The strippers each include a curved upper surface 59 conforming in shape to the curvature of the inner surface 26 of the pole. The two strippers are located adjacent the opposite ends 47 of the male die 20 and project upwardly from the horn so the upper surfaces 59 are positioned slightly above the upper surface 24 of the die 20. Herein, each stripper is of a diameter substantially smaller than its associated cavity and is formed of a resiliently yieldable material such as the material sold under the name of Prothane by Prothane Limited of Toronto, Ontario. As the slug 11 is punched from the pole 13, each stripper is squashed downwardly, spreading radially into its cavity. Then, as the ram 21 is retracted upwardly, the strippers expand upwardly to lift the pole from around the male die 20 so that the pole may be removed easily from the horn.

As shown in FIGS. 4 and 5, the movable tool element or female die member 19 is secured to a head 60 which, in turn, is fastened by a screw 61 to the lower end of the ram 21. Herein, the head is shaped as a generally rectangular plate, there being upwardly projecting guide rods 63 fastened to the head adjacent the opposite ends thereof. The rods extend upwardly parallel with the ram and extend slidably through bushed openings 64 in the mounting plate 16 to guide the head vertically as the ram is reciprocated. Sandwiched between the head and the die is a generally rectangular spacer plate 65 which, in horizontal cross section, is about the same size and shape as the die. Suitable screws such as the four screws 66 in FIG. 5, are used to hold the die 19 and spacer plate together and to fasten the plate to the head.

The female die member 19 includes an oblong central opening 67 extending therethrough, the opening being approximately the same size and shape as the size and shape of the male die member 20 so that the edges of the opening cooperate with the male die to cut through and remove the slug 11 from the side of the pole. Herein, the lower surface 23 of the female die 19 is curved in conformance to the shape of the outer surface 25 of the pole 13 so that, as the ram 21 is advanced, the lower surface 23 engages the outer surface 25 of the pole, the male die member 20 telescoping into the opening 67 to punch out the slug 11 without deforming the latter.

In accordance with the primary aspect of the present invention, holes 73 (see FIG. 3) are punched in the slug at the same time as the slug 11 is punched from the pole 13 so as to enable the slug to be refastened to the pole. To form the two holes, two punches 75 (FIG. 4) are

mounted within the opening 67 in the female die 19 and extend downwardly beyond the curvature of the lower surface 23. Accordingly, when the slug is punched from the pole the auxiliary small punches 75 form the two holes in the slug, one hole adjacent each end thereof.

In the present instance, the punches 75 are secured to the head 60 by a holder 76 which in turn is secured to the head by screws 77 (FIG. 5) within a rectangular opening 79 in the spacer plate 65. With this arrangement, as the ram 21 is advanced, the punches engage the outer surface 25 of the pole and form the holes 73 therein by mating with small holes 80 (FIG. 6) in the male die member 20. The small holes 80 open into passages 81 which extend through the male die and the horn 27 so the small slugs (not shown) removed by the punches drop beneath the horn after the pole is removed. Preferably, the slug may be refastened to the pole such as by means of screws (not shown) and brackets 74. Herein, two such brackets are secured to the inner surface 26 of the pole after the slug is removed, the brackets projecting toward each other and beyond the edges forming the opposite ends of the hole 14.

To remove the slug 11 from the opening 67 in the female die member 19, pins 69 (FIG. 4) are telescoped downwardly through the head 60, the spacer plate 65 and the opening 67. The pins are free to slide vertically through the head and the spacer plate and include enlarged bosses 70 on their upper ends to keep them from dropping completely through the head. The lower ends of the pins are anchored within bosses 85 projecting upwardly from a knock-out plate 86 adapted to engage with and push the slug from the opening as the die 19 is retracted upwardly. Advantageously, the lower surface 87 of the plate is curved to conform with the curvature of the slug so that the slug is kept from flattening to possibly bind against the sides of the opening and jam within the die. Also, notches 89 are formed in opposite ends of the plate for the punches 75 to pass through the plate. In operation, as the die 19 is advanced to engage the pole 13 during punching, the lower surface of the plate, which normally extend downwardly beyond the lower edge of the opening 67, engages the outer surface 25 of the pole and slides upwardly relative to the die with the pins 69 and into the opening. Then, when the die is retracted, the bosses 70 engage the lower surface 72 of the mounting plate 16, and the die slides upwardly along the pins and the knock-out plate so the latter forces the slug out of the opening.

Thus, it is seen from the foregoing that the punch press 10 of the present invention is particularly adapted to punch the slug 11 from the tubular member or pole 13 and, at the same time punch small holes 73 in the slug without deforming the slug so that it may be refitted in the hole 14 and used as a cover. This is accomplished by virtue of the auxiliary punches 75 which punch the holes 73 through the slug as the latter is punched from the pole. Thus, the cover is formed completely with the holes accurately positioned by simply punching the slug from the pole. Then, only the brackets 74 need to be added to the pole to enable the slug to be refastened to the pole for use as the cover. Moreover, the novel knock-out plate 86 keeps the slug from jamming within the die 19 during the punching operation.

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We claim as our invention:

1. A press for punching a slug from the side of a tubular member to form a hole therein, said press including a frame, a vertically reciprocable ram mounted on said frame, a female die member carried by said ram, a horn secured to said frame and projecting beneath said female die member to telescopically receive said tubular member, a male die member secured to said horn and underlying said female die member, said female die member having a central opening of predetermined size and shape and having a lower surface curved in conformance with the outer surface of said tubular member, said male die member having a cross-sectional size and shape approximately equal to the size and shape of said opening and projecting upwardly from said horn to mate with said female die member to punch said slug from the side of said tubular member, said male die member further having an upper surface curved in conformance with the inner surface of said tubular member to keep from deforming said slug as the latter is punched from the tubular member so the slug may be refitted within the hole in the side of the tubular member, a small punch carried by the ram and projecting downwardly through said opening in said female die member, and a small hole formed through said male die member to receive said small punch to form a small hole in said slug as an incident to punching said slug from the tubular member.

2. A press as defined by claim 1 including a stripper mounted on said horn adjacent said male die member and normally projecting upwardly beyond the upper surface of said male die member to lift said tubular member above the upper surface and to facilitate removal of the tubular member from the horn after the slug is punched from the side of the tubular member.

3. A press as defined by claim 2 wherein said stripper is formed of resiliently yieldable material which is pressed downwardly by engagement with the inner surface of the tubular member as the latter is moved downwardly by the ram to punch out the slug, said material expanding upwardly to lift the tubular member from around the male die member when the ram is retracted.

4. A press as defined by claim 3 in which two of said strippers are mounted on said horn, one of said strippers being located adjacent each of the opposite ends of said male die member, cavities formed in said horn adjacent opposite ends of said male die member and receiving said strippers, said cavities being substantially larger in diameter than the diameter of said strippers to permit the latter to expand radially as they are pressed downwardly by engagement with the inner surface of the tubular member.

5. A press as defined by claim 2 including a pin supported on the lower end of said ram and extending ver-

tically into the opening in said female die member to slide vertically with respect to said ram, a knock-out plate anchored to the lower end of said plate and having a lower surface curved to conform with the curvature of said slug to engage said slug and push the latter from the opening in said female die member as the ram is retracted upwardly relative to said male die member.

6. A press as defined by claim 5 including a head secured to the lower end of said ram, a spacer plate secured to the underside of said head and having a central opening, a punch holder mounted on the underside of said head within the opening in said spacer plate and supporting said small punch on the ram, said female die member being secured to the underside of said spacer plate, therebeing two of said pins spaced from each other, said pins being telescoped through said head, said spacer plate and the opening in said female die member with the lower ends of said pins anchored to said knock-out plate adjacent opposite ends thereof.

7. A press as defined by claim 6 wherein each of said pins includes a boss on the upper end thereof to keep said pin from falling through said head, said pins sliding downwardly within the opening of said female die member to move said knock-out plate to push said slug out of said opening as the bosses engage said frame when the ram is retracted.

8. A press for punching a slug from the side of a tubular member to form a hole therein, said press including a frame, a vertically reciprocable ram mounted on said frame, a female die member carried by said ram, a horn secured to said frame and projecting beneath said female die member to telescopically receive said tubular member, a male die member secured to said horn and underlying said female die member, said female die member having a central opening of predetermined size and shape and having a lower surface curved in conformance with the outer surface of said tubular member, said male die member having a cross-sectional size and shape approximately equal to the size and shape of said opening and projecting upwardly from said horn to mate with said female die member to punch said slug from the side of said tubular member, said male die member further having an upper surface curved in conformance with the inner surface of said tubular member to keep from deforming said slug as the latter is punched from the tubular member so the slug may be refitted within the hole in the side of the tubular member, and a knock-out plate mounted within said opening to move within said vertical opening as said ram is reciprocated, said plate having a lower surface curved to conform with the curvature of said slug and engaging said slug to push the slug out of the opening as said female die is retracted away from said male die member after punching out said slug.

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