

- [54] **CLAMP WITH WORKPIECE LOCATOR**
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- [52] U.S. Cl. **269/58, 83/277, 83/412, 83/419, 83/461, 269/32, 269/60, 269/234**
- [51] Int. Cl. **B23q 3/18, B26d 7/16**
- [58] Field of Search **269/58, 24, 25, 30, 269/32, 60, 229, 234; 83/412, 415, 418, 419, 421, 277**

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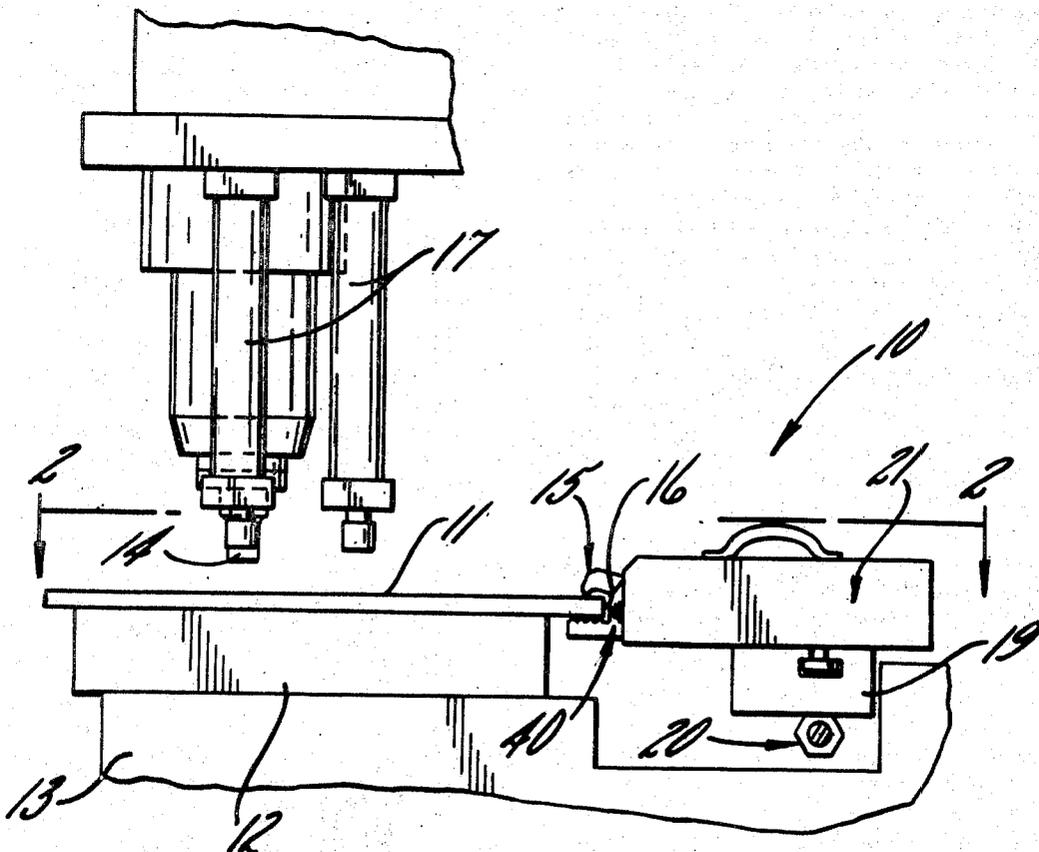
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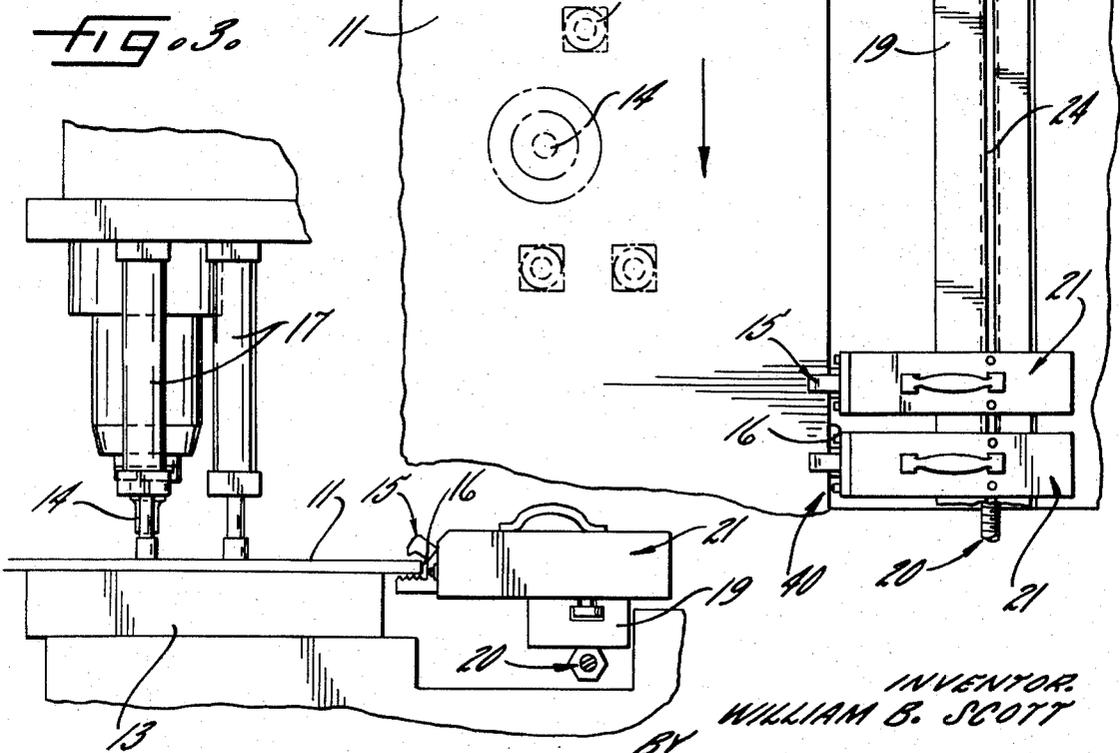
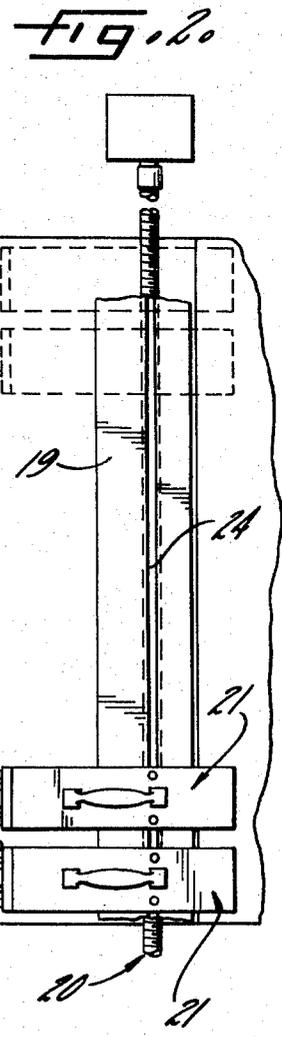
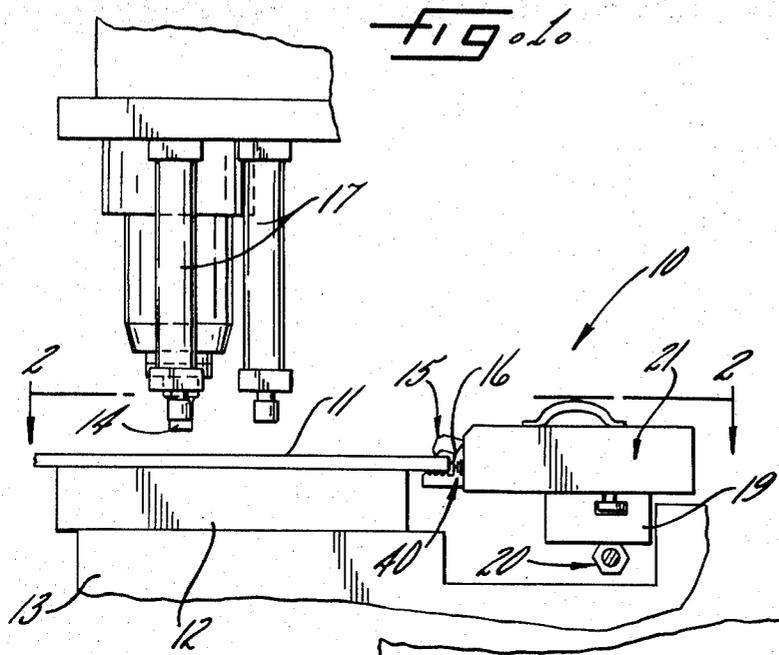
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[57] **ABSTRACT**

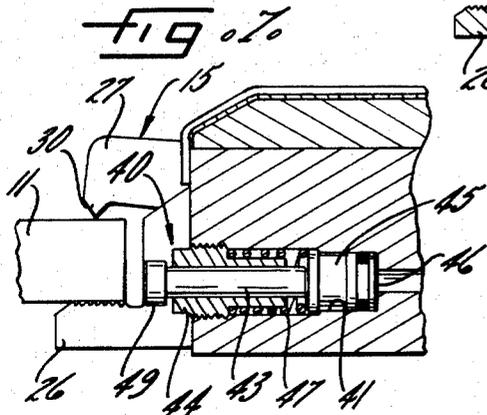
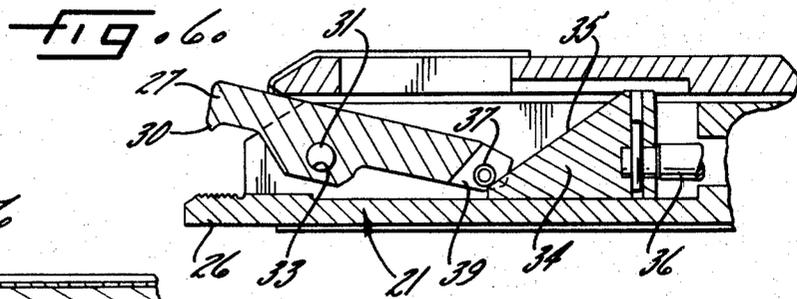
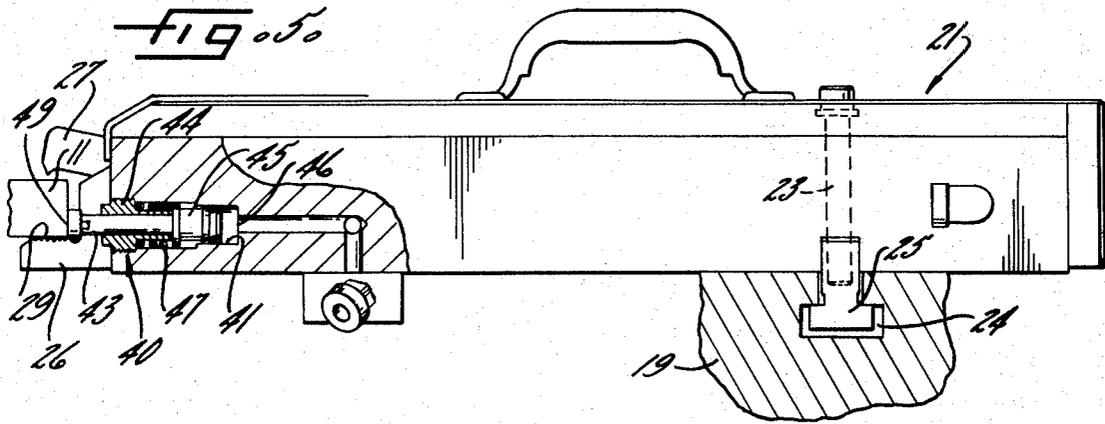
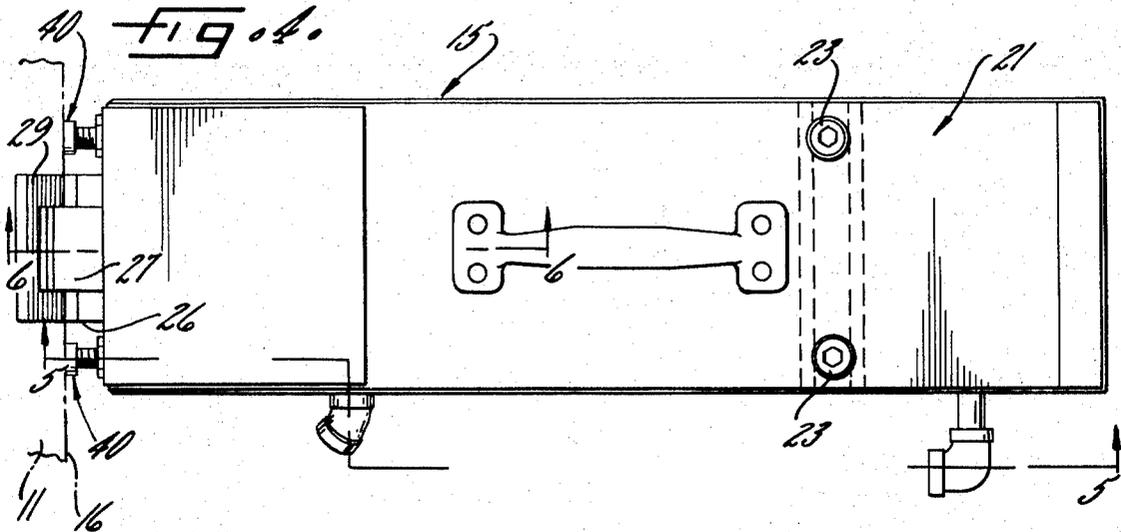
An apparatus for locating and holding a workpiece of sheet material on a punch press bed in an exact predetermined edgewise position relative to a punch tool. The apparatus includes two spaced clamps mounted on an elongated slide which is movable incrementally to draw the workpiece beneath the punch tool for punching. When the slide reaches its natural limits of movement, temporary holders are used to clamp the workpiece on the bed in the edgewise position before the clamps release the workpiece to allow the slide to be slid back along the edge of the workpiece to reposition the clamps on the workpiece for further incremental movement. To assure that the workpiece is located in the exact edgewise position when first placed within the clamps, locators are movable with the slide and are mounted on the opposite sides of each clamp so as to extend outwardly into position to be engaged by the edge of the workpiece when the latter is placed in the clamps. The locators are retractable away from the edge of the workpiece once the workpiece is clamped in position so that the locators will not be scored and worn by the edge of the workpiece when the clamps are repositioned.

4 Claims, 7 Drawing Figures





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CLAMP WITH WORKPIECE LOCATOR

BACKGROUND OF THE INVENTION

This invention relates generally to movable clamps for holding a sheet metal workpiece in a predetermined edgewise position as the workpiece is moved endwise relative to a punch tool which is reciprocated by a punch press to perform a punching operation on the workpiece. More particularly, the invention relates to a locator with an outer face which is used as a stop to locate the workpiece in the exact predetermined edgewise portion for clamping preparatory to the punching operation.

SUMMARY OF THE INVENTION

The primary object of the present invention is to provide a locator of the above general character which has a greatly lengthened service life and which remains unscored and unworn in spite of relative sliding movement between the locator and the edge of the workpiece during a punching operation.

A further object is to achieve the foregoing by providing a locator which is movable between (a) a projected position in which the outer face of the locator is positioned to engage the edge of the workpiece for locating the workpiece in the exact predetermined edgewise position and (b) a retracted position in which the face of the locator is spaced away from the edge of the workpiece to avoid being scored and worn by relative sliding between the workpiece and the locator.

Another object is to mount the locator for movement in unison with the clamp so that the locator will be located adjacent the clamp when the workpiece is clamped initially in the edgewise position.

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 fragmentary elevational view of a punch press equipped with apparatus embodying the novel features of the present invention.

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

FIG. 3 is a fragmentary elevational view similar to FIG. 1 but showing parts in moved positions.

FIG. 4 is an enlarged plan view of part of the apparatus shown in FIG. 1.

FIG. 5 is a partial cross-sectional view taken substantially along line 5—5 of FIG. 4.

FIG. 6 is a fragmentary cross-sectional view taken substantially along line 6—6 of FIG. 4.

FIG. 7 is an enlarged fragmentary view similar to FIG. 5 with parts shown in cross-section.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in the drawings for purposes of illustration, the present invention is embodied in an apparatus 10 for locating and holding a sheet metal workpiece 11 on a punch press work table 12 in an exact predetermined edgewise position relative to a reciprocable punch tool 14, the table being mounted on a support such as the bed 13 of the press. In the present instance, the punch tool is operable to punch precisely positioned holes in the workpiece in timed relationship to incremental

endwise advancement of the workpiece beneath the punch tool.

More particularly, the workpiece 11 initially is located in a precise edgewise position on the table 12 and then is held in such position by two clamps 15 (FIGS. 1 and 2) which grip across the located edge 16 of the workpiece and which are movable along the table 12 to pull the workpiece endwise beneath the punch tool 14. When the clamps have reached the natural limits of their movement, temporary holders 17 clamp the workpiece in the edgewise position (see FIG. 3) thus allowing the two clamps to be repositioned on the workpiece. During repositioning, the clamps are slid in one motion back along the edge of the workpiece and are positioned to once again grip the edge of the workpiece for further incremental movement of the workpiece. Thus, the workpiece is held continuously in the edgewise position during the entire punching operation of a single workpiece so that it is unnecessary to relocate the workpiece each time the limits of movement of the clamps are reached.

Herein, the two clamps 15 are mounted in spaced positions laterally across an elongated slide 19 with the outer ends of the clamps overhanging the edge portion of the workpiece 11. The slide is supported on the bed 13 and is numerically controlled for incremental endwise movement to bodily transport the clamps and the workpiece. A threaded lead screw and nut assembly 20 mounted on the underside of the slide as shown in FIGS. 1 and 2 is driven by appropriate mechanism to move the slide.

To hold the clamps 15 on the slide 19, each clamp includes a carrier 21 with two bolts 23 (FIGS. 4 and 5) extended vertically through the carrier and into an elongated slot 24 formed along the centerline of the upper side of the slide. More particularly, the slot is formed with an inverted T-shaped lateral cross section to receive a similarly shaped bar 25 threaded at its opposite ends on the lower ends of the bolts, the bar holding the carrier on the slide while at the same time allowing adjustment of the carrier along the length of the slot. Thus, the clamps can be adjusted toward or away from each other in order to accommodate differently sized workpieces while remaining fixed vertically and laterally on the slide. When the bolts are tightened down, the bar engages the top edges of the slot to prevent movement of the carrier along the slot.

To hold the workpiece 11 for movement with the slide 19, each of the clamps 15 includes a fixed lower jaw 26 (FIG. 5) integrally formed with the outer end of the carrier 21 and an upper jaw 27 which is pivotally mounted on the carrier for movement toward and away from the lower jaw (see FIG. 6) to grip and release the workpiece. As shown in FIGS. 4 and 5, the lower jaw is formed with a serrated upper surface 29 to insure a tight grip on the workpiece and prevent the workpiece from slipping out of the edgewise position when held by the clamps. The upper jaw is formed generally as a rectangular metal block with one large vertical tooth 30 formed integrally with and extending across the front bottom surface of the block for pressing the workpiece tightly against the lower jaw. Supporting the upper jaw 27 is a pivot shaft 31 mounted between the sides of the carrier 21 and extending through a hole 33 positioned intermediate the ends of the upper jaw so that the weight of the upper jaw naturally pivots the outer end

thereof away from the lower jaw 26 and into an open position as shown in FIG. 6.

To pivot the outer end of the upper jaw 27 downwardly toward the lower jaw 26 in order to grip the workpiece 11, the inner end of the upper jaw is forced upwardly by a wedge 34 as the latter is moved forwardly through an advance stroke. Herein, the wedge is located on the carrier 21 behind the upper jaw and includes a rearwardly inclined front face 35, the wedge being mounted on the outer end of a rod 36. The rod is reciprocated by a hydraulic cylinder (not shown) mounted on the carrier to force the inclined surface of the wedge underneath the inner end of the upper jaw 27 to cause the latter to pivot downwardly on the shaft 31 toward the lower jaw. To facilitate movement of the wedge beneath the inner end of the upper jaw, a roller 37 is journaled between two parallel flanges 39 projecting rearwardly from the inner end of the upper jaw to roll over the inclined surface as the wedge is forced beneath the upper jaw. Thus, after the workpiece has been located in its edgewise position while the jaws of the clamps are open, the upper jaws are pivoted toward the lower jaws to grip the workpiece at spaced positions along the edge for bodily movement with the slide 19.

To assure that the workpiece 11 is located precisely in the edgewise position when placed within the open jaws of the clamps 15, two locators 40 (FIG. 4) are mounted on each carrier 21 with one locator being positioned on each side of each clamp. As shown in FIG. 5, each locator extends forwardly from the carrier and generally parallel to the sides of the clamp jaws 26 and 27 with the end face of each locator positioned to abut with and align the edge 16 of the workpiece in an exact edgewise position between the open jaws as the workpiece is slid into the clamps. Once the workpiece is aligned edgewise within the clamps, the latter are actuated to hold the workpiece for incremental endwise movement for punching precisely located holes in the workpiece.

In accordance with the present invention, each locator 40 is retractable to move away from the edge 16 of the workpiece 11 after first locating the latter precisely so that the locator will not be worn and scored by relative sliding movement between the end face of the locator and the edge of the workpiece. With this arrangement, the normal service life of the locators is greatly lengthened and the introduction of inaccuracies in positioning the workpiece is greatly reduced by avoiding unnecessary wearing and scoring of the locators.

In the present instance, each locator 40 includes a reciprocable rod 43 slidable within a bore or cylinder 41 in the outer end of the carrier 21 and having an outer end projecting through a sleeve 44 in the outer end of the cylinder. The inner end of the rod is connected to a piston 45 slidably mounted within the cylinder for movement toward the outer end thereof as pressure fluid from a suitable pressure source (not shown) is introduced through an opening 46 in the inner end of the cylinder. Movement of the piston outwardly of the cylinder is limited by engagement of the piston with the sleeve as shown in FIG. 5. The sleeve is threaded into the outer end of the cylinder and may be turned to length or shorten the stroke of the piston in order to adjust the distance the rod protrudes past the end of the carrier for movement between projected and retracted positions shown in FIGS. 5 and 7, respectively. Telescoped over the sleeve 44 and into the cylinder is a

spring 47 which is compressed between the sleeve and the piston when the latter is advanced. Upon venting of the pressure fluid, the spring urges the piston toward the inner end of the cylinder thereby retracting the rod away from the edge of the workpiece. Threaded onto the end of the rod is a removable head 49 which is formed of a wear resistant metal and may be replaced as desired.

Prior to initial positioning of the workpiece 11 in the edgewise position on the punch press bed 13, pressure fluid is introduced into the cylinder 41 to drive the locators 40 into their projected positions shown in FIG. 5. Then once the workpiece is clamped in position by the clamps 15, the pressure fluid is vented from the cylinder and the locators are retracted away from engagement with the edge of the workpiece under the urging of the spring 47 (See FIG. 7). The locators remain in this latter position during the entire punching operation on the workpiece. Thus, as the clamps are repositioned on the workpiece, the locators are not scored or worn by sliding across the edge of the workpiece. Once the punching operation is completed on a particular workpiece and that workpiece is removed from the punch press, the locators are again advanced preparatory to positioning the next workpiece in the exact edgewise position desired.

I claim as my invention:

1. Apparatus for locating a workpiece of sheet material in a predetermined edgewise position, for holding the workpiece during the performance of a punching operation on the workpiece by a punch and for advancing the workpiece edgewise between successive punching operations, said apparatus comprising a support, a clamp on said support and having a pair of jaws, means for closing and opening said jaws to cause the jaws to grip and release said workpiece, means for moving said clamp on said support and in a direction parallel to one edge of said workpiece to enable advancement of said workpiece when said jaws are closed and to enable return of said clamp along and parallel to the edge of said workpiece when said jaws are open, means for temporarily holding said workpiece in a given position relative to said punch during the return of said clamp when said jaws are open, and a locator carried on said clamp for movement with the latter, said locator being movable relative to said jaws between (a) a projected position in which the locator is engageable by said one edge of said workpiece to locate the latter in a predetermined edgewise position with respect to said jaws preparatory to closing of the latter and (b) a retracted position in which the locator is spaced from said one edge of the workpiece to avoid being worn by such edge during the return of said clamp, and reversible power actuated means carried on said clamp for advancing said locator to said projected position preparatory to initial loading of said workpiece in said jaws and for returning said locator to said retracted position prior to the return of said clamp along said one edge of the workpiece, said reversible means being operable to move said locator between said projected and retracted positions while said clamp is in a stationary position on said support.

2. Apparatus as defined by claim 1 wherein said locator includes a reciprocable rod having an outer end extending from said clamp.

3. Apparatus as defined by claim 2 including a removable head of wear resistant material attached to the

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outer end of said rod for engagement with the edge of the workpiece when said rod is in said projected position, said reversible means comprising a cylinder in said clamp, and a fluid-actuated piston slidable within said cylinder for forcing said rod to said projected position.

tor is positioned on one side of said clamp, said apparatus further including a second locator positioned on the opposite side of said clamp and movable relative thereto between projected and retracted positions.

4. Apparatus as defined in claim 2 in which said loca-

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