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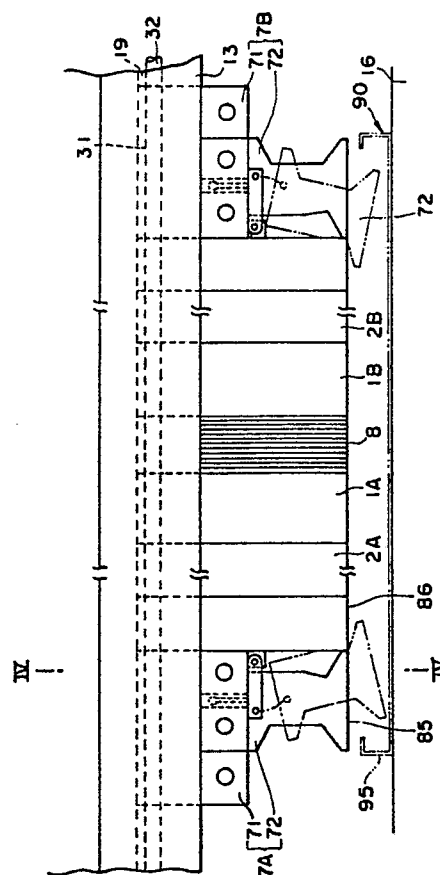
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Bending machine.

In a bending machine for bending metal plate work so as to have four U-shaped rims, there are provided a ram (13) having a lower end, a bottom tool (16), a top tool body mounted on the lower end of said ram (13) above the bottom 16, the top tool body carrying central and corner die segments (1A, 1B, 7A, 7B) engagable with the work piece (90) for bending it. Difficulties occur upon lowering and lifting the top tool past the U-legs of the rims already bended. For overcoming these difficulties, each corner die segment (7A, 7B) includes a main body (71, 101) and an openable die segment portion (72, 102, 110); a link (75, 103) mounted inside the lower portion of the main body of the upper corner die segment supports pivotably about a generally horizontal axis the openable die segment portion on the end of the link; and a rod (88) is erected on the center of the upper surface of the openable die segment portion to be inserted into a guide hole (89) in the corner die segment main body.

FIG. 2



Bending Machine

This invention relates to a bending machine and more particularly to corner die segments of an upper die segment group, preferably associated with an apparatus for adjusting the tool length of the bending machine in which the effective length of an upper tool can be exchanged to the desired bending length according to the bending width of a sheet metal plate.

Rectangular sheet metal plates having each edge of the four sides bent at least two times, i.e. about two parallel fold lines, are used for cabinets, display cases, bending machines, refrigerators, freezers, air conditioners, computer units, various office machines, etc.. To prepare such plates, wiping benders, folding machines or press brakes are used to bend each side edge of a sheet metal previously cut into a quadrilateral. For example, in order to bend each side edge in the U-shaped form, the edge of one short side of the sheet metal is bent by two steps (short side bending) and then, after the sheet metal is turned by 180° on a handling table, the edge of the other short side is bent. Next, the sheet metal is turned by 90° and the edge of one long side is bent (long side bending) by a clamp die or punch set to the bending width adjusted to the inside of the short side bending. Further, the sheet metal is turned 180° and the other long side is bent so that the rectangular metal plate having the four sides bent in the U-shaped form is obtained from the first step bending and the following second step bending.

In the above working, when the long side of the metal is bent, rising portions are produced by bending the previously bent short side, so that the upper die should have the length of the long side obtained by subtracting the thickness corresponding to two sheets and avoids the interference with the rising rim of the short side.

When the respective side edges of the metal plate are bent in the U-shaped form, since the edges of the short sides are previously bent into the rise having the U-shaped section, the upper corner die segments should avoid the interference with this rise to approach the sheet metal. Furthermore, when the die is withdrawn after the U-shaped bending of the long side edge, the upper corner die segments should not interfere with said rise. Thus, normally, an openable die segment (or rotary die segment) is mounted on the upper corner die segments disposed on both ends of the upper lateral die segments by the use of a pin. And to pivot this openable die segment without any troubles, a clearance is provided in an edge portion of the upper corner die segment body to avoid the

contact with the pivotal portion of the openable die segment. However, since this clearance provides a cut-out portion of the edge line of the upper die, the bending line of the sheet metal has irregularities on the clearance portion so that an accurate bending form cannot be obtained.

An object of the present invention is to provide a bending machine in which the edge lines of the lower portion of the upper die are interconnected continuously. This is obtained by the claimed invention.

In the present invention, the upper corner die segments at both ends of the upper lateral die segment group are improved to make the bending operation of the four sides of sheet metal advantageous. Namely, the upper corner die segment according to the present invention consists of a main body having same type and openable die portions pivotally supported relative to the main body. The upper corner die segment is provided inside the lower portion with a pin supported link which supports the openable die segment portion on the end. A rod erected on the central portion of the upper surface of the openable die portion is inserted loosely into a guide hole in said main body. Since the upper lateral die segment adjacent the upper corner die segment and the openable die segment portion are formed with continuous edge lines connected closely to each other without providing any clearance between the edge portions, accurate bending can be provided with respect to all bending lines. Further, since the openable die segment portions, after descending vertically along a central rod, are inverted respectively inside at both end positions of the upper die row by the ascend of the ram, they can be smoothly withdrawn from the sheet metal.

The present invention can be applied not only to press brakes, but also to bending machines such as folding machines, wiping benders, etc.. Particularly, it can be applied to those bending machines comprising an apparatus for tool length adjustment.

A preferred embodiment of the invention - illustrative of the bending mode in which applicants have contemplated applying the principles - is set forth in the following description and shown in the drawings and is particularly and distinctly pointed out and set forth in the appended claims.

Fig. 1 is a perspective view showing a bending machine provided with rockable corner die segments and an apparatus for adjusting the tool length;

Fig. 2 is an enlarged front view showing the upper die segments of the machine in Fig. 1;

Fig. 3 is a side view showing the same as Fig. 2;

Fig. 4 is an enlarged sectional view taken along the line IV-IV in Fig. 2;

Fig. 5 is a cross-sectional view taken along the line V-V in Fig. 4;

Fig. 6 is a sectional view taken along the line VI-VI in Fig. 5 and showing the condition of one of the upper lateral die segments having a wedge (Fig. 4) removed;

Fig. 7 is a sectional view showing the condition of one of the upper lateral die segments reversed from the condition in Fig. 6;

Fig. 8 is a sectional view taken along the line VIII-VIII in Fig. 5;

Fig. 9 is a front view showing an upper corner die segment according to the present invention;

Figs 10 to 13 are schematic front views showing an apparatus operated for changing the tool length;

Fig. 14 is a sectional view of an embodiment of the present invention applied to a goose-neck-shaped press brake;

Fig. 15 is a front view showing the upper corner die segment of the apparatus shown in Fig. 14;

Fig. 16 is a sectional view showing an embodiment of the present invention applied to a folding machine.

Fig. 17 is a perspective view showing a sheet metal; and

Fig. 18 is a perspective view showing a finished bent product.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, a preferred embodiment of the present invention is illustrated therein and reference numeral 10 designates left and right frames, 11 is a front plate stretched in front of the frames, 12 press cylinders mounted on the upper ends of the frames, and 13 a ram moved vertically to the front plate 11 by the actuation of the press cylinders 12. Reference numeral 14 designates a bed on the upper surface of the front plate, 15 a slide member provided on the bed 14, 16 a lower die, 17 a V-shaped groove formed in the lower die 16, 18 a back gauge, 19 a T-shaped groove formed in the lower end of the ram and 20 a group of upper die segments (punch).

As shown in Figs. 2 to 5, the group of upper die segments 20 are constituted from a pair of left and right central die segments 1A, 1B slidable longitudinally of the tool length, a pair of left and

right upper corner die segments 7A, 7B slidably similarly, a plurality of upper split, lateral die segments 2A to 6A and 2B to 6B which are inserted between the central die segments and the upper corner die segments and a plurality of thin upper die segments 8 which are inserted between the left and right central die segments. Said upper lateral die segments and the thin upper die segments cannot slide and are supported by the shaft to be reversed rearward, i.e. rotated out from the line of the tool, and adjusted to the change in the tool length.

As shown in Figs. 5 and 8, the central die segments 1A, 1B have the upper portions inserted into a groove 19 in the lower end of the ram to be slidably supported thereby. Brackets 21, 22 extend to the back of the central die segments to hold the thin upper die segments group 8 and spline cylinders 23, 24 having a split respectively, as will be later described. The left and right upper corner die segments 7A, 7B have the upper portions inserted into the groove 19, while being supported slidably by a drive mechanism 30 (Fig. 10 - 13). That is, each upper corner die segment is formed in the interior with a female thread 31 (Fig. 4) into which is screwed a left and right threaded rod 32 extending through the groove 19 so that the left and right upper corner die segments are moved in the opposite directions to each other by driving a rotary unit 33 on the rod 32 end. Further, each upper corner die segment 7A, 7B has an openable die segment portion 72 pivotably connected to the upper corner die segment body; the constitution and features of the openable die segment portion will be described later.

As shown in Figs. 3 and 10, a pair of left and right shafts 35, 36 are disposed on the back of said central die segments 1A, 1B and provided near the ends with a reversing drive unit 34 such as a rack-pinion or gear mechanism so as to be supportably rotated about 180°. The shafts 35, 36 are provided on the ends with cylinders 38, 39 operated when the number of the thin upper die segments 8 to be reversed is selected, and further on an end of one cylinder with a shift cylinder 40 for centering the whole upper die segment group when an odd number of the upper lateral die segments are used. Further, on the way of the shafts 35, 36 are provided cylinders 41, 42 for fastening the upper lateral die segment group in the reversed, ascended state.

As shown in Fig. 6, the upper lateral die segments 2A, 2B --- 6A, 6B are constituted respectively from body portions 57 and die segment portions 58, and the shafts 35, 36 are inserted into a hole 45 laterally provided in the body portions 57 and are provided with a longitudinal key way 46 on a portion supporting the whole upper lateral die

segments (Figs. 5 and 10). To the lower portion of the body portion 57 is attached a movable body 51 urged normally to advance by a spring 48. A wedge 50 is provided which is bent and inserted into the key way 46 in said shafts 35, 36 from the upper end of this movable body 51.

On the other hand, the upper corner die segments 7A, 7B have a tool length of integral times that of the upper lateral die segments (two times in the drawing), and as shown in Figs. 5 and 10, the upper portions thereof each have such tool length plus the length of one upper lateral die segment (one corresponding to 3 upper lateral die segments in the drawing). In the upper corner die segments are each provided a wedge releasing mechanism 55 (Fig. 4, 5) consisting of a piston 53 and a cylinder 54 to release said upper lateral die segments from the wedge and put said upper lateral die segments into the non-reversed condition of Fig. 2 in pivoting the shafts 35, 36.

As shown in Figs. 5 and 8, the thin upper die segments 8 are provided respectively with a spline hole 26 meshing with a spline cylinder and supported on a mechanism 25 for selecting the number of the upper lateral die segments to be reversed. This mechanism 25 consists of the spline cylinders 23, 24 having splits near the position in which the shafts 35, 36 are butted against each other, and the cylinders 38, 39 for shifting each shaft outward. The spline cylinder 23 is secured fixedly to an end of the shaft 36 by the use of a pin 27 to reverse the thin upper die segments 8 engaging the corresponding spline cylinder 23 in rotating the shaft. The other spline cylinder 24 is secured fixedly to the bracket 22 for one central die segment to support the thin upper die segments 8 engaging the corresponding spline cylinder 24 under the non-reversing condition.

Now will be described in detail the upper corner die segments 7A, 7B in the present invention.

The upper corner die segments are arranged left and right of the upper lateral die segment row and moved in the opposite directions to each other by the left and right reversely threaded rod 32. As shown in Figs. 2, 4, 5, 9 and 10, the upper corner die segments 7A, 7B consist of main bodies 71 having the height equal about a half of that the adjacent upper lateral die segments, and the openable die segment portions 72 mounted on the lower part of each main body 71. A T-shaped part formed on the upper portion of the main body 71 is inserted into the T-shaped groove 19 in the lower portion of the ram 13 and is screwed onto the screw rod 32 extending through the T-shaped groove 19.

Said openable die segment portion 72 is mounted removably on the main body 71 through a link 75 provided on the lower portion of the main body

71. That is, a bracket 76 is suspended from the lower corner of the main body 71 at the side contacting the upper lateral die segment, and a pin 77 extends through this bracket 76 in the direction orthogonal to the bending line to mount said link 75, on the end of which is supported the openable die segment portion 72 by the use of a pin 78 (Figs. 9, 15). As shown in Fig. 9, the openable die segment portion 72 has a recess 79 to avoid the interference with a rise 95 at the work end side as viewed from the front and is formed with a cavity 80 at the side adjacent the upper lateral die segment. The cavity 80 has a side oblique surface 82 abutting against an end face 81 of the adjacent upper lateral die segment upon withdrawing the die segment upwardly, preventing the openable die segment portion 72 from further pivoting. Furthermore, a side oblique surface 83 extending from the lower end of the side oblique surface 82 toward the edge of said upper die segment portion is designed so as to form a vertical flat surface 84 in the lower end of said side oblique surface, surface 84 contacting closely said end face 81 of the upper lateral die segment in the non-opened condition of the die segment portion 72. When the openable die segment portion 72 contacts closely the adjacent lateral die segment, no clearances appear between edges 85, 86 of both die segments by the presence of the flat surface 84 to hold a continuous edge line at the same level. Further, a rod 88 with a head 87 is planted into the upper surface of the openable die segment portion 72. A guide hole 89 corresponding to the rod 88 is provided in the main body 71. When the openable die segment portion 72 begins to be opened, the rod 88 descends vertically through the guide hole 89 before the link pivots about the fulcrum, and after said flat surface 84 is spaced from the adjacent upper lateral die segment, the link is allowed to pivot about the horizontal fulcrum and brought down to the position shown by the chain line in Fig. 9. As can be seen from the drawing, the fulcrum which is determined by the axis of the pin 77 is at the innermost end of the segment.

Next will be described the operation of said apparatus with reference to Figs. 10 to 13.

Four side edges of a sheet metal 90 which has been cut previously into an approximately rectangular shape as shown in Fig. 17 are bent into the U-shaped form as follows: First, the edge of one short side 91 is bent in two steps into the U-shaped form and then the work is turned 180° in a plane on a handling table (not shown). The other short side 92 of the metal 90 is thus bent similarly. In bending these short sides, adjustment of the tool length is not needed and a length of the upper die segment group 20 larger than that of the short side will do. Next, the work is turned 90° and the edge

of one long side 93 is bent. The work is then further turned 180° , and the other long side 94 is bent. As a result, as shown in Fig. 18, a product of rectangular shape having a width W and a length L with the four sides bent in a U shape by the first bends E and the second bends H, is obtained. In the above working, since a U-shaped rise 95 is produced by bending the short said edge, the length of the upper die must be adjusted in bending the long side. The upper corner die segments 7A, 7B should avoid the interference with the rise 95 in approaching the work and in withdrawing the die segments after bending the long sides. The present invention can cope with all these requirements.

Now, to simplify the description, the change of work length (length of long side) will be described with reference to two central die segments having 75 mm width, each five * two upper split lateral die segments having 50 mm width each, two upper corner die segments having 100 mm width each and ten thin upper die segments having 5 mm width each.

Fig. 10 shows the tool length of 850 mm using all die segments except for the thin upper die segments 8, and Fig. 11 shows the tool length of 350 mm with the central and upper corner die segments only.

Now will be described the case in which a 350 mm tool length shown in Fig. 11 is changed to 475 mm. First, the rotary unit 33 is driven by an NC control to rotate the screw rod 32 and move left and right the central die segments 1A, 1B each by 150 mm. For this movement, the piston 53 (Fig. 4, 6) of the wedge releasing mechanism 55 for the upper corner die segments 7A, 7B is moved to the position of the respective movable body 51 of the wedge 50 for the upper lateral die segments 3A to 5A, 3B to 5B. Here, the cylinder 54 is operated to move left in Fig. 4, 6 the movable body 51 and remove the wedge 50 at the upper end out from the key way 46 by the extension of the piston 53 as shown in Fig. 6. When under this condition the shafts 35, 36 are withdrawn each 12.5 mm left and right by the cylinders 38, 39, the central die segments 1A, 1B are moved away from each other by the same dimension, as shown in Fig. 12. Then, when the reversing drive unit 34 is driven to pivot the shafts 35, 36, five thin upper die segments 8 are inserted into the 25 mm gap between the central die segments 1A, 1B. At the same time, the upper lateral die segments 2A, 2B and 6A, 6B other than those turned off by the releasing mechanism 55 are rotated by 180° so that the 475 mm tool length can be set as shown in Fig. 13.

Thereafter, the ram 13 is lowered to bend the proximity of the edge of the sheet metal 90 and to bend the long and short sides for providing a

completed product as shown in Fig. 18. After the completion of bending, when the tool length is again changed, the reversing drive unit 34 is driven in the opposite direction to the previous one to reverse simultaneously five thin upper die segments 8 inserted between the central die segments 1A, 1B and the upper lateral die segments 2A, 2B left wedged in the shafts 35, 36 to the condition shown in Fig. 12. Next, after the rotary drive mechanism 30 is reversely rotated and the left and right threaded screw rod 32 is rotated to return the upper corner die segments 7A, 7B to the original positions, the piston 53 is retreated to insert the wedges 50 of all upper lateral die segments into the key way 46, and the shafts 35, 36 are reversed for returning them to the condition shown in Fig. 10.

The upper corner die segments 7A, 7B before and after the bending are operated as follows:

As shown in Figs. 2 and 9, until the openable die segment portion 72 of each upper corner die segment 7A, 7B descends from the ram lifting position and touches the sheet metal 90, it is supported and brought down inwardly slanted by the link 75 as shown by the chain line in said drawings. When the ram 13 is lowered in such state, it does not abut against the rise 95 of the sheet metal. When the ram 13 is then further lowered, the openable die segment portion 72 touches the work before the upper lateral die segments 2A, 2B --- 6A, 6B touch same, and begins to pivot clockwise in Fig. 9. Then, when the edges 86 of the upper lateral die segments touch the work, as shown by the solid line in the same drawing, the flat surface 84 of the openable die segment contact closely the end face 81 of the adjacent upper lateral die segment 6A or 6B, while the edges 85, 86 are arranged on the same line. Since the edge line does not have any gaps, it can withstand a large load so that the sheet metal can be bent along a clear even bending line by pressing it under such condition.

After the completion of bending, when the ram 13 is raised, while the openable die segment portion 72 hung by the link 75 tends to pivot about the pin 77 with its own weight, the rod 88 guided by the hole 89 is regulated to descend for example 3 to 5 mm vertically at the beginning of the pivoting. Since the flat surface 84 of the openable die segment portion is moved out of the end face 81 by that vertical descend, the openable die segment portion is thereafter pivoted about the pin 77 and the side oblique surface 82 abuts against the end face of the upper lateral die segment and stops so that it can return to the condition shown by the chain line and be withdrawn without interfering with the rise 95 of the work.

Figs. 14 and 15 are respectively sectional and

front views showing a modification of the upper corner die segment. In this example, applied to a goose-neck-shaped press brake, same parts as those in Fig. 9 are designated by the same symbols. As shown in Figs. 10 and 15, a main body 101 is provided on the lower corner with the bucket 76 for supporting the goose-neck-shaped openable die segment portion 102 through a link 103. An arm 104 is provided upward from the pivotal fulcrum side of the link 103, while an air cylinder 105 parallel to the edge line is provided in the main body 101 and an end of a piston 106 inserted into the cylinder 105 is disposed to abut against an end of said arm 104. Before entering the bending process, pressurized air is supplied from an approach port 107 of the cylinder to move the piston 106 right, hold the link 103 horizontally and make the openable die segment portion 102 contact closely the main body 101 and the upper lateral die segment. Before and after the bending process, air in the cylinder 105 is vented to slant the openable die segment 102 by its own weight and avoid the interference with the rise 95 of the sheet metal similarly to the previously mentioned embodiment. Also, similarly, the edge line is formed without any gaps between the openable die segment portion and the adjacent upper lateral die segments.

Fig. 16 shows a further modification of the upper corner die segment applied to a folding machine according to the present invention. This upper corner die segment is almost the same as that in Figs. 14 and 15. The die itself applies to a clamp die segment 110 of the folding machine which is opposed to a lower die 111 and lowered by the press cylinder of the ram to clamp the sheet metal 90 and bend the sheet metal edge by pivoting a rotary die segment 112 in the direction of arrow. In this case, while all of the upper lateral die segments, central die segments and thin upper die segments have the same shape as the clamp die segment 110, the illustration of them is omitted. The operational effect of the upper corner die segment is the same as that of the before-mentioned embodiment.

Claims

1. A bending machine comprising:
a ram (13) having a lower end;
a bottom tool (16);
a top tool body mounted on the lower end of said ram (13) above the bottom tool (16);
the top tool body carrying central and corner die segments (1A, 1B, 7A, 7B) engagable with a work piece (90) for bending it;
the corner die segments being characterized in that each corner die segment (7A, 7B) includes a main

body (71, 101) and an openable die segment portion (72, 102, 110); a link (75, 103) mounted inside the lower portion of the main body of the upper corner die segment supports pivotably about a generally horizontal axis the openable die segment portion on the end of the link; and a rod (88) is erected on the center of the upper surface of the openable die segment portion to be inserted into a guide hole (89) in the corner die segment main body.

2. The bending machine according to claim 1, characterized in that the openable die segment portion (72, 102, 110) at its side directed toward the central die segment (1A, 1B) has a cavity (80) for avoiding the interference with an end face (81) of the adjacent die segment (2A, 2B, ..., 6A, 6B) when rotated inwardly, and the lower portion of the cavity has a flat surface (84) contacting the end face of said adjacent die segment to form a continuous edge line (85, 86).

3. The bending machine according to claim 1 or 2, characterized in that the top tool body carries: a pair of the central die segments (1A, 1B) mounted longitudinally movable on the lower end of the ram (13),
a plurality of upper lateral die segments (2A, 2B, ..., 6A, 6B) arranged outside the central die segments (1A, 1B) and mounted reversibly to the upper die segment row,

a plurality of further upper die segments (8), thinner than the upper lateral die segments (2A, 2B, ..., 6A, 6B) and inserted reversibly inbetween the central die segments (1A, 1B), and
the upper corner die segments (7A, 7B) arranged on both left and right ends of the upper lateral die segments (2A, 2B, ..., 6A, 6B);

and that the bending machine further comprises:
a shift mechanism (38, 39, 40) for sliding said central die segments (1A, 1B) reversely at the central portion of the lower portion of the ram (13);
a drive mechanism (30, 33) for sliding the upper corner die segments (7A, 7B) to the longitudinally symmetrical positions of the lower portion of the ram (13);

shafts (35, 36) pivotably disposed at the back of said central die segments (1A, 1B) and upper corner die segments (7A, 7B);

a plurality of said upper lateral die segments (2A, 2B, ..., 6A, 6B) wedged (40, 50) to the shafts and reversed in pivoting of the shaft to be selectively inserted between said central die segment (1A, 1B) and upper corner die segment (7A, 7B);

a wedge releasing mechanism (55) for releasing said upper lateral die segment (2A, 2B, ..., 6A, 6B) from the wedge (50) to be received in the corresponding upper die segment in pivoting the shaft (35, 36); and

a mechanism (38, 39) for selecting the number of

the thin upper die segments (8) supported by the shaft (35, 36) at the back of the central die segments (1A, 1B) so as to be reversed.

4. The bending machine according to claim 3, characterized in that the central die segments (1A, 1B) are slidable fitted into a groove (19) in the lower portion of the ram (13) and provided on the back with brackets (21, 22) for holding a spline cylinder (23, 24) supporting the thin upper die segments (8).

5. The bending machine according to claim 3 or 4, characterized in that the drive mechanism (30, 33) for the upper corner die segments (7A, 7B) comprises a left and right threaded rod (32) provided in the groove (19) of the lower portion of the ram (13), female screws (31) provided in the upper corner die segments (7A, 7B) and a rotary unit (33) provided on an end of the rod.

6. The bending machine according to any of claims 3 to 5, characterized in that the upper corner die segment (7A, 7B) has the width equal to integral times that of the upper lateral die segment (2A, 2B, ..., 6A, 6B) and is provided in the interior with the wedge releasing mechanism (55) to temporarily release each opposed upper lateral die segment (2A, 2B, ..., 6A, 6B) from the wedge (50) by a plurality of sets of cylinder (54) and piston (53).

7. The bending machine according to any of claims 3 to 6, characterized in that the mechanism (38, 39) for selecting the number of the thin upper die segments (8) to be reversed comprises spline cylinders (23, 24) having a split near a position in which the shafts (35, 36) are butted against each other and cylinders (38, 40) for shifting each shaft outward, one spline cylinder (23) being secured fixedly to an end of one shaft (36) to reverse the thin upper die segment (8) engaging the corresponding spline cylinder in pivoting the shaft and the other spline cylinder (24) being secured fixedly to a bracket (22) of one central die segment (1A, 1B) to support the thin upper die segment (8) engaging the corresponding spline cylinder (24) in non-reversing condition.

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FIG. 1

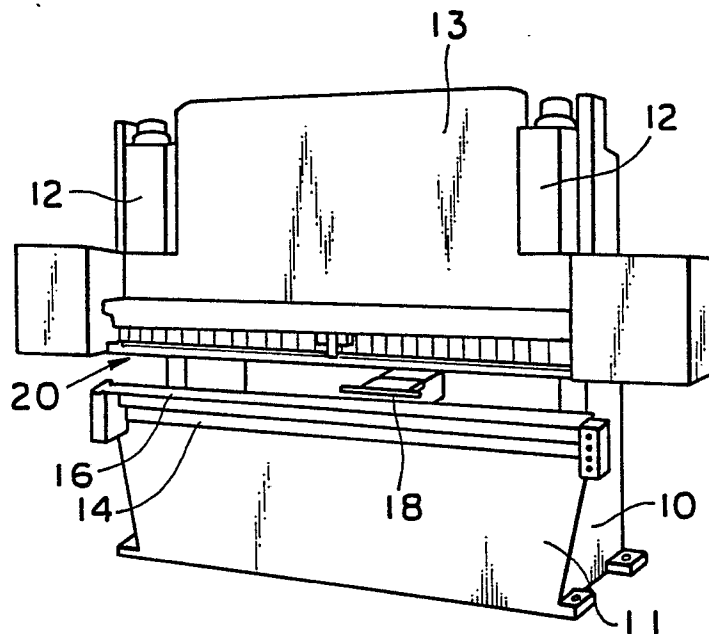


FIG. 3

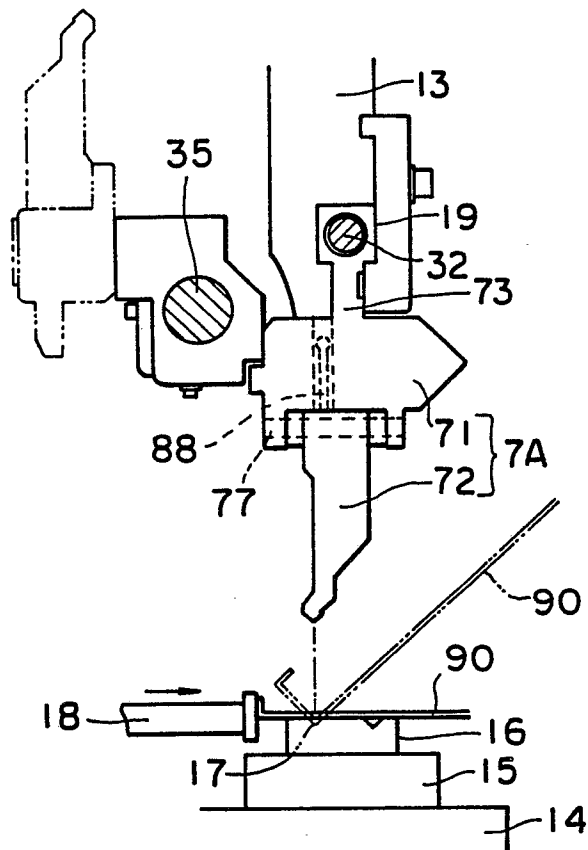


FIG. 2

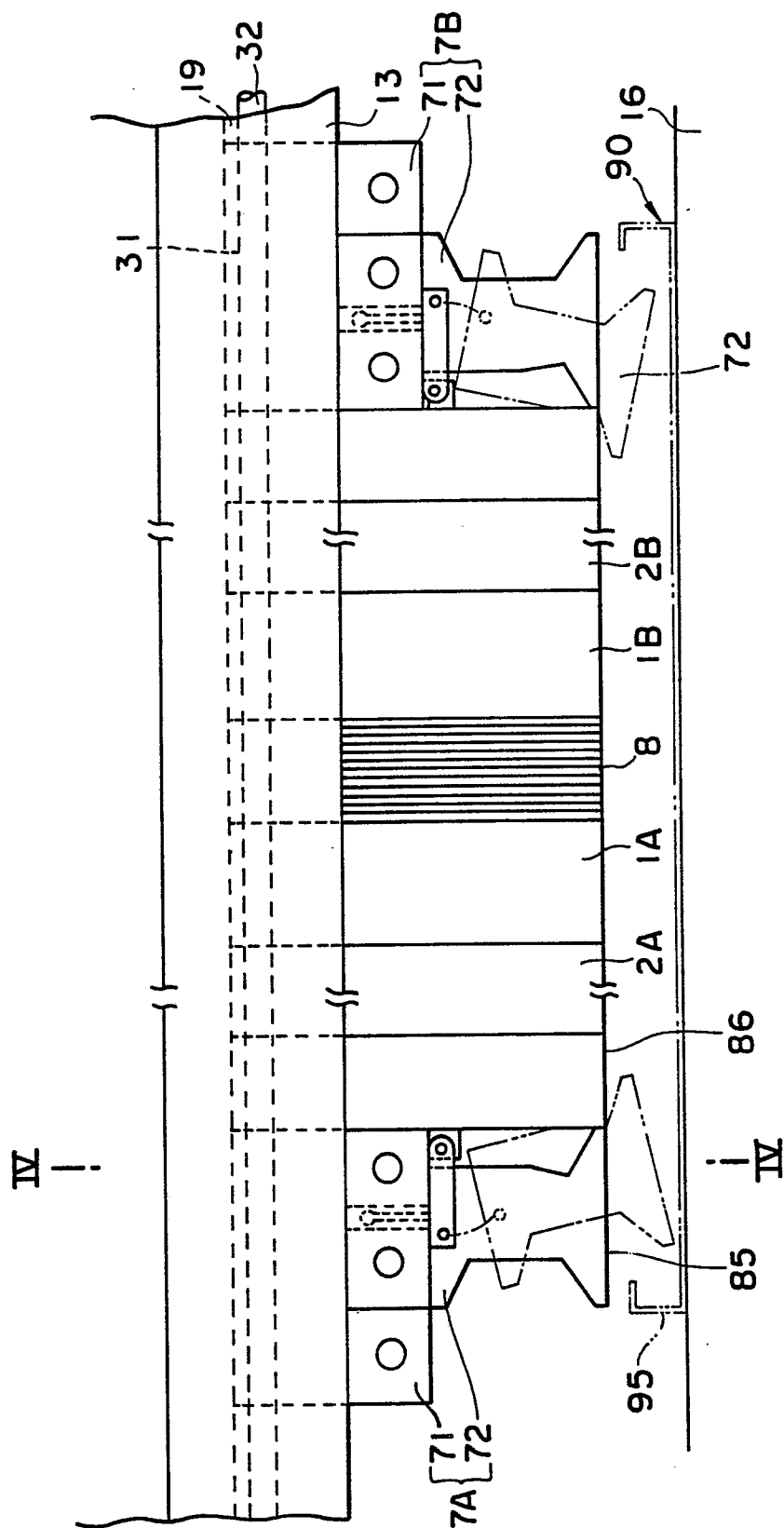
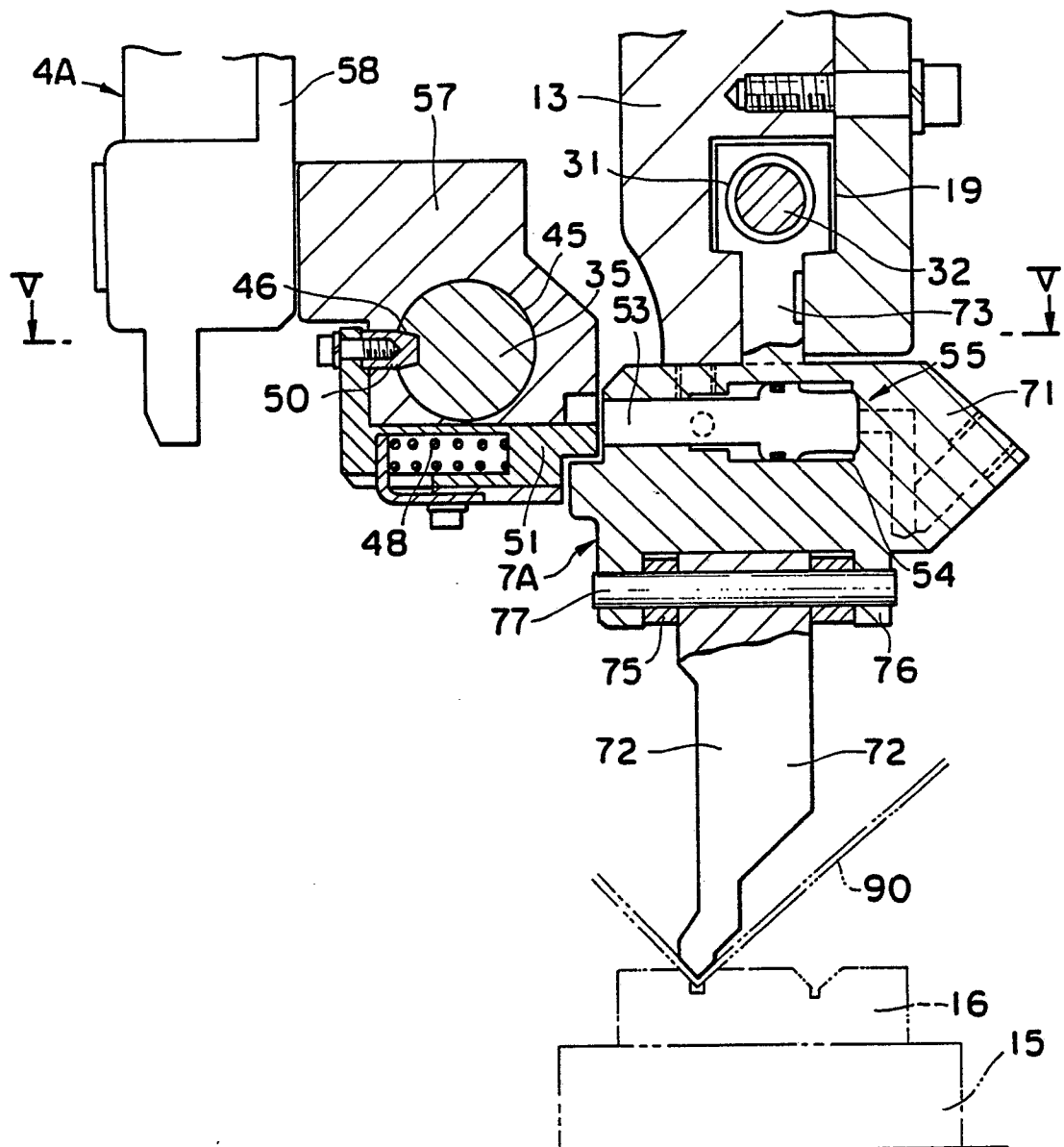


FIG. 4



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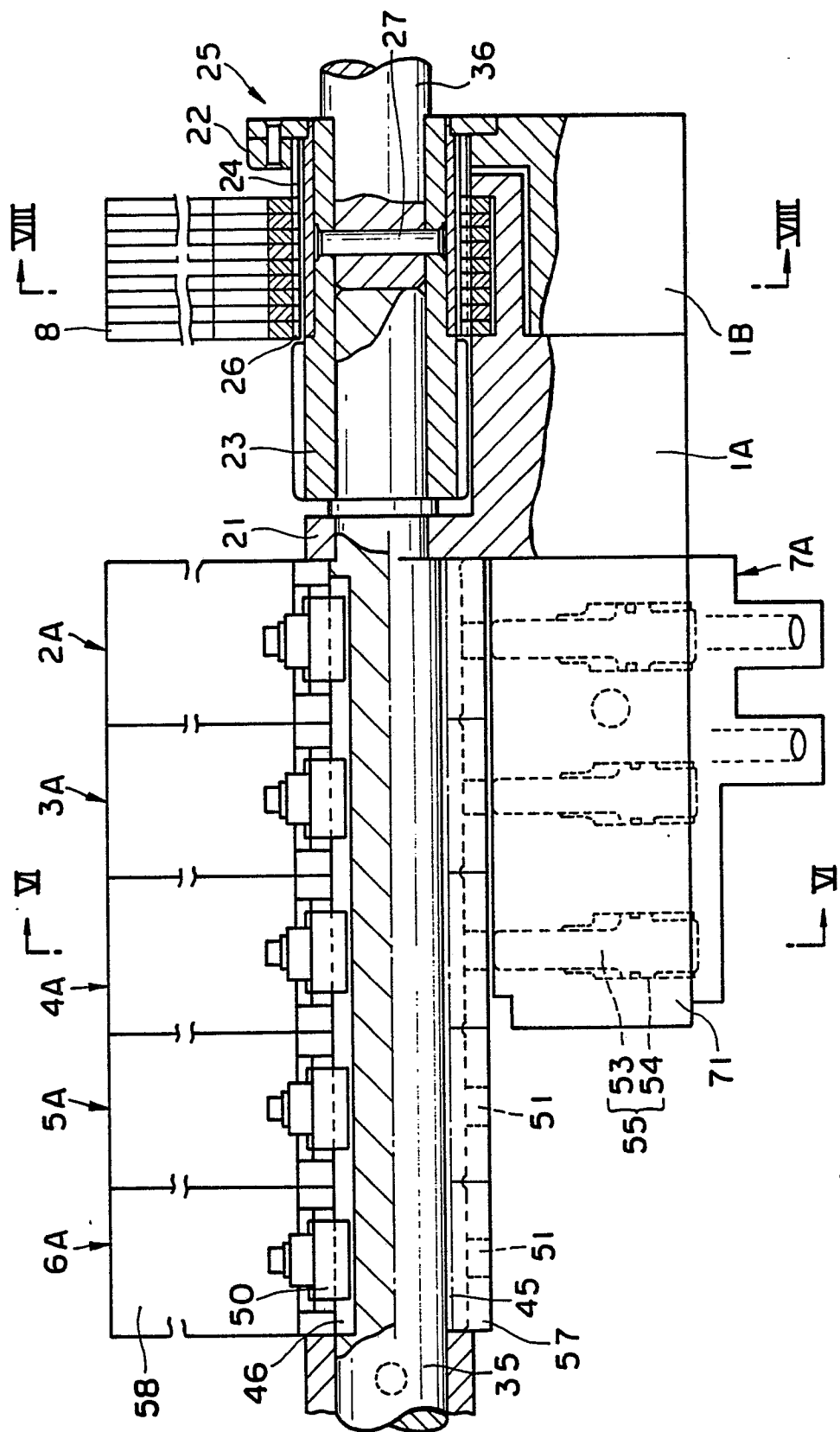


FIG. 6

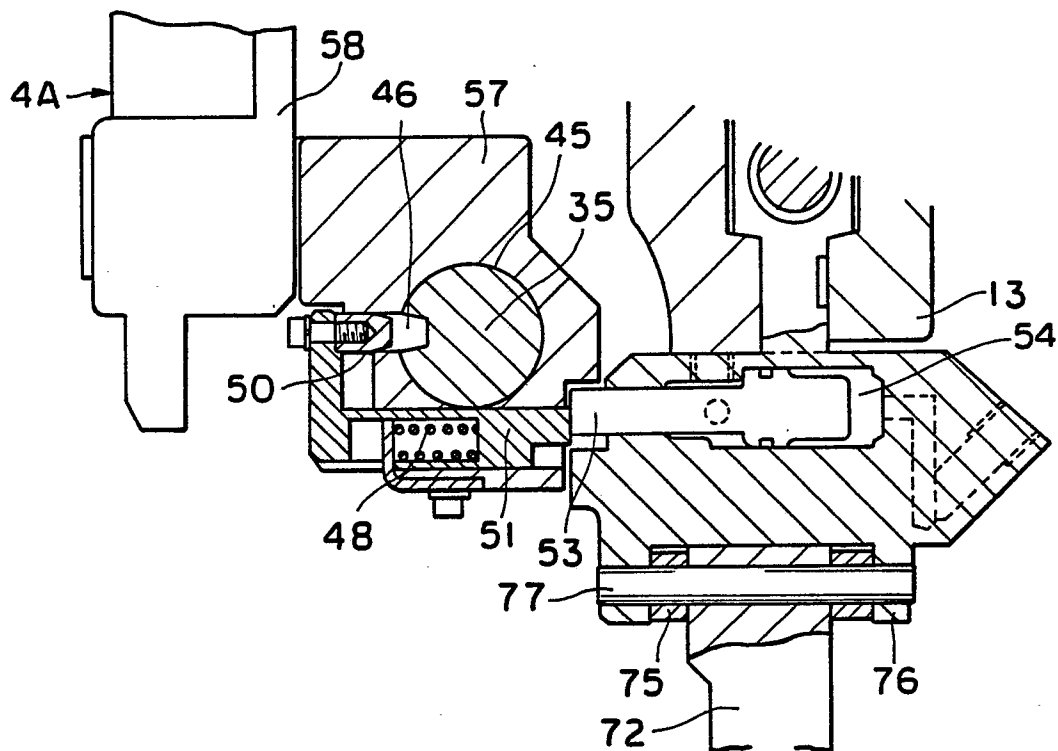


FIG. 8

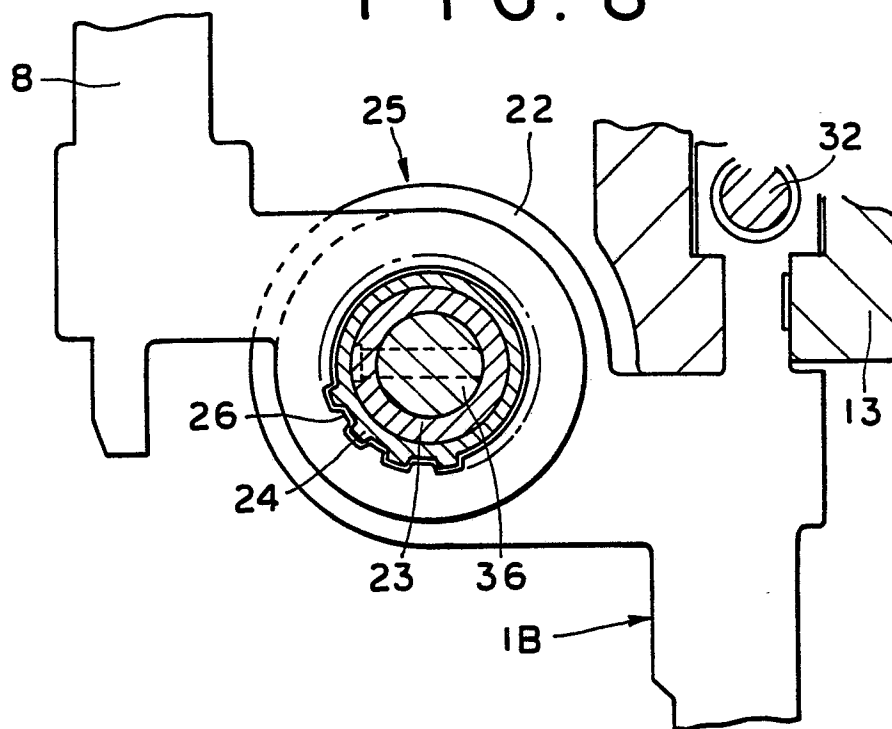


FIG. 7

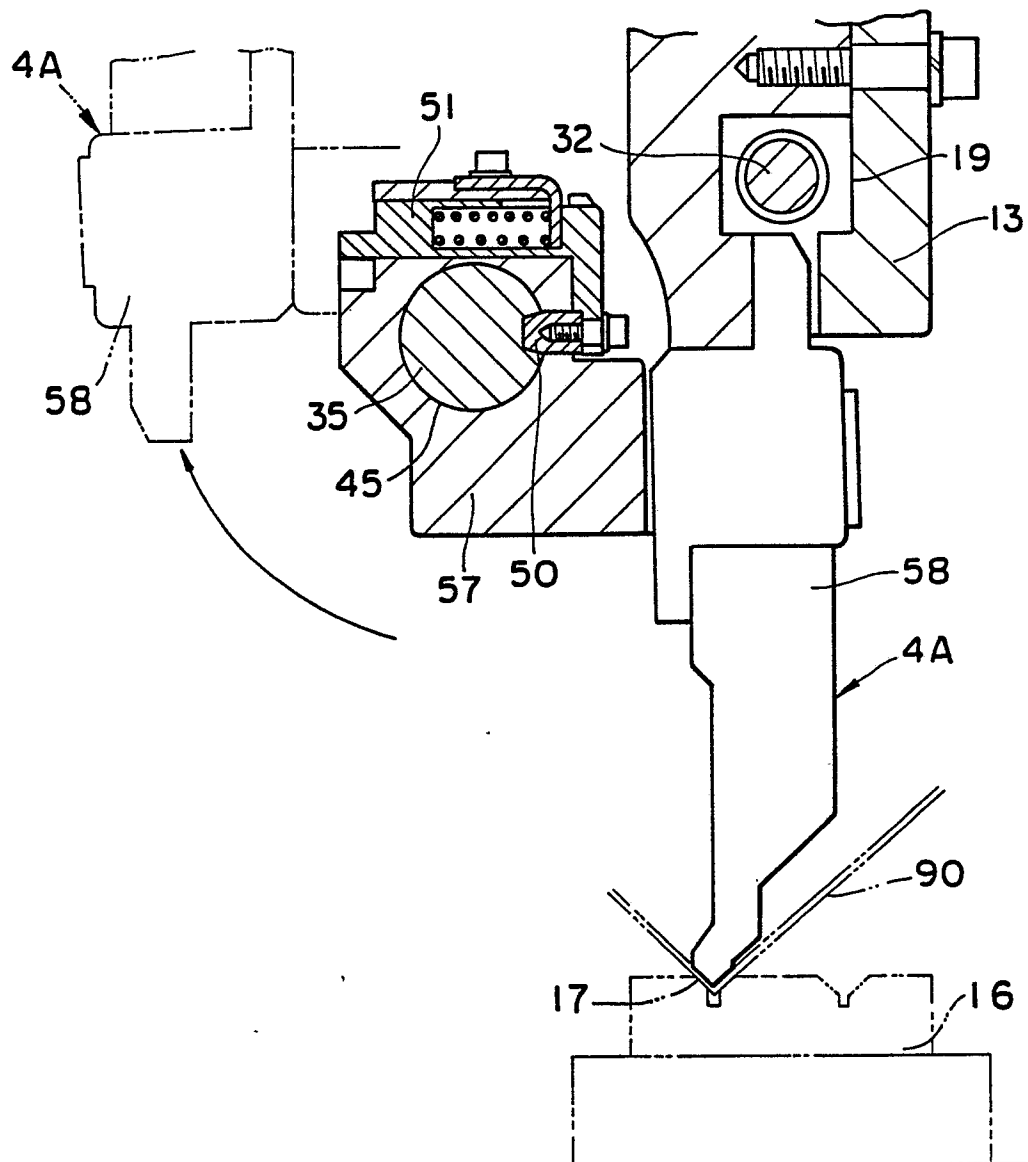


FIG. 9

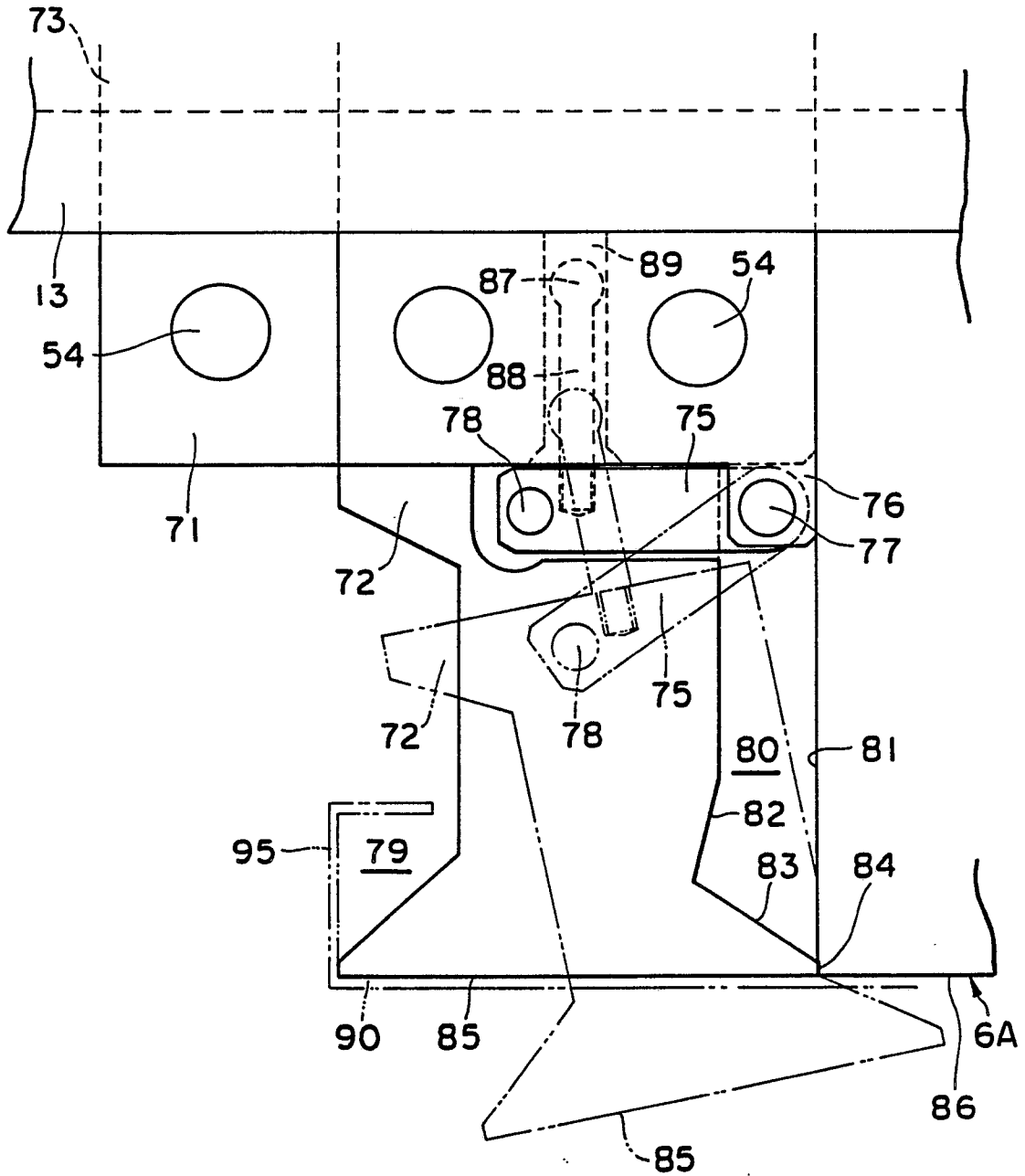


FIG. 10

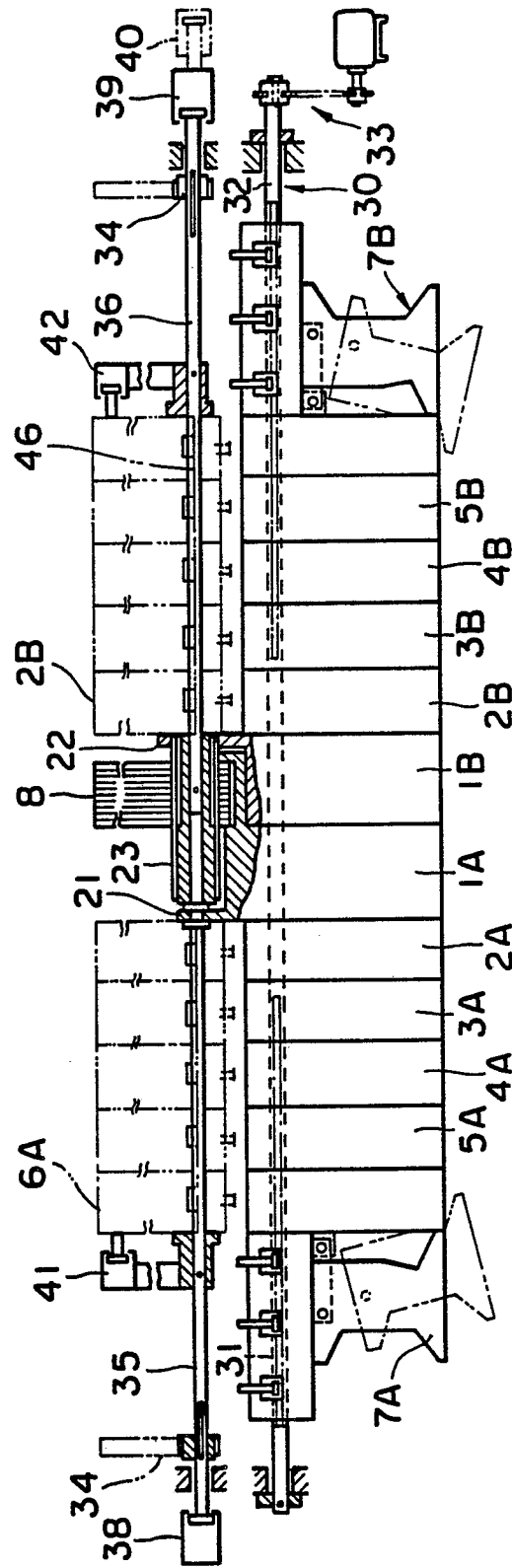


FIG. 11

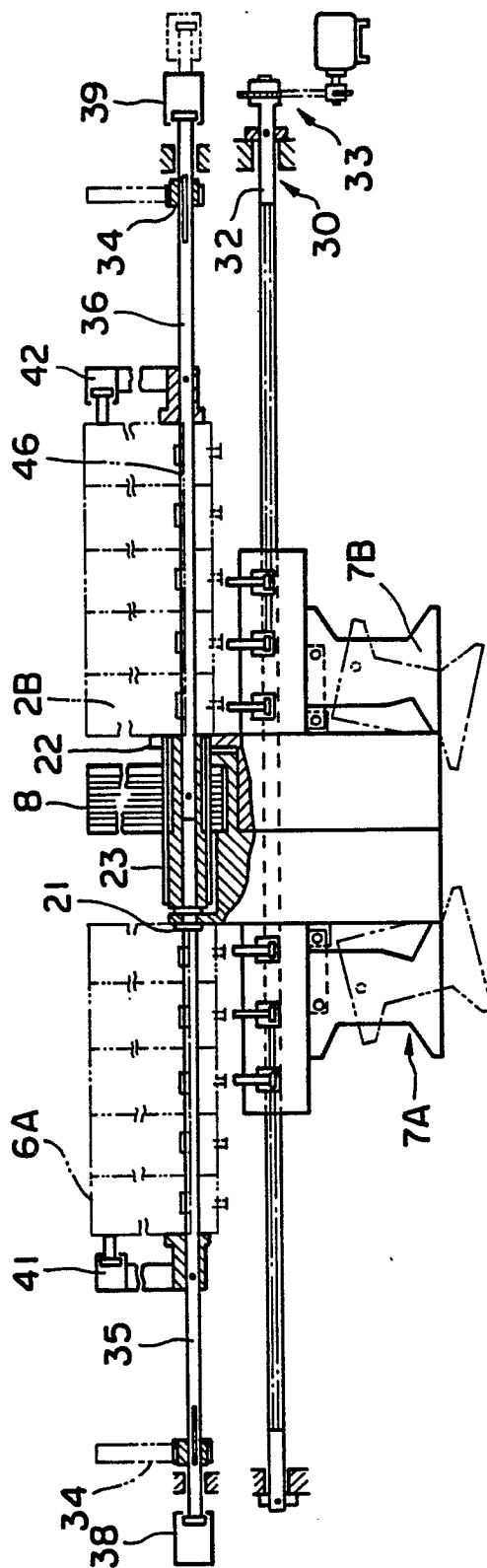


FIG. 12

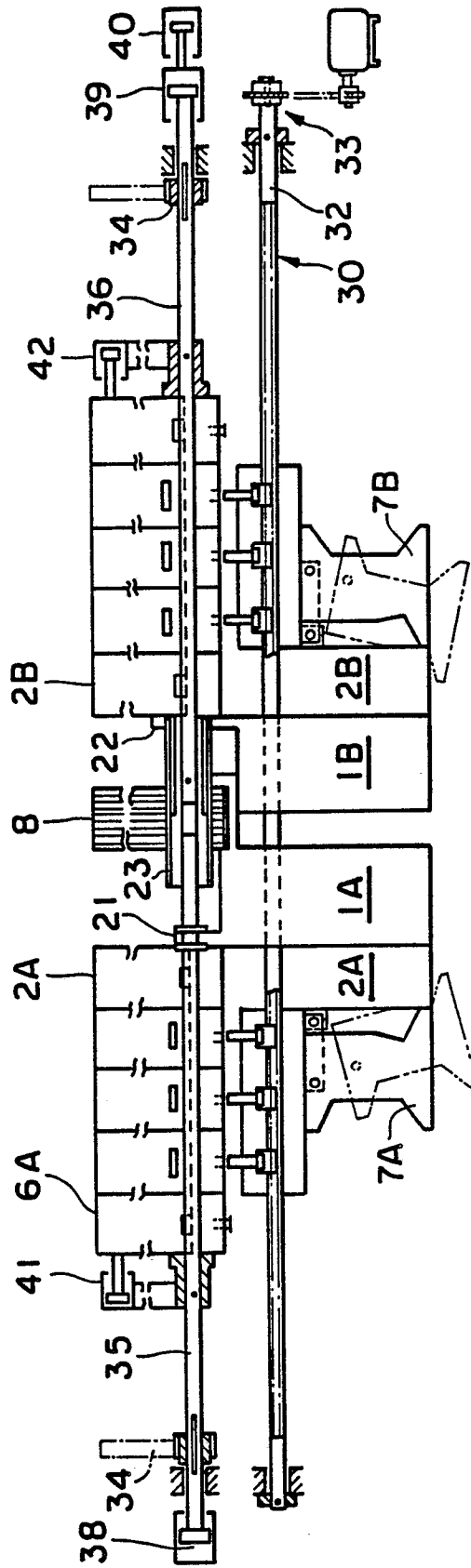


FIG. 13

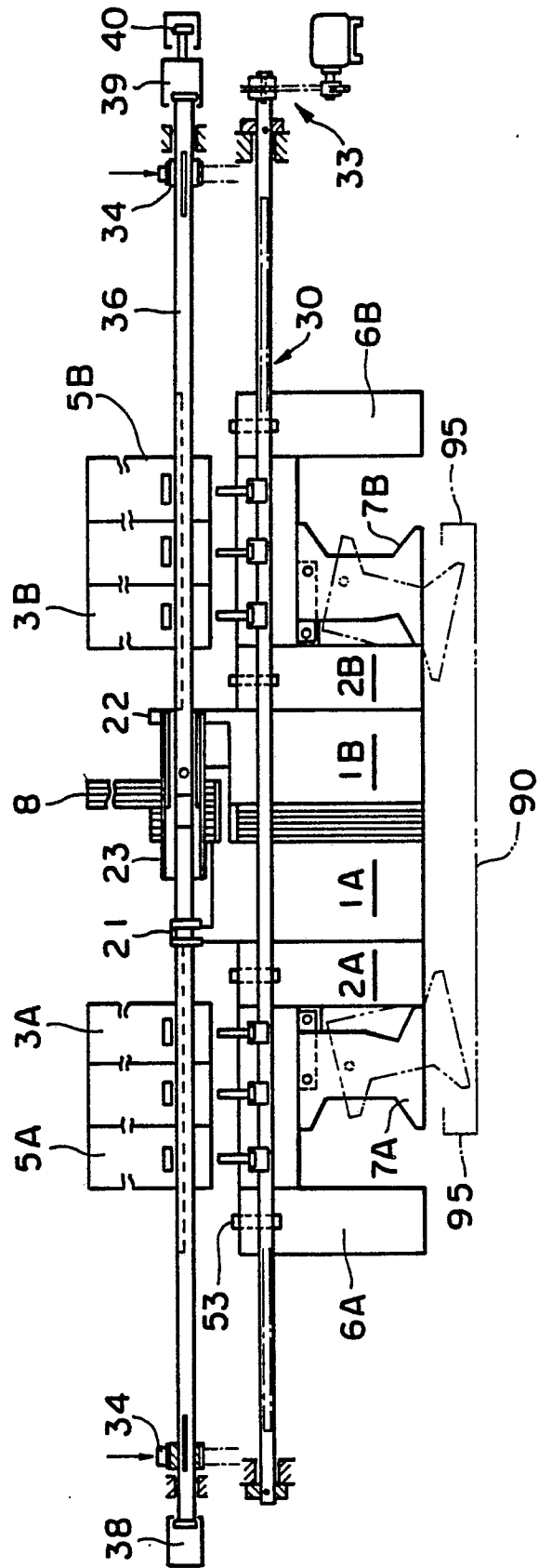


FIG. 14

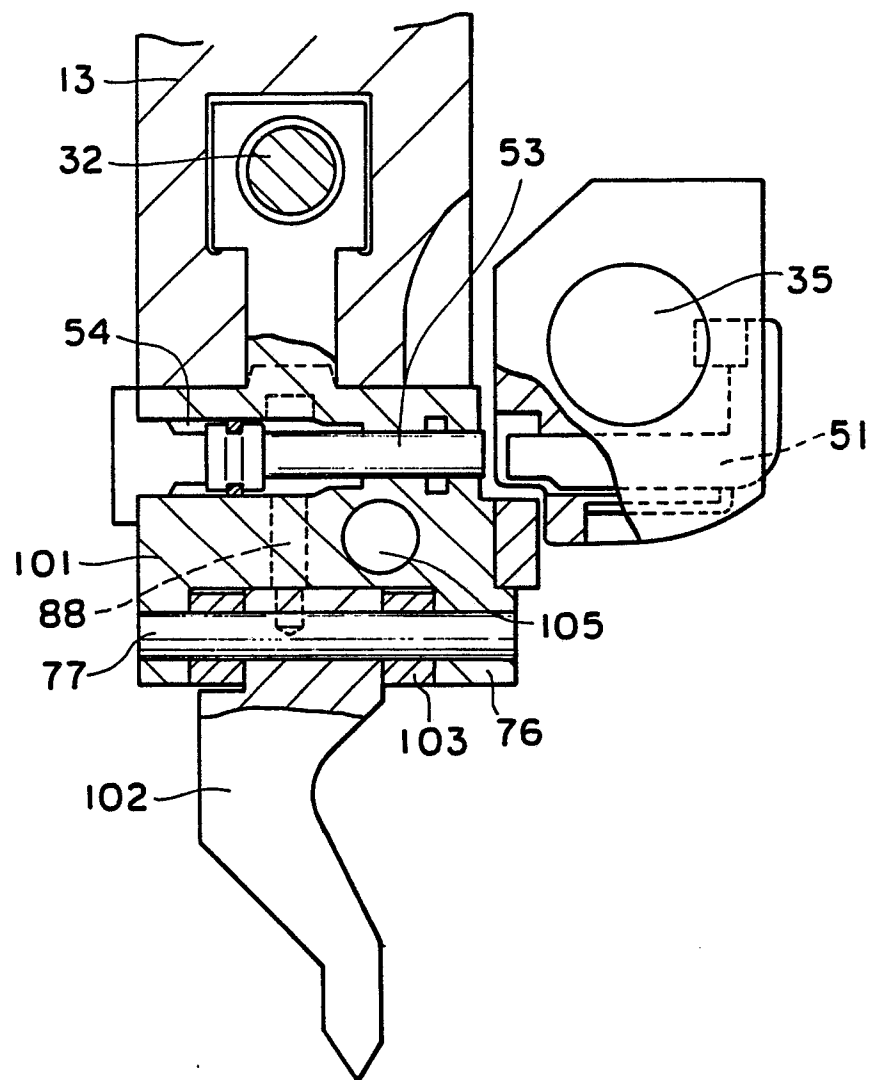


FIG. 15

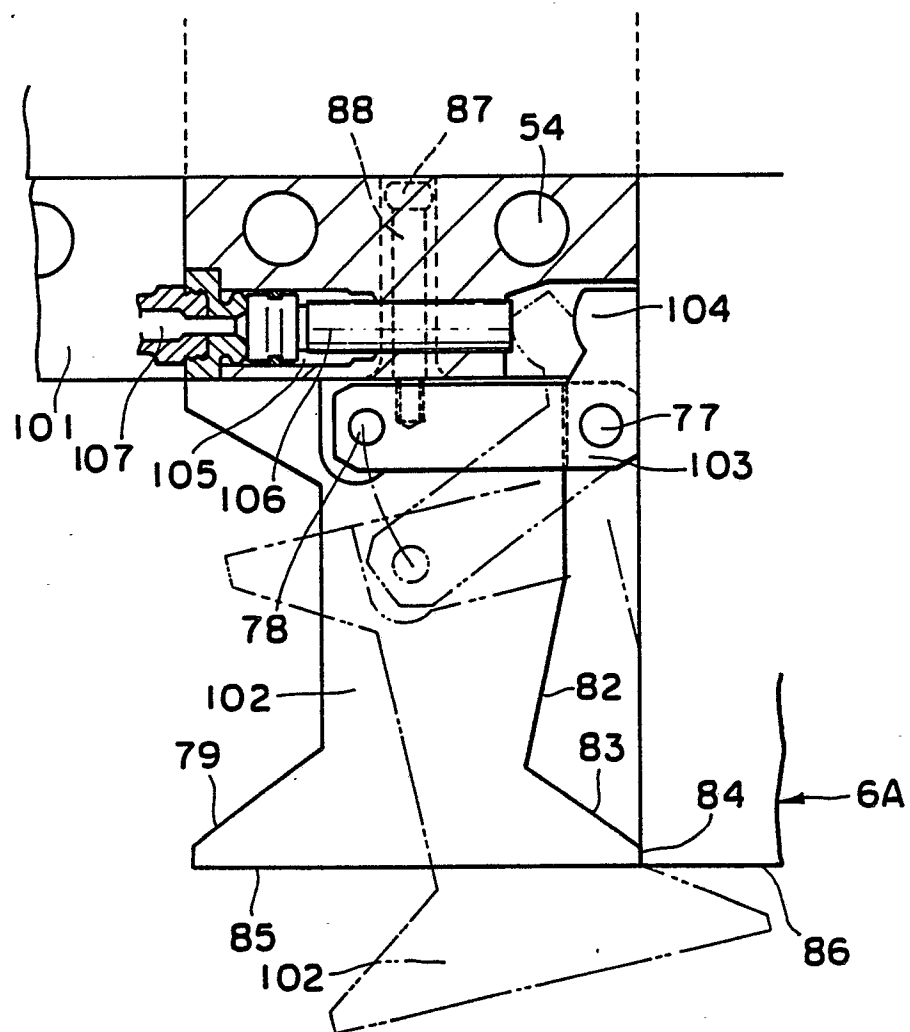


FIG. 16

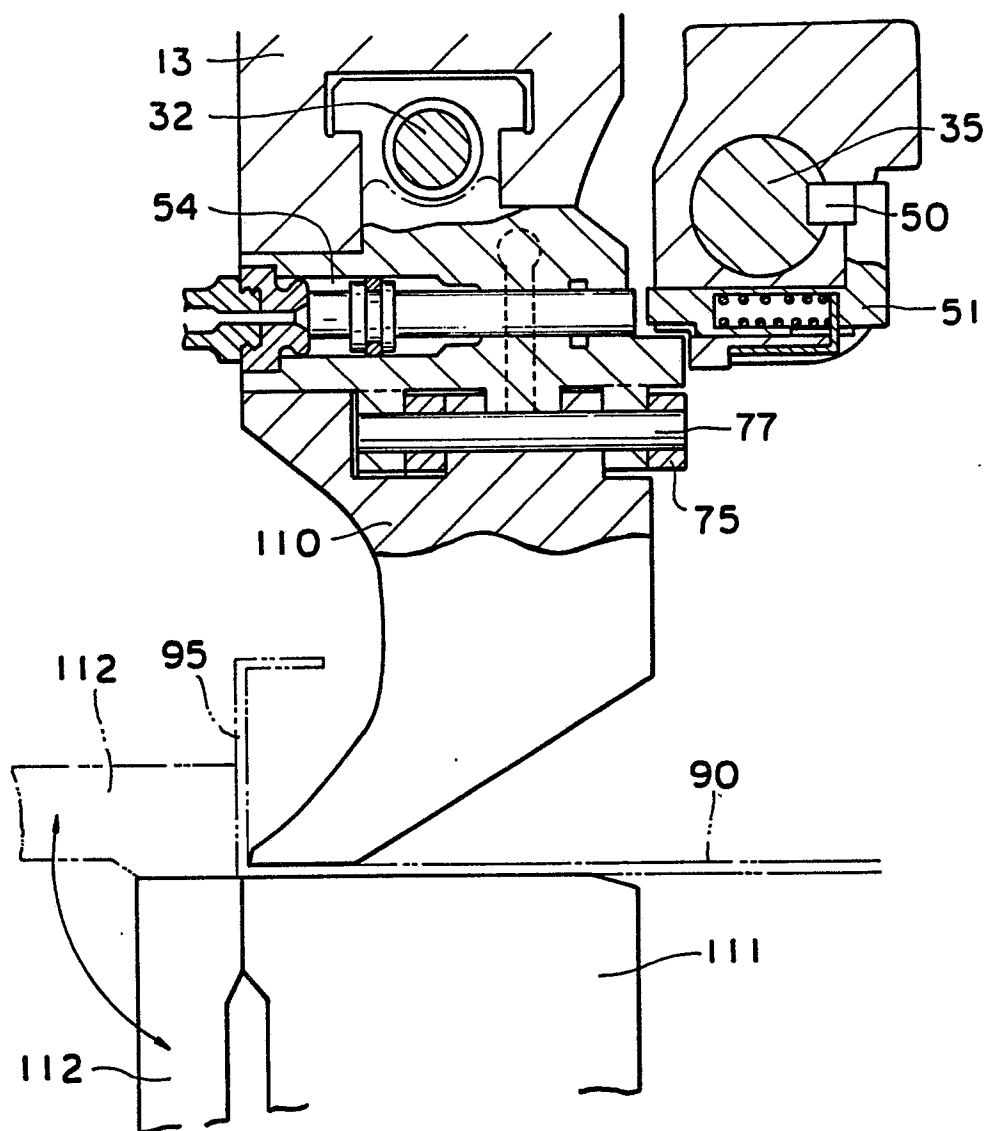


FIG. 17

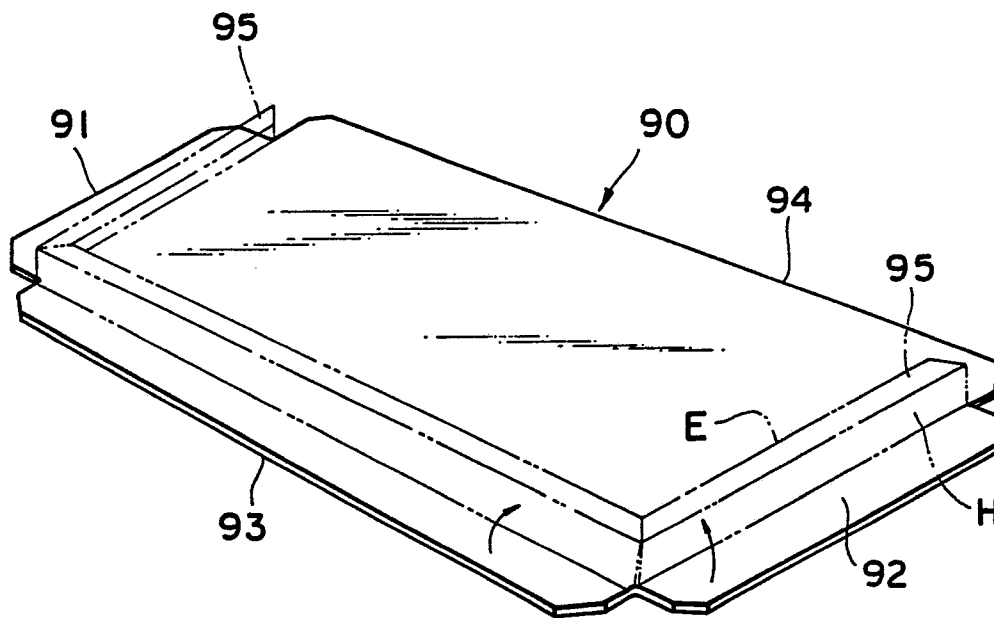


FIG. 18

