Aug. 12, 1969 O. G. HILDEBRAND 3,460,226

DIE SET MANIPULATOR

Filed April 20, 1967 2 Sheets-Sheet 1

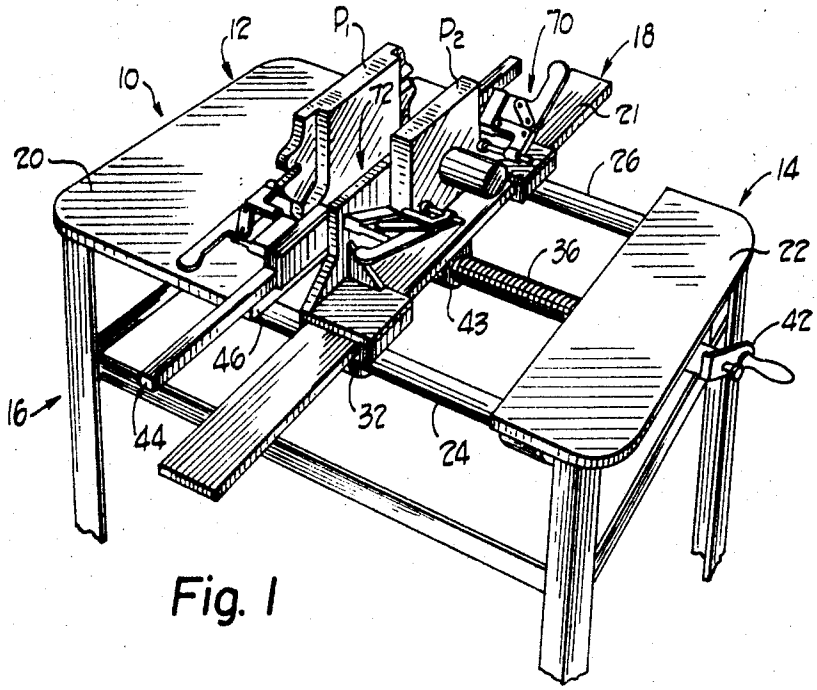


Fig. 1

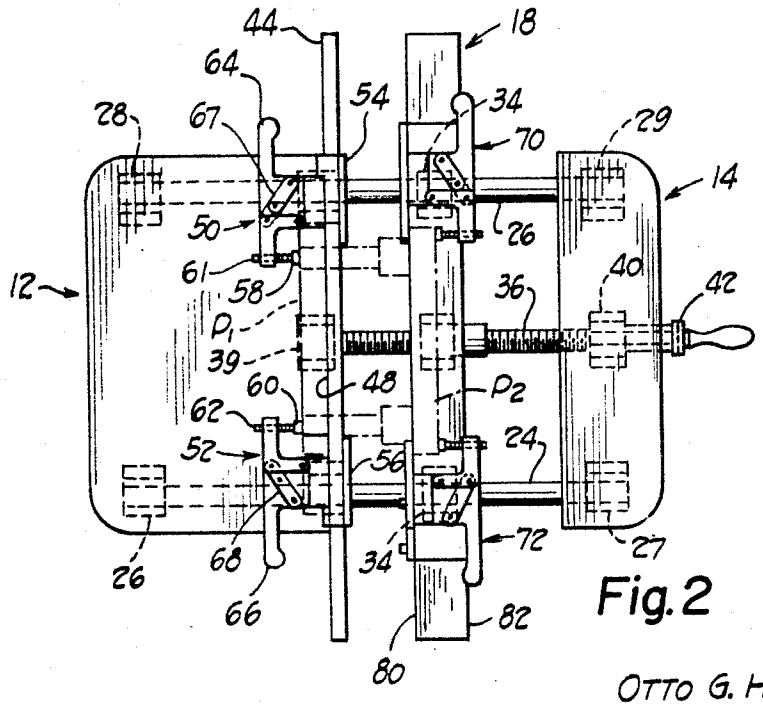


Fig. 2

INVENTOR.
OTTO G. HILDEBRAND
BY Watts, Hoffmann, Fisher & Heinke
ATTORNEYS.

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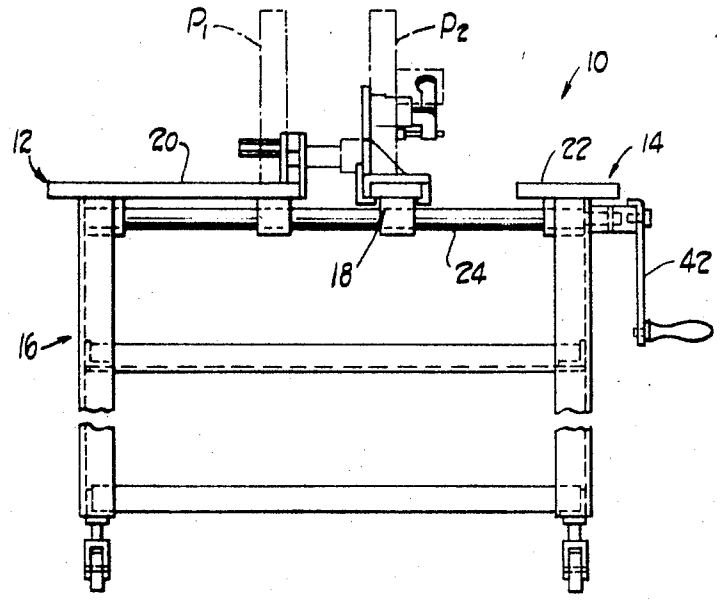


Fig. 3

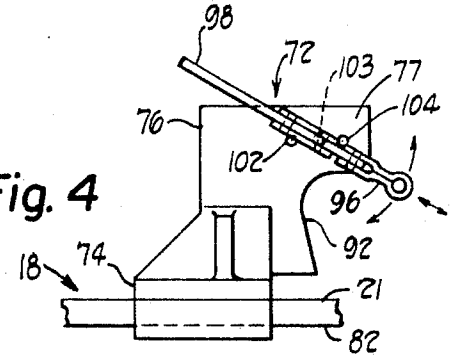


Fig. 4

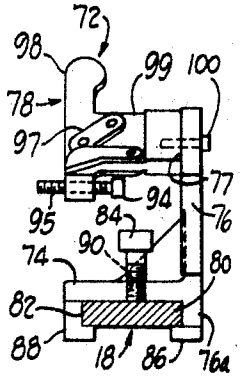


Fig. 5

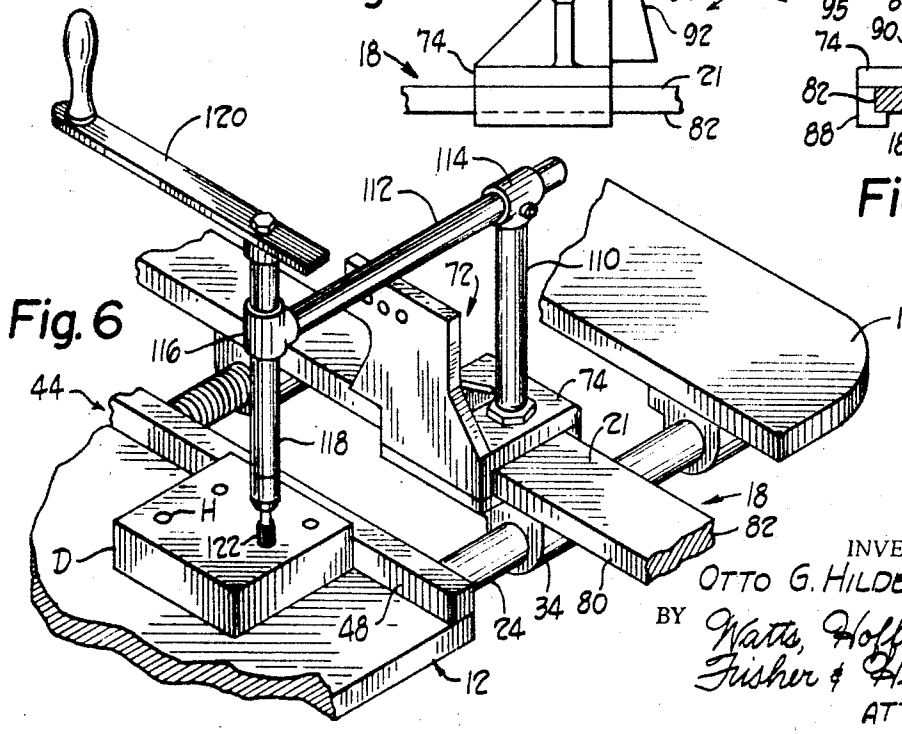


Fig. 6

INVENTOR.
OTTO G. HILDEBRAND
BY Watts, Hoffmann, Fisher & Heinke
ATTORNEYS.

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3,460,226

DIE SET MANIPULATOR

Otto G. Hildebrand, 9094 Avery Road,
Brecksville, Ohio 44141

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Int. Cl. B25j 9/00; B25b 1/20
U.S. Cl. 29—200 6 Claims

ABSTRACT OF THE DISCLOSURE

A support for holding plates of a die set vertically and moving one horizontally relative to the other assembly of a punch and die on the plates. One plate is clamped to a fixed support and the other to a movable support, each support having clamps and a locating surface for the die plates.

Background

This invention relates to a punch press die set manipulator and more particularly to apparatus for supporting and moving the members comprising a die set so that the members can be brought together or separated conveniently and easily during assembly.

Dies and punches, such as those employed for cutting and forming sheet metal parts by punch presses, are conventionally mounted on a die set, which comprises two relatively heavy metal plates. The die is secured to one of the metal plates and the plate is mounted on a table or stationary member of a punch press. The punch is secured to the other metal plate of the die set, which in turn is connected to the ram or movable member of the press. The plates of the die set are maintained in proper alignment during use by one or more guide rods, which project from the die plate and which extend through bushings located in the punch plate.

In securing the die and punch to the heavy metal supporting plates, it is necessary from time to time to check the manner in which the die elements cooperate when they are brought together. This can be difficult to do because the die elements and the die set are quite heavy. In addition, the guide rods of the die plate have a close fit in the bushings of the punch plate and as a result the two plates do not always move easily relative to each other.

It has been customary in the past to rest the die plate horizontally on a support and manually or with mechanical assistance lift and lower the punch plate and punch vertically relative to the die plate to determine whether the elements properly fit. Typically, it may be necessary to engage and disengage the die set ten or more times during the fabrication and assembly of an operative die set. As proposed in my United States Patent No. 2,691,212, issued October 12, 1954, and entitled "Die Set Separator," the die sets can advantageously be moved horizontally into and out of engagement by supporting the die plates vertically and face-to-face on a horizontal support. This not only eliminates the need for lifting one plate relative to the other and then carefully lowering it while supporting the weight in order to test the fit, it also locates the plates so that the die elements can be easily observed by the die maker as one of the plates is moved toward and away from the other.

Summary of the invention

The present invention is an improved apparatus for supporting the two plates of a die set and for moving one of the plates relative to the other to simulate the operation of the die set in a punch press.

In accordance with this invention, one of the plates of

the die set is supported vertically on a fixed horizontal support surface. The other plate of the die set is supported vertically on a movable horizontal support surface. The movable support surface is located in the same plane as the fixed support surface and is movable in that plane toward and away from the fixed support. Both the fixed and the movable support have a vertical locating surface extending above the horizontal supporting surface. Clamping means is provided on each support to secure the two plates of a die set in a vertical position relative to the respective locating surface for movement toward and away from each other during the assembling of the die and punch on the plates of the die set. Extremely wide die sets can be accomodated by merely replacing the movable support with one of greater width. Since the die plates do not slide on the support surface, the width of the supports is significant only adjacent the vertical locating surfaces, and it is not necessary to have a wide fixed surface on which to slide a die plate, as in the above-mentioned earlier apparatus.

Accordingly, the principal object of this invention is the provision of novel and improved apparatus that provides relatively movable surfaces for supporting and moving the plates of a die set toward and away from each other in a horizontal plane.

Another object of the invention is the provision of apparatus of the character referred to having a fixed horizontal support surface and a movable horizontal support surface in a common plane, each with vertical locating surfaces above the support surfaces to (1) locate the plates of a die set in parallel relationship, (2) locate clamping means for the plates, and (3) along with the clamping means, retain the plates in proper relationship and impart relative horizontal movement thereto.

An additional object of the invention is to provide an apparatus that can easily be adapted with minor modifications to handling die sets of greatly varying sizes.

These and other objects, features and advantages of this invention will become more apparent as the invention becomes better understood from the detailed description that follows, when considered in connection with the accompanying drawings.

The drawings

FIGURE 1 is a perspective view of a die set manipulator embodying the invention;

FIGURE 2 is a top plan view of the die set manipulator shown in FIGURE 1;

FIGURE 3 is a side elevational view of the die set manipulator shown in FIGURES 1 and 2;

FIGURE 4 is a rear elevational view of a clamp member and locating surface of the die set manipulator apparatus;

FIGURE 5 is a side elevational view of the locating surface and clamp of FIGURE 4; and

FIGURE 6 is a fragmentary perspective view of the die set manipulator apparatus with an auxiliary threaded tapping apparatus, illustrating the manner in which the apparatus can be used to tap holes in punch and die sections preparatory to mounting the sections on die set pin-guided plates.

Description of a preferred embodiment

A die set manipulator, also called a separator, constructed in accordance with this invention is illustrated in the drawings and consists of a table-like assembly **10** for supporting and relatively moving two plates P1, P2 of a die set. The table assembly **10** includes a horizontal split top formed of two flat pieces **12**, **14** spaced apart and supported upon a frame **16**, and a narrow movable flat piece **18** located within the space between the two pieces

12, 14. Each flat table piece 12, 14, 18 has a top surface 20, 21, 22, respectively, located in a common plane. As shown, the plate P1 is supported upon the table piece 12, which is fixed with respect to the frame 16, and the plate P2 is supported upon the movable table piece 18.

Two horizontal support rods 24, 26 support the table piece 18 for sliding movement within the space between the fixed pieces 12, 14 of the table top. The rods 24, 26 extend along opposite sides of the table, parallel to each other, and are secured at opposite ends beneath the fixed pieces 12, 14 by brackets 26, 27 and 28, 29, respectively. Guides 32, 34 are attached beneath the movable table piece 18, are slidable on the guide rods 24, 26, and serve to maintain the movable table piece 18 in a fixed transverse alignment when it is moved.

A screw threaded rod 36 is secured to the table assembly 10 to move the table piece 18 along the guide rods 24, 26. The threaded rod 36 extends parallel to the guide rods 24, 25, spans the space between the fixed table pieces 12, 14 and is secured at opposite ends beneath the fixed table pieces 12, 14 by end bearings 39, 40. A hand crank 42 is connected to the screw threaded rod 36 at the end of the table 10 adjacent the fixed top piece 14. A nut 43 is secured centrally beneath the movable table piece 18 and engages the threaded rod 36. When the crank handle 42 is turned in one of two directions, rotation of the screw threaded rod 36 moves the nut 43 and table piece 18 toward or away from the fixed table piece 12.

A locating bar 44 is fixed to and extends across the fixed table piece 12 along an edge 46 of the piece 12 that faces the movable table piece 18. The locating bar 44 provides a vertical locating surface 48 for the palte P1 supported on the upper surface 20 of the fixed table piece 12. Two toggle clamps 50, 52 are slidably mounted on the locating bar 44. Each of the toggle clamps has a base portion 54, 56 (FIGURE 2) that rides over the locating bar 44 and which opposes a respective clamping member 58, 60. Each clamping member 58, 60 is supported at the end of a threaded rod 61, 62 of the toggle clamps, which adjusts for plates P1 of different thicknesses. Actuating handles 64, 66 of the toggle clamps 50, 52 move the clamping members 58, 60 through links 67, 68 against the plate P1, forcing the plate P1 against the fixed locating bar 44 upon which the base members 54, 56 of the toggle clamps ride. The clamping members act adjacent the side edges of the die plate for maximum stability. The clamping pressure itself firmly locates the toggle clamps as well as the plate P1 in fixed positions relative to the locating bar 44.

Two toggle clamps 70, 72 are carried by the movable table member 18 to locate and to secure the vertically oriented plate P2 on member 18 parallel to the plate P1. The construction of both clamps 70 and 72 is substantially the same, the difference being that each is a mirror image of the other. Only the clamp 72 as shown in FIGURES 4 and 5 will be described in detail.

The toggle clamp 72 includes a supporting base plate 74, a vertical clamping and locating plate 76 attached at a right angle to the base plate 74, and a toggle lever assembly 78 secured to the locating plate 76. The plate 76 has a locating surface 77, and a portion 76*a* of the locating plate extends beneath the base plate 74 and contacts a straight edge 80 of the table piece 18. This edge 80 is parallel with both an opposite edge 82 of the table piece 18 and with the locating surface 48 of the locating bar 44. A foot 86 extends from the bottom of the plate 76 beneath the table piece 18 and an L-shaped member 88 depends from the base plate 74 opposite the foot 86 at the edge 82 of the table piece 18. The foot 86 and member 88 together form a slot that locates and guides the toggle clamp on the table member 18. As a result of this construction, the surface 77 of the plate 76 functions as a locating surface for the plate P2 of the die set and is positioned parallel to the locating surface 48. A threaded aperture 90 is formed in the base plate 74 and receives a lock bolt 84 which can be used to secure the toggle clamp 72 in a desired position along the movable table piece 18. As illustrated in FIGURE 4, the locating plate 76 is recessed at 92. This provides a clearance for the guide rods and bushings of the die set.

The toggle lever assembly 78 includes a clamping element 94 that is adjustably supported on a threaded rod 95 in a movable toggle lever 96. The clamping element 94 is spaced from and opposed to the locating surface 77. The threaded rod 95 permits adjustment of the clamping element relative to the surface 77 to accommodate die plates of different thicknesses. The toggle lever 96 and a toggle link 97 are fastened to a base block 99 and the two support a toggle operating handle 98. The base block 99 is fastened by a bolt 100 to the vertical plate 76. There are three horizontally spaced holes 102, 103, 104 in the vertical locating plate 76 to accommodate lateral adjustment of the base block 99 of the lever assembly 78 so that the location of the toggle clamping element 94 can be varied if necessary due to a particular construction of the punch plate P2. Since only one bolt 100 is used to attach the base block 99 to the locating plate 76, the vertical location of the clamping element 94 can be varied by changing the angular relatioinship of the block 99 with respect to the vertical. A plurality of holes (not shown) are provided in the base block 99 to selectively receive the bolt 100, thereby providing a substantial amount of lateral adjustment of the toggle lever assembly 78 with respect to the locating plate 76.

When a punch plate P2 is supported upon the flat surface 21 of the movable table piece 18, it is positioned parallel with the die plate P1 by the locating surfaces 77 of the vertical plates 76 adjacent each lateral side of the plate P2. The clamping elements 94 of the toggle lever assemblies 78 clamp the plate P2 securely against the locating surface 77. As a result, the plate P2 is not only located in the proper parallel relationship to the plate P1, but it is also secured for movement with the movable table member 18 toward and away from the fixed table member 12 and plate P1.

As shown in FIGURE 6, this apparatus can be conveniently used as a work bench when holes are to be tapped in a die member D, which is to be mounted upon the plate P1. In the fabrication of a die set, it is necessary to properly locate holes in the die, by which the die is attached to the die plate. Once these holes are drilled, they must be threaded. As shown in FIGURE 6, a die D having drilled holes H is placed upon the top surface 20 of the fixed table member 12, in abutment along one edge with the locating surface 48 of the locating bar 44. The toggle lever assembly 78 and the locking bolt 84 are removed from one of the clamps 72. A vertical support bar 110 is then screwed into the threaded bore 90 in the base member 74 of the clamp 72. A horizontal radial bar 112 is adjustably secured to the upper end of the vertical support 110 by a split clamp 114. At one end of the radial bar 112 a split collar 116 guides a vertical spindle 118, which can be clamped in place by the split collar 116 or be allowed to rotate. A lever arm and handle 120 are secured at the top of the spindle 118 and a thread cutter 122 is secured at the lower end of the spindle 118. With this construction, the thread cutter 122 can be conveniently and quickly aligned with the hole H to be tapped, and the clamp member 72 along with the vertical support 110 and radial bar 112 support the spindle 118 in vertical alignment with the hole. Once the radial bar 112 is adjusted and clamped at 114 it prevents the die member D from moving away from the locating surface 48 while the hole is being tapped. The die is prevented from rotating by the locating surface 48 against which it abuts.

While the operation of the above-described apparatus is believed to be already clear from the detailed description, the operation is briefly summarized below.

In the course of assembling a die and punch on die plates to construct a die set, the die is first located and secured to the plate P1 and a punch is then located and

secured to the plate P2. In order to properly locate the punch relative to the die, the punch is placed within the die, transfer screws are located in mounting holes of the punch and the plate P2 is moved against the transfer screws to mark the location for holes in the plate P2, for securing the punch. The holes must then be drilled and the punch secured to the plate P2 and the die set tried to see that the punch and die properly fit. In further operations locating pins are provided for the die and punch, and in the complete course of building a die set, the plates P1, P2 are typically brought together and taken apart as much as 10 times or more. With the present apparatus, the die plates are brought together by first placing the plates P1 and P2 on the table **10**, with the face of each plate adjacent the position where the plate will be located. That is, the plate P1 is placed on the fixed table portion **12** and tipped up vertically against the locating surface **48** of the locating bar **44**. The toggle clamps **50**, **52** are then slid into place at each side of the plate P1. The plate is then clamped against the locating plate **48**.

Normally, the plate P2 will be placed upon both the fixed table member **14** and the movable member **18** and then tipped up vertically so that a lower edge of the plate P2 rests upon the upper surface **21** of the movable member **18**. In this position, the front surface of the plate P2 abuts the locating surface **77** of each toggle clamp **70**, **72** and is parallel to the facing surface of the plate P1. The plate P2 is clamped firmly in position so that the movable table piece **18** can be reciprocated in either direction along the guide rods **24**, **26** to move the plate P2 relative to the plate P1. Initially, the plate P2 is spaced from the plate P1 and guide rods of the die plate P1 are not engaged in bushings of the punch plate P2. Rotation of the handle **42** causes the threaded shaft **36** to reciprocate the movable table piece **18** along the guide rods **24**, **26**. The movable support member **18** is first moved toward the fixed member **12** and die plate P1. During this movement, the operator can easily view the punch and die to be certain that the two parts will properly mate. The punch on the plate P2 can then be withdrawn from the die by turning the handle **42** in the opposite direction, pulling the punch plate P2 away from the die plate P1 with the vertical plates **76** of the clamps **70**, **72** carried by the movable table piece **18**.

Once the toggle clamping elements of each toggle clamp **50**, **52** and **70**, **72** are adjusted for the thickness of the die plate P1 and punch plate P2, the plates can be simply and easily removed, worked upon, replaced and again tested.

The movable table piece **18** supports the punch plate P2 in a fixed position so that it need not slide along a fixed table top. It is long enough, extending beyond the width of the table **10**, to accommodate relatively wide die plates and yet support the toggle clamps **70**, **72** when they are moved apart in order to remove the plate P2. Where plates of still larger die sets must be supported, only the table piece **18** and the locating bar **44** need be replaced to accommodate the larger size. In addition, there is no wear upon the table top due to sliding of the plate P1 and it its not necessary that one edge surface of the plate P2 be constructed to facilitate sliding. For example, an irregular edge can readily be accommodated and once the plate is positioned, it will tend to remain in the fixed position during the reciprocation of the movable table piece **18**. A further advantage in greater accuracy of alignment is achieved by clamping the plates P1, P2 at opposite edges rather than at a single central location. The relatively long length of the parallel edge surfaces **80**, **82** of the movable table piece **18** and the locating surface **48** of the locating bar **44** assures that the two plates P1, P2 will be accurately located in parallel relationship.

If necessary or desired, as for example if a die plate has extremely long guide rods and the space between the two fixed table portions **12**, **14** will not allow sufficient movement of the table piece **18** to accommodate the length of the die plate guide rods, the toggle clamps **70**, **72** can be reversed so that the plate P2 is clamped adjacent the back edge **82** of the movable table piece **18**, providing additional distance between the two plates P1, P2.

While a preferred embodiment of this invention has been described with particularity, it will be understood that various modifications or alterations may be made therein without departing from the spirit and scope of the invention, as set forth in the appended claims.

What is claimed is:

1. A device for supporting and relatively moving plates of a die set, which comprises:

a first member having a flat horizontal surface for supporting a first plate of a die set,

a second member having a flat horizontal support surface in a plane common to the first member for supporting a second plate of the die set,

means for supporting the first and second members for relative rectilinear movement in the common plane,

means connected to one of the members and the support means for causing relative reciprocation of the members,

a vertical locating surface on the first member extending above the horizontal surface thereof and defining a first vertical plane,

means supported by the first member to clamp the first plate of the die set in a vertical plane against the vertical locating surface,

a vertical locating surface on the second member extending above the horizontal surface thereof and defining a second vertical plane parallel to the first vertical plane, and

means supported by the second member to clamp the second plate of the die set in a vertical plane against the vertical locating surface on the second member.

2. A device for supporting and relatively moving plates of a die set, which comprises:

a fixed member having a flat horizontal surface,

a movable member having a flat horizontal surface in the same plane as the fixed member,

means fixed relative to the fixed member for supporting the movable member for rectilinear movement relative to the fixed member and in the plane thereof,

means connected to the movable member for reciprocating the movable member on the supporting means relative to the fixed member,

a vertical locating surface on the fixed member extending above the horizontal surface thereof,

means supported by the fixed member to clamp a plate of a die set in a vertical plane against the vertical locating surface,

a vertical locating surface on the movable member extending above the horizontal surface thereof and parallel to the locating surface on the fixed member, and

means supported by the movable member to clamp a plate of a die set in a vertical plane against the vertical locating surface on the movable member.

3. A device for supporting and relatively moving plates of a die set, which comprises:

first and second fixed members, each having a flat horizontal surface in a common plane and spaced from each other,

a movable member having a flat horizontal surface in the plane of the fixed members and located between the two fixed members, said fixed members being spaced apart a distance greater than the distance occupied by the movable member,

means fixed relative to the said two fixed members for supporting the movable member for rectilinear movement between the two fixed members and in the plane thereof,

means connected to the movable member for recip-

rocating the movable member on the supporting means relative to the fixed members,

a vertical locating surface on the first fixed member extending above the horizontal surface thereof,

means supported by the first fixed member to clamp a plate of a die set in a vertical plane against the vertical locating surface,

a vertical locating surface on the movable member extending above the horizontal surface thereof and parallel to the locating surface on the fixed member, and

means supported by the movable member to clamp a plate of a die set in a vertical plane against the vertical locating surface on the movable member.

4. A device for supporting and relatively moving plates of a die set, which comprises:

a fixed member having a flat horizontal surface,

a movable member having a flat horizontal surface in the same plane as the fixed member,

means fixed relative to the fixed member for supporting the movable member for rectilinear movement relative to the fixed member and in the plane thereof,

means connected to the movable member for reciprocating the movable member on the supporting means relative to the fixed member,

an elongated bar secured horizontally along an edge of the fixed member with a locating surface extending vertically upward from the horizontal surface and facing away from the said edge of the fixed member,

means secured to the bar and slidable therealong to clamp a plate of a die set in a vertical plane against the said locating surface of the bar,

a vertical locating surface on the movable member extending above the horizontal surface thereof and parallel to the locating surface of the elongated bar, and

means supported by the movable member to clamp a plate of a die set in a vertical plane against the vertical locating surface on the movable member.

5. A device for supporting and relatively moving plates of a die set, which comprises:

a fixed member having a flat horizontal surface,

a movable member having a flat horizontal surface in the same plane as the fixed member,

means fixed relative to the fixed member for supporting the movable member for rectilinear movement relative to the fixed member and in the plane thereof,

means connected to the movable member for reciproating the movable member on the supporting means relative to the fixed member,

a vertical locating surface on the fixed member extending above the horizontal surface thereof,

means supported by the fixed member to clamp a plate of a die set in a vertical plane against the vertical locating surface,

a combined clamp and locating surface carried by the movable member for locating and holding a plate of a die set in a fixed vertical position upon the movable member parallel to the plate held by the fixed member, said locating surface facing away from the fixed member, and said clamp arranged to hold a die plate against the locating surface so that movement of the movable member is transmitted by the locating surface and clamp to a die plate supported on the movable member.

6. A device as set forth in claim **5** wherein the movable member includes a reference edge extending along the member parallel to the vertical locating surface on the fixed member and wherein the combined clamp and locating surface is movable along and positioned relative to the reference edge.

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THOMAS H. EAGER, Primary Examiner

U.S. Cl. X.R.

29—239, 243, 256; 269—45

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,460,226 Dated August 12, 1969

Inventor(s) OTTO G. HILDEBRAND

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 1, line 12, after "other" insert --during--.

Col. 2, line 58, "threaded" should be --thread--.

Col. 3, line 19, "24, 25" should be --24, 26--.

Col. 3, line 32, "palte" should be --plate--.

Col. 8, line 6, "reciproat-" should be --reciprocat- --.

SIGNED AND
SEALED
APR 28 1970

(SEAL)
Attest:

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Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents