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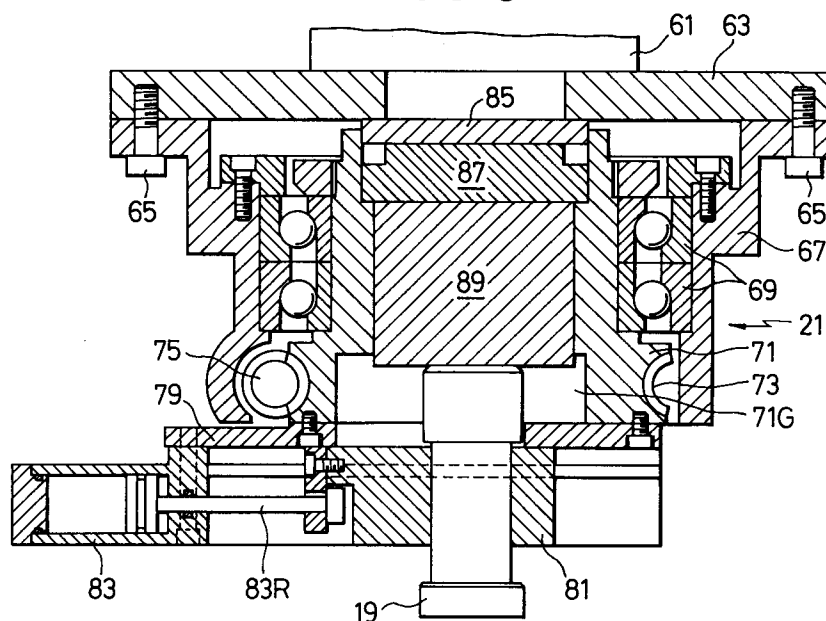
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10.03.93 Bulletin 93/10**4-3011, Iriya, Zama-shi,
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Kanagawa 259-11(JP)**(54) **Punch press and method of punching plate-type workpiece by the press.**

(57) A punch press comprising a pair of disc-shaped tool holders (15U, 15L) rotatably mounted on supporting portions (11U, 11L), one of the holders (15U)-carrying a plurality of punch tools (17P), and the other holder (15L) carrying a plurality of die tools (17D) which cooperate with the punch tools (17P) in order to punch a workpiece (W), a vertically movable

ram (61), and a striker (19) attached to the ram, wherein the striker (19) is movable to a position into which desired punch and die tools attached to the pair of tool holders are indexed in order to change direction of the tools by rotating the pair of tool holders.

FIG.5**EP 0 530 649 A1**

Background of the Invention

Field of the Invention

This invention relates to a punch press and a method of punching plate-type workpieces, and in particular to a punch press provided with one or more than two pairs of disc-shaped rotatable tool holders each of which supports a plurality of punches or dies, and a method of processing plate-type workpieces by the punch press.

Description of the Prior Art

As a conventional punch press is known a turret punch press comprised of a frame, an upper and a lower turrets rotatably mounted on the frame, for carrying a number of punch and die tools at the outer peripheries of the turrets, and a striker attached to the frame, for striking one of the punches. The punch to be struck is positioned or indexed under the striker when the workpiece is punched.

Japanese Patent Publication No. 52-27393 discloses a turret punch press comprised of an upper and lower turrets on which a number of punches and dies are arranged in several concentric circles so that some punches and dies respectively align in the radial directions of the upper and lower turrets. The punch press has a striker movable in a radial direction of the turrets.

United State Patent No. 4412469 discloses a turret punch press of which upper and lower turrets carry rotatable punch and die tools. The punch and die tools can be rotated and positioned or indexed as desired.

Another US Patent 4976180 discloses a turret punch press provided with upper and lower turrets to which a pair of rotatable disc-shaped tool holders for carrying a plurality of punch and die tools are attached. The position or direction of the tool is changed by the rotation of the tool holder.

In the above-mentioned turret punch press including the upper and lower turrets carrying a number of punch and die tools, the turrets are turned or indexed in order to position the tools with respect to the striker. After the turrets are indexed as mentioned above, then the tool holder rotates to index the predetermined tools under the striker. The punch and die tools are immovably attached to the holders and are therefore not rotated automatically with respect to the holders. The tools may be rotatably attached to the holders. Making such a complicated configuration, however, in which the tools rotatably mounted on the rotatable holders attached to the rotatable turrets will make the tool portion and the holder portion larger and require larger spaces.

Summary of the Invention

The primary object of the present invention is to provide an improved punch press, wherein a striker of the press can move to a given position into which punch and die tools of the press are indexed by rotation of tool holders rotatably mounted on the press.

A punch press of the present invention is comprised of tool holder portions supporting a pair of disc-shaped tool holders, one of the holders carrying a plurality of punch tools and the other holder carrying a plurality of die tools which cooperate with the punch tools in order to punch a plate-type workpiece; a reciprocatingly movable ram; and a striker mounted on the ram, wherein the striker is movable onto the punch and die tools which are positioned by rotation of the tool holders.

In the above configuration, when the pair of die holders rotate the directions of punch and die tools attached to the holders change. For example, when the punch and die tools face in the X direction and rotate 90 degrees, the tools turn in the Y direction perpendicular to the X direction. In other words, the tools move to a position of which phase shifts 90 degrees from the original position with respect to the radius of rotation of the tool.

The striker for hitting the punch tool attached to the punch holder can move to a position into which the tools are indexed by changing their direction and position, and therefore can punch the workpiece even if the direction and position of the punch and die tools are changed.

Brief Description of the Drawings

Figure 1 is a front view of a punch press of the present invention.

Figure 2 is a plan view showing the primary portion of the punch press of the Figure 2.

Figure 3 is a plan view of the primary portion showing change in the direction of punch and die tools.

Figure 4 is another plan view of the primary portion showing the change of directions of the punch and the dies.

Figure 5 is a sectional view, in a large scale, of a striker device of the punch press of Figure 1.

Figure 6 is a bottom view of the striker of Figure 5.

Figure 7 is a sectional view of a second embodiment of the primary portion.

Figure 8 is a sectional view of a third embodiment of the primary portion.

Description of the Preferred Embodiments

Figures 1 and 2 are front view of a punch press 1 of the invention and plan view of the primary portion of the punch press.

The punch press 1 has a portal frame 3 comprised of upper frame 3U and lower frame 3L. The lower frame 3L is provided with a worktable 5 for supporting a plate-type workpiece W. The frame 3 is also provided with workclampers 7 for clamping the workpiece W and a work positioner 9 for moving the workpiece W in the X and Y directions to position it. The work positioner 9 is known and used for a conventional turret punch press, and therefore a further description will be omitted.

The upper and lower frames 3U and 3L of the frame 3 respectively support upper and lower turrets 11U and 11L which rotate about axes 13 (see Figure 2). The design for attaching the upper and lower turrets 11U and 11L to the frame 3 may be similar to that of a conventional turret punch press, and therefore a further description of the design will be omitted.

The upper and lower turrets 11U and 11L act as tool holder supporting portions for supporting punch and die holders 15U and 15L and are, in this embodiment, in the shape of beam or bar. The punch and die holders 15U and 15L are rotatably mounted on longitudinal ends of the upper and lower turrets 11U and 11L. A plurality of punch and die tools 17P and 17D are concentrically attached to the punch holder 15U and the die holder 15L.

In order to punch the workpiece W by striking the punch tool 17P, the upper frame 3U of the frame 3 has a vertically movable striker device 21 provided with a striker 19.

The design for rotating the turrets 11U and 11L may be the same as that of a conventional turret punch press. In this embodiment, however, the turrets or beams may rotate by 180 degrees. Hence, each turret is turned by pinion 23 and lack 25 as shown in Figure 2. The pinion 23 is attached to the axis 13 of the turret and engaged with the lack 25 which is reciprocatingly moved by a known actuator such as a pneumatic or hydraulic cylinder (not shown).

In order to lock the turned and positioned upper and lower turrets 11U and 11L, both ends of the turrets are provided with catch blocks 27, while the frame 3 is provided with lock pins 27 and hydraulic cylinders 31. The hydraulic cylinders 31 activate the lock pins 29 to engage the catch blocks 27 to lock the turrets.

The circumferential surfaces of the disc-shaped tool holders 15U and 15L are formed with worm gears 33U and 33L which engage with rotatable worms 35U and 35L mounted on the turrets 11U and 11L. Axes 37U and 37L of the worms 35U and

35L extend outward from the turrets. A clutch nail 39U or 39L is attached to an end of each axis 37U or 37L.

The frame 3 supports a servo motor 41 with a pair of pulleys 43, 43 and another pair of, or upper and lower pulleys 47U and 47L for turning the tool holders 15U and 15L through the worms 35U and 35L (the supporting configuration is omitted in the drawing). The upper and lower pulleys 47U and 47L are so disposed as to face the worms 35U and 35L. As shown in Figures 1 and 2, an upper drive belt 45U is expanded around the one pulley 43 of the motor 41 and the upper pulley 47U, while a lower drive belt 45L is expanded around the other pulley 43 and the lower pulley 47L. The upper and lower belts 45U and 45L are tensioned by a plurality of tension pulleys 49. Axes 51U and 51L of the upper and lower follower pulleys 47U and 47L respectively engage upper and lower spline shafts 51U and 51L each of which is provided at its one end with a clutch nail 53U or 53L for engaging the clutch nail 39U or 39L of the worms 35U or 35L. For engaging and disengaging the clutch nails 53U and 53L from the clutch nails 39U and 39L of the worms 35U and 35L, clutch cylinder 55U and 55L are mounted on the frame 3. A shifter arm 57U or 57L is attached to an end of a piston rod of the clutch cylinder 55U or 55L. The shifter arms 57U and 57L fit into circumferential grooves of the clutch nails 53U and 53L so as to cause the clutch nails 53U and 53L to move reciprocatingly toward and away from the opposite clutch nails 39U and 39L.

The clutch nails 53U and 39U, or 53L and 39L engage or disengage each other when a clutch mechanism 59 comprised of the clutch nails 39U and 53U and the clutch cylinder 55U, or of the clutch nails 39L and 53L and the clutch cylinder 55L operates. By driving the servo motor 41 when the worms 35U and 35L are connected to the opposite clutch nails 39U and 39L, the punch and die tool holders rotate simultaneously in the same direction, and therefore desired punch and die tools in the tool holders are indexed or positioned with respect to the striker 19 of the striker device 21.

The turrets 11U and 11L rotate to index desired tool holders when the lock of the turrets by lock pins 29 is released and the clutch nails 39U and 53U, and 39L and 53L are disconnected.

As understood from the above description, the tool holders 15U, 15L rotate with respect to the upper and lower turrets 11U, 11L. When the tool holders rotate 90 degrees with respect to the turrets the direction (longitudinal direction) of punching areas P of the tools 17P, 17D change from the X direction shown in Figure 3 into the direction Y shown in Figure 4 and the positions or phases of

the punch and die tools 17P, 17D shift 90 degrees. The directions of the punching areas P or the tools 17P, 17D and positions of the tools change as desired by controlling the rotation of the holders.

It becomes necessary to move the striker 19 of the striker device 21 with respect to the change in the position of the punch and die tools 17P, 17D. In this embodiment, the striker 19 is so designed as to move to the changed position of the tools.

A vertically movable ram 61 (Fig. 1) activated by means of a conventional hydraulic cylinder mechanism or the like (not shown) is mounted on the frame 3. The striker device 21 is disposed under the ram 61 and provided with the striker 19 which is movable to changes its position.

Figures 5 and 6 show the detail of the striker device 21. A supporting plate 63 is secured to a bottom portion of the ram 61 by bolts or the like (not shown). A casing 67 is integrally attached to the supporting plate 63 by a plurality of bolts 65. The casing 67 supports inside a cylinder-shaped revolving body 71 through a plurality of bearings 69.

An outer annular surface of a lower portion of the revolving body 71 is formed with a worm gear 73 which engages a rotatable worm mounted on the casing 67. The worm gear 73 is rotated by a servo motor 77 (Fig. 6) mounted on the casing 67. A guide member 79 extending in a radial direction of the revolving body 71 is attached to the bottom surface of the revolving body 71 by means of bolts. The guide member 79 supports a block 81 which moves along the guide member 79 while carrying the striker 19. In order to move the block 81 along the guide member 79, a transfer cylinder 83 is attached to one end of the guide member 79. A free end of a piston rod 83R is connected to the transfer cylinder 83 for reciprocatingly moving the block 81 carrying the striker 19.

When the transfer cylinder operates, the block 81 carrying the ram 19 moves in the radial direction of the revolving body 71. Hence, the ram 19 moves to the center or in the radial direction of the tool holders 15U, 15L. As the revolving body 71 can be rotated while the striker 19 is positioned off the center of the revolving body 71, the striker 19 can move as desired with respect to the change in the position of the punch and die tools 17P, 17D. The radius of rotation of the striker 19 is preferably equal to that of the punch and die tools 17P, 17D.

A top portion of the striker 19 extrudes upward from the block 81 into a groove 71G defined by the lower portion of the revolving body 71. A shear plate 85, anvil block 87 and power transmission block 89 are provided between the supporting block 85 and the top portion of the striker 19. The ram 61 transmits its pressing force to the striker 19 through the shear plate 85 and the blocks 87 and

89. This design cause the ram 61 under overload to punch the shear plate 85 and protects the other members from damages.

When punching of the workpiece W is carried out by a selected pair of punch and die tools 17P, 17D attached to the tool holders 15U, 15L and the position and direction of the tools are changed by the rotation of the tool holders, the servo motor 77 operates to rotate the revolving body 71 and move the striker 19 to the position into which the tools 17P, 17D has transferred.

Figure 7 shows a second embodiment of the mechanism for moving a striker 19 to a desired position. In this embodiment, an X-axis guide member 91 extending in the X direction is secured to a lower portion of the ram 61, and an X-axis slider 95 is mounted on the X-axis guide member 91. The X-axis slider 95 is moved by an X-axis cylinder 93 along the X-axis guide member 91. The X-axis slider is formed with Y-axis grooves 97 extending in the direction Y substantially perpendicular to the X direction. An Y-axis slider 101 which is moved by a Y-axis cylinder 99 engages the Y-axis grooves 97 of the X-axis slider 95 so as to slide in the Y direction. A striker 19 is secured to the Y-axis slider. The Y-axis cylinder 99 is provided so that it penetrates an elongate hole 91H formed in the X-axis guide member 91 and extending in the X direction.

In the above configuration, the striker can move in the X and Y directions with respect to the change in position of the tools.

Figure 8 shows a third embodiment of the mechanism for moving the striker 19 to a desired position. In this embodiment, a first striker 19A is provided at the center of a revolving body 103 which is mounted on the ram 61 in a way similar to that of the first invention. The same numeral references are assigned to the members which function the same as those of the first embodiment. A second striker 19B is provided apart from the first striker 19A by a distance e.

In this configuration, the first striker 19A hits a punch tool attached to the center of the punch holder, while the second striker 19B hits a plurality of punch tools attached to the punch holder apart from the center of the holder by the distance e.

Claims

1. A punch press comprising:
 - tool holder supporting portions;
 - a pair of tool holders rotatably mounted on the supporting portions, one of the holders carrying a plurality of punch tools, the other holder carrying a plurality of die tools which cooperate with the punch tools in order to punch a workpiece;

a vertically movable ram; and
a striker attached to the ram, wherein the
striker is movable to a position into which
desired punch and die tools attached to the
pair of tool holders are indexed in order to
change direction of the tools by rotating the
pair of tool holders.

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2. The punch press of Claim 1, wherein the ram
is provided with a revolving body rotatable
about the ram, and the striker is attached to
the revolving body so as to move in a radial
direction of the revolving body.
3. The punch press of Claim 1, wherein the ram
is provided with a slider movable in a direction,
and the striker is mounted on the slider mov-
ably in a direction substantially perpendicular
to the direction in which the slider is movable.
4. The punch press of Claim 1, wherein the ram
is provided with a revolving body rotatable
about the ram, and the striker is attached to
the revolving body apart from a center of a
lower portion of the revolving body.
5. A method for punching a plate-type workpiece
by a punch press provided with a striker and
tool holder supporting portions which carry a
pair of disc-shaped rotatable tool holders, one
of the holders carrying a plurality of punch
tools, the other holder carrying a plurality of
die tools which cooperate with the punch tools
in order to punch the workpiece, wherein the
punching is carried out by moving the striker
to a position into which the punch and die tools
on the pair of tool holders are indexed in order
to change direction of the tools by rotating the
pair of tool holders.

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FIG. 2

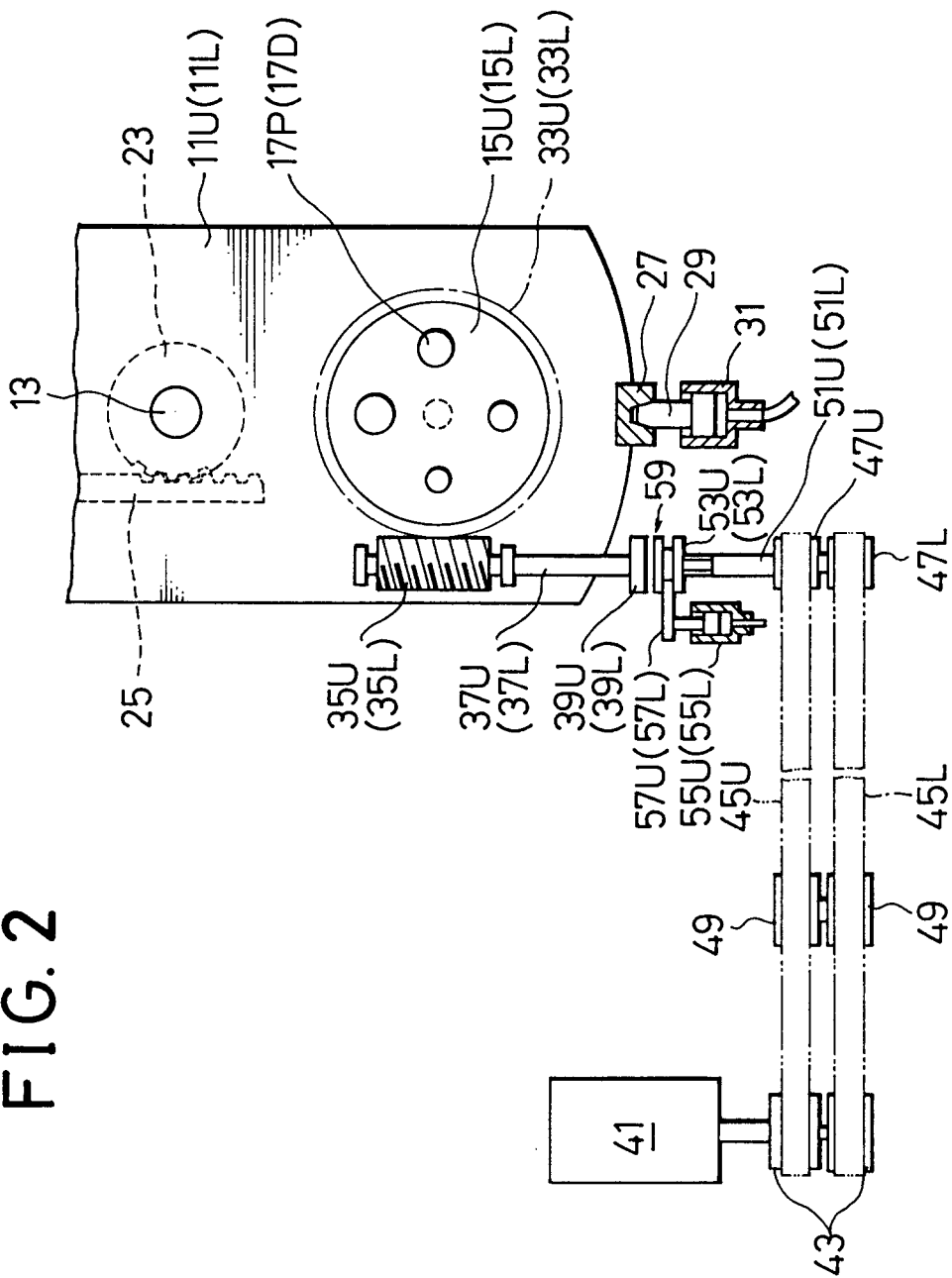


FIG.3

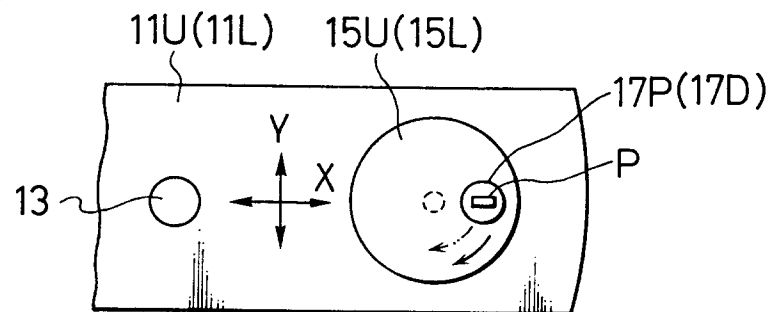


FIG.4

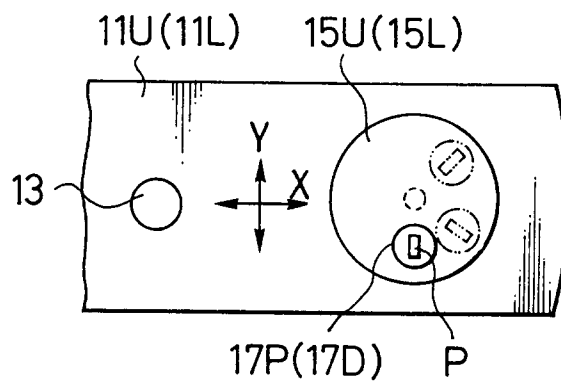


FIG.8

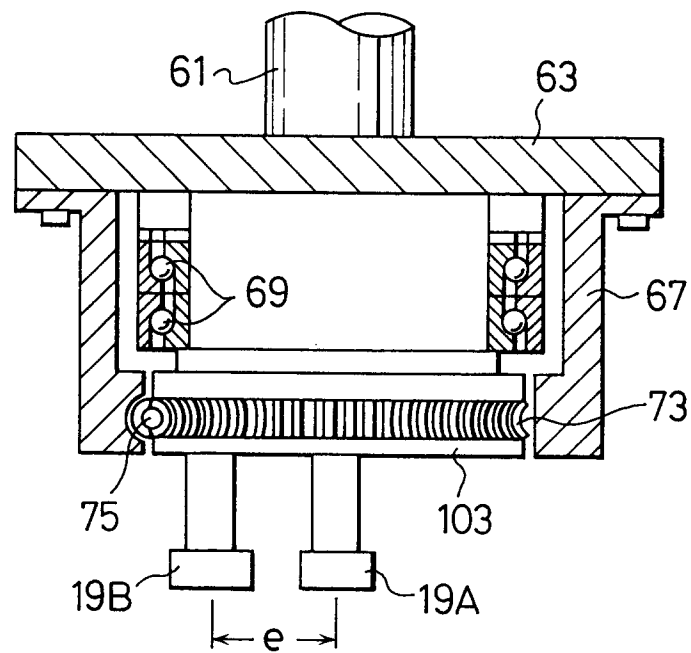


FIG. 5

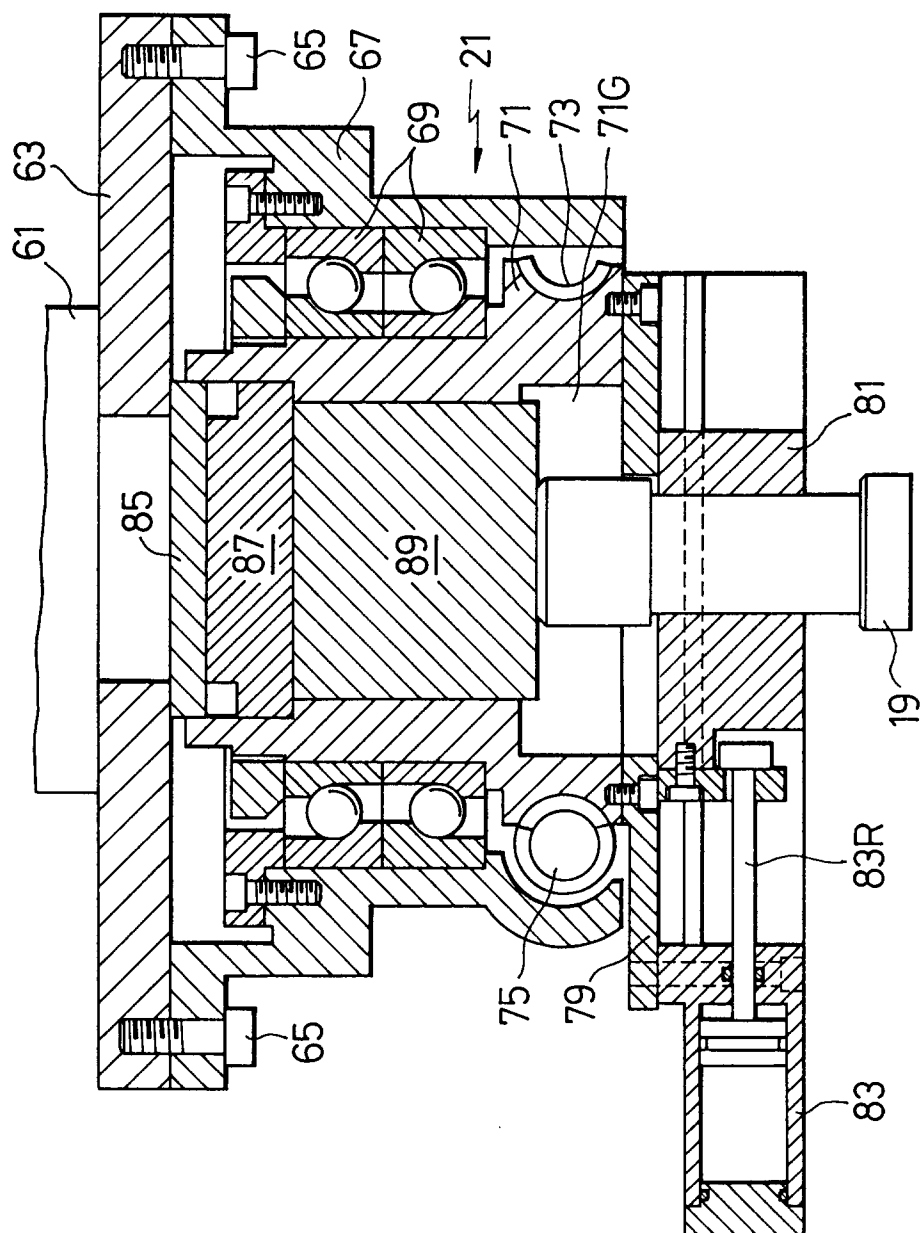


FIG. 6

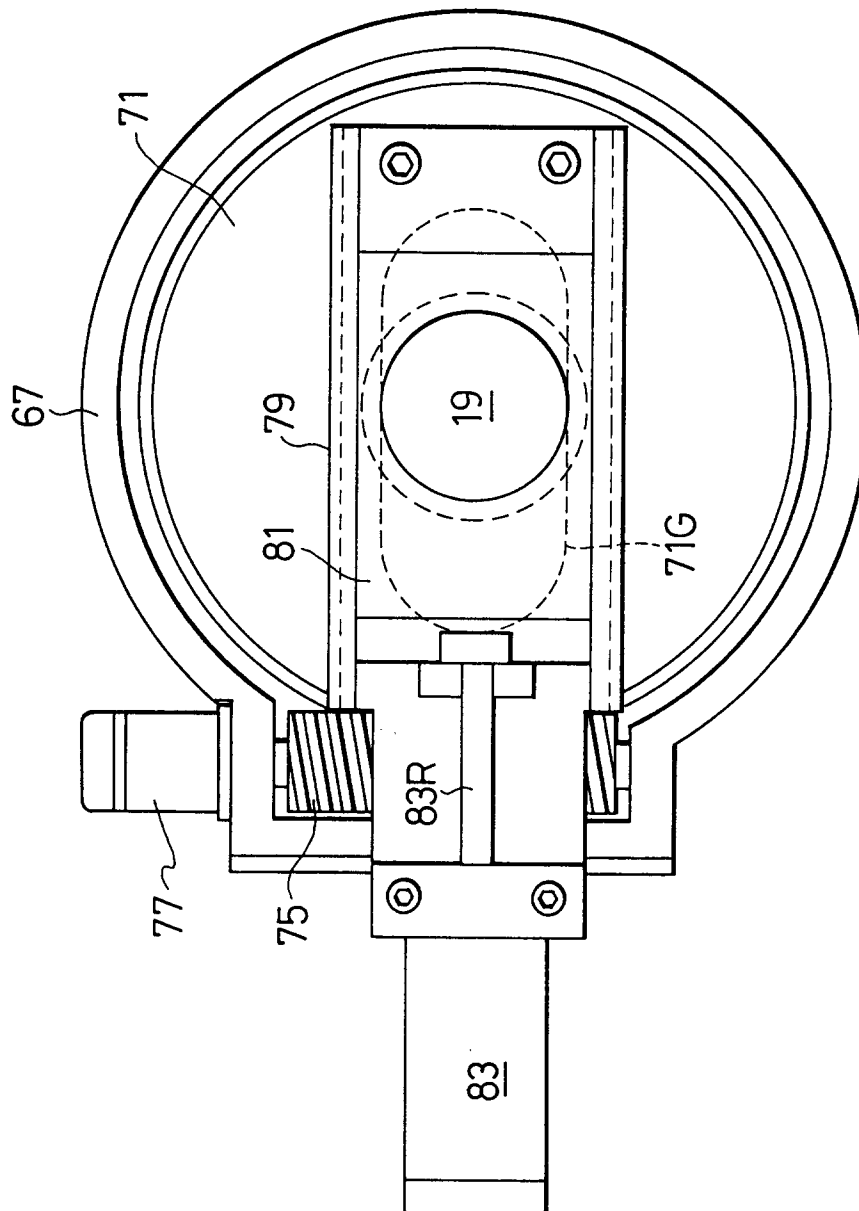
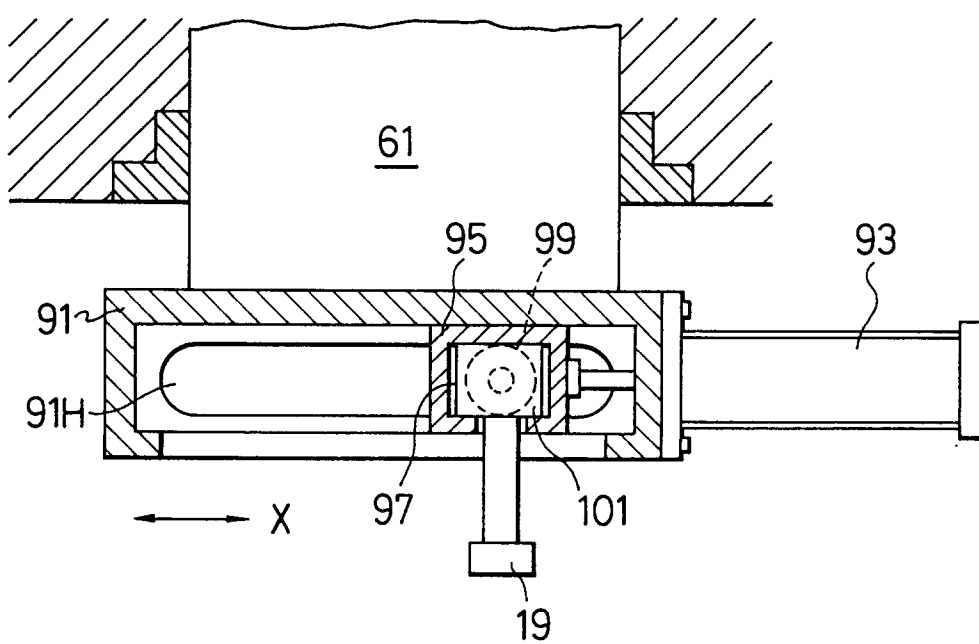


FIG. 7





European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 92 11 4484

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,A	US-A-4 976 180 (OTTO) * claims 1,2; figures 1,3 * ---	1	B21D28/12
D,A	US-A-4 412 469 (HIRATA) * claims 1-3; figures 1-3 * ---	1	
A	WO-A-9 005 601 (AMADA) * claims 1-4; figures 1,3,4 * ---	1-3	
A	US-A-3 449 991 (DANIELS) * claims 1-5; figures 2,4,8 * ---	1,2	
A	EP-A-0 310 908 (RASKIN) * claim 1; figures 3-5 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B21D
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 14 DECEMBER 1992	Examiner SCHLAITZ J.
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