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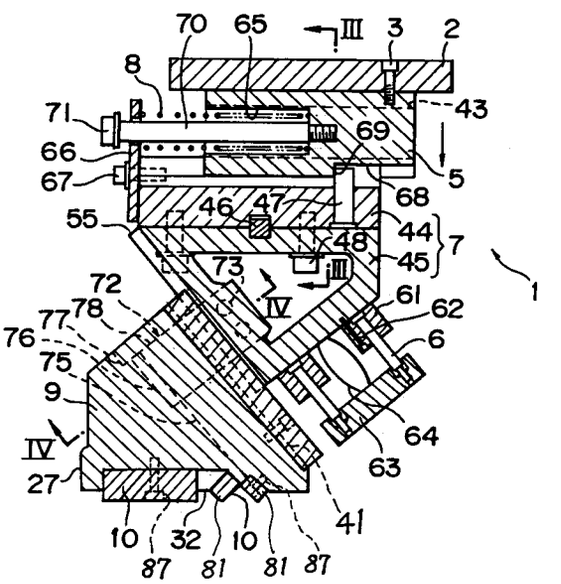
(54) Die having triple-structural hanging cams.

(57) The object of the present invention is to provide a die which enables automated press working in such a way that even in a die having a slant face working cam (104), feeding and taking-out of works are not obstructed by an actuating cam (112) fixed to a lower die.

The present invention proposes a die having triple- structural hanging cams comprising: a slide cam base (5) which is fixed to a base (2) of a upper die (1) and is formed into a polyhedron guide portion (43) at its end; a slide cam (7) which holds the polyhedron guide portion (43) of the slide cam base (5) and slides the polyhedron guide portion and carries a machining member like a punch (6); an elastic body (8) which is interposed between the slide cam base (5) and the slide cam (7) and energizes the slide cam; and an actuating cam (9) which contacts with the slide cam (7) to drive it, a plurality of positioning grooves (10) are formed on an undersurface of the actuating cam (9), said die further comprises positioning protrusions (12) which are provided in lower die (11) portions facing said positioning grooves (10) of the actuating cam (9) and engage said positioning grooves.

Fig. 1



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BACKGROUND OF THE INVENTION

This invention relates to a die having triple-structural hanging cams.

In the press work, a lower die is mounted on a bolster of a press machine and a upper die is mounted on a ram of the machine and a work placed on the lower die is pierced by vertical movement of the ram.

Machining like piercing of a work is performed by the vertical movement of the ram, thus it is easy to machine a horizontal or almost horizontal portion of the work placed on the lower die, but it is difficult to machine a slant face of the work, especially the same having a steep slant.

Therefore, cams shown in Fig. 6 are used so as to enable machining such as piercing on slant faces and steep slant faces. That is, a slide base 103 is fixed to an undersurface of a base 102 of a upper die 101. The slide base 103 is slidably provided with a slide cam 104 which is placed beneath the slide base 103 and slides on that base 103.

On the other hand, a positioning member 108 for a work 107 is fixed to a top surface of a base 106 of a lower die 105, and on a front slant surface 109 of the slide cam 104, punches 110 are disposed perpendicularly to a machining portion of the work 107.

Furthermore, on a top surface of the base 106 of the lower die 105, an actuating cam 112 is fixed to a position opposing to a rear slant face 111 of said slide cam 104.

When piercing the work 107, using this die and simultaneously when the upper die 101 is at the upper dead-end point, the slide cam 104 is withdrawn from the work 107 by energizing an elastic body 114 as compared with its position shown in Fig. 6.

When the upper die 101 goes down, the slide cam 104 contacts with a slant face 113 of the actuating cam 112, and the slide cam 104 is pinched between the actuating cam 112 and slide base 103, and the wedged slide cam 104 approaches the work 107, and the upper die 101 subsequently goes down, then the punches 110 of the slide cam 104 pierce holes in the work 107. This state is shown in the figure, that is, the state at the lower dead-end point of the upper die 101. In this way, the holes are pierced perpendicularly to the work 107's slant face, thus the holes of a true circle rather than an ellipse are pierced. After the piercing the upper die 101 goes up and the slide cam 104 slides on a slant face 113 of the actuating cam 112, and thus the punches 110 withdraw from the work 107's holes and then go up.

Holes are pierced in a non-horizontal slant face or steep slant face in such a way as mentioned above.

Now, in the recent press works, automated machining is promoted in order to do the working efficiently. Automatic feeding of the work 107 to the lower die 105, that is, automatic placement of the work 107 on the positioning member 108 of the lower die 105, or automatic taking-out of the pierced work 107 are automatically performed. But when an automated apparatus is not available for automation, only the work of this part is performed by a worker.

Usually, in the press work several pressing machines are disposed spacing a predetermined distance in the order of process, providing a drawing die, perimeter trimming die, piercing die and a forming die respectively, and the works 107 are carried between the dies by a conveyor.

In this case, the work 107 is fed from one side of the lower die 105, for example, from the right side of the figure and positioned by the positioning member 108, and after piercing the work 107 must be taken out from the other side of the lower die 105, that is, the left side of the figure, making the work 107 jump over the actuating cam 112.

When taking out the work 107 from the positioning member 108 to the exterior of the lower die 105, the actuating cam 112 obstructs the taking-out of the work 107 due to its height.

In order to solve this problem of the obstruction of the actuating cam 112 for being too high, if the actuating cam 112 is placed lower to the extent not obstructing, the slide cam 104 must be made larger to the extent that it contacts with the lower actuating cam 112, thus the slide cam 104 should be extremely large.

Furthermore, when the actuating cam 112 is disposed lower, scrap, that is, punching residue produced when piercing a hole in the work 107 by the punch 110 becomes troublesome to remove. The reason is that the scrap produced when piercing holes is usually taken away automatically by sliding of its own weight from the piercing position to the exterior of the lower die 105 through a slant discharge path. For displacing the scrap by its own weight, the piercing position must be in some height. It is because that, when the actuating cam 112 is located lower, it frequently obstructs the ejection path.

In view of the above situation, the present invention aimed to enable automated press work in such a way that feeding and taking-out of works are not obstructed by an actuating cam fixed to a lower die even in a die provided with a cam which machines a slant face, and the invention proposes a die having triple-structural hanging cams comprising; a slide cam base which is fixed to a base of a upper die and is formed into a polyhedron guide portion at its end; a slide cam which holds

the polyhedron guide portion of the slide cam base and slides the polyhedron guide portion and carries a machining member like a punch; an elastic body which is interposed between the slide cam base and slide cam and energizes the slide cam; and an actuating cam which contacts with the slide cam to drive it, a plurality of positioning groves are formed on the undersurface of the actuating cam, said die further comprises positioning protrusions which are provided in lower die portions facing said positioning groves of the actuating cam and engage said positioning groves.

The upper die has a triple-structural comprising: the slide cam base which is fixed to the base of the upper die and is formed into the polyhedron guide portion at its end; the slide cam which holds the polyhedron guide portion of the slide cam base and slides the polyhedron guide portion and carries a machining member like a punch; the elastic body which is interposed between the slide cam base and the slide cam and energizes the slide cam; and the actuating cam which contacts with the slide cam to drive it, while the lower die has no actuating cam of a large height, therefore the die of the invention greatly facilitates feeding and taking-out of works.

In the meantime, a plurality of the positioning grooves are formed on the undersurface of the actuating cam and the positioning protrusions which engage said positioning grooves are provided in the lower die portions facing said positioning grooves of the actuating cam, thus when machining a steep slant face of a work, the position of the actuating cam is precisely determined and this enables precise machining.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a longitudinal sectional view showing one practical embodiment of a die having triple-structural hanging cams of the invention when it is at the upper dead-end point.

Fig. 2 is a plan view showing the lower die of Fig. 1.

Fig. 3 is a sectional view taken along line III - III of Fig. 1.

Fig. 4 is a sectional view taken along line IV - IV of Fig. 1.

Fig. 5 is a longitudinal sectional view showing the embodiment of Fig. 1.

Fig. 6 is a longitudinal sectional view showing a die having conventional cams which are used for machining a slant face of a work.

DETAILED DESCRIPTION OF THE INVENTION

The present invention will be described in detail referring to Figs. 1 - 5 of the accompanying drawings.

Fig. 1 is a longitudinal sectional view showing one practical embodiment of a die having triple-structural hanging cams of the invention when it is at the upper dead-end point, Fig. 2 is a plan view showing the lower die of Fig. 1, Fig. 3 is a sectional view taken along line III - III of Fig. 1, Fig. 4 is a sectional view taken along line IV - IV of Fig. 1, Fig. 5 is a longitudinal sectional view showing the embodiment of Fig. 1 when it is at the lower dead-end point.

As shown in Fig. 1, the present invention proposes a die having triple-structural hanging cams comprising; a slide cam base 5 which is fixed with a bolt 3 to a base 2 of a upper die 1 and is formed into a polyhedron guide portion 43 at its end which has a substantially square section; a slide cam 7 which holds the polyhedron guide portion of the slide cam base 5 and slides the polyhedron guide portion and carries a machining member like a punch 6; an elastic body 8 which is interposed between the slide cam base 5 and the slide cam 7 and energizes the slide cam 7; and an actuating cam 9 which contacts with the slide cam 7 to drive the cam 7, a plurality of positioning grooves 10 are formed in T-shape on an undersurface of the actuating cam 9, said die further comprises positioning protrusions 12 which are provided in lower die 11 portions facing said positioning grooves 10 of said actuating cam 9 and engage said positioning grooves 10.

That is, in the upper die 1 of the die, the slide cam base 5, slide cam 7 and the actuating cam 9 hang in this order from the upper die 1's upper portion to its lower portion, and the actuating cam 9 of a large height is provided in the upper die 1, therefore this structure facilitates feeding of a work 13 to a positioning member 14 of the lower die 11 and taking-out of the work 13 from the positioning member 14 to the exterior of the lower die 11, thus enabling to use automated apparatuses.

The following embodiment will be described in which holes 15 are pierced in the work 13.

The positioning member 14 which positions the work 13 is fixed with a bolt 22 to a base 21 of the lower die 11. The positioning member 14 is provided with die-brushes 26 for piercing holes in piercing positions.

A guide member 24, which has a vertical wall 23 bear the positioning member 14 and guides the actuating cam 9 to position it, is fixed with a bolt 25 to the base 21.

As shown in Figs. 1 and 2, on the inner surface of the vertical wall 23 of the guide member 24, a wear plate 28, which contacts a rear face 27 of the actuating cam 9 to slide the cam 9, is fixed with a bolt 29. On a top surface 31 of the guide member 24, positioning protrusions 12, which position the

actuating cam 9, are projectedly fixed with bolts 86. The positioning protrusions 12 are used for positioning the actuating cam 9 and are disposed, in T-shape, in the positions facing to the positioning grooves 10 to engage with said grooves 10 as shown in Fig. 2. Installation of only one positioning protrusion 12 does not suffice to position the actuating cam 9 precisely, and thus another positioning protrusion 12 is so disposed that it perpendicularly intersects the former protrusion in T-shape. And the positioning protrusion 12 is so formed that its upper taper slant faces 30 make an apex angle of 90° and it completely contacts with the groove 10 of the actuating cam 9. This positioning protrusion 12 is made of a square sectional rod and the groove 10 is formed with two plates 81, integrating them with a bolt 87. The grooves 10 of the actuating cam 9 completely contact with the taper faces 30 of the two positioning protrusions 12 disposed in T-shape, therefore positioning of the actuating cam 9 can be performed precisely and stably. If dust adheres to the positioning protrusion 12, the upper die 1 goes down and crushes the dust, thus it does not affect the precision in positioning.

In the meantime, at the lower dead-end point, in order to enable complete contact between the positioning protrusion 12 and the groove 10 of the actuating cam 9, a clearance is so formed that an undersurface 32 of the actuating cam 9 does not contact with a top face 31 of guide member 24.

Positioning of the actuating cam 9 is described concerning the example using a straight line positioning groove 10 and straight line positioning protrusion 12, but a dot-like positioning groove and protrusion may be used.

The guide member 24 is fixed to a precise position on the base 21 of the lower die 11, and is positioned firmly with a key 35 making its back face 34 to contact with a heel portion 33 of the base 21 so that the guide member 24 will not be moved when the actuating cam 9 comes down and contacts with it and slides.

As shown in Figs. 1 and 4, the upper surface of the actuating cam 9 is formed into a slant face 41 which goes down as it approaches a positioning member 14.

This actuating cam 9 is positioned by the above-mentioned guide member 24 and simultaneously slides the slide cam 7 to pierce a hole 15 in the work 13.

On the base 2 of the upper die 1 which opposes to the actuating cam 9, the slide cam base 5 is fixed with a bolt 3 as shown in Figs. 1 and 3. At the end of this slide cam base 5, a tetrahedron guide portion 43 is formed which has a substantially square section and an edge line 42 at its lower end.

The slide cam 7 is provided which slidably holds the tetrahedron guide portion 43 of this slide cam base 5 and slides on said actuating cam 9.

This slide cam 7 is comprised of a V-shaped groove member 44 and a machining member 45 which carries punches 6. The V-groove member 44 is positioned by a key 46 which is struck into a contacting portion of both the members, and fixed to the member 45 with bolts 48, erecting a stopper pin 47.

The top face of the slide cam 7 is the same as the slant face of the tetrahedron guide portion 43 of said slide cam base 5, and formed into a V groove which receives the tetrahedron guide portion 43, and the lower plane 51 of the tetrahedron guide portion 43 of said slide cam base 5 is supported by fixing wear plates 49 with bolts 50, and the upper plane 52 is pressed by pressing plates 54 which are fixed with bolts 53 to the slide cam 7, and thus the tetrahedron guide portion 43 of the slide cam base 5 is slidably provided with the slide cam 7.

As shown in Figs. 1 and 4, on the slant face 41 of the actuating cam 9, a key 82 is fixed with a bolt 83, and further on both sides of the key 82, wear plates 84 are fixed with bolts 85 and are engaged with a key way 86 of the slide cam 7 and contacted with its lower face.

As shown in Fig. 1, on the work 13 - machining side of the slide cam 7, the punches 6 for piercing holes 15 are mounted on the slide cam 7 by fixing punch plates 61 with bolts 62. As shown in Fig. 1, a stripper plate 63 is energized by a cushion rubber 64 and presses the work 13 before piercing the holes 15 in the works 13.

As shown in Figs. 1 and 3, in order to retract the slide cam 7 after machining, a holding hole 65 is provided in concave form at a rear end part of the tetrahedron guide portion 43 of the slide cam base 5, and in a position facing this holding hole 65, a supporting plate 66 is disposed and fixed with a bolt 67 to the slide cam 7, and the elastic body 8 like a coil spring is provided in contactile state between the holding hole 65 and support plate 66. When the upper die 1 goes up, the slide cam 7, retreats due to energizing force of the elastic body 8. In order to stop this retreat of the slide cam 7, a stopper pin 47 erected on the slide cam 7 is made to engage with an end portion 69 of a stop groove 68 formed on the lower edge line 42 of the tetrahedron guide portion 43 of the slide cam base 5. Further, a safety stopper 70 is provided in said holding hole 65 by screwing to define radial movement of the elastic body 8, and simultaneously is made to pass through the supporting plate 66, and the end portion of the stopper 70 is formed into a head 71, thus if the stopper pin 47 does not stop at the end portion 69 of the stop groove 68, the support plate 66 is made to bump the head 71 to

stop the stopper pin 47, thus eliminating a safety problem.

In addition, when the upper die 1 goes up, the actuating cam 9 can also go up, and further as shown in Figs. 1 and 4, the actuating cam 9 is slidably hanged, via a hanging plate 72, by the slide cam 7 so that the actuating cam 9 can slide the slide cam 7. That is, the hanging plate 72, which is fixed with bolts 73 to both sides of the slide cam 7, supports supporting lower faces 75, which are formed on both sides of the actuating cam 9 and in parallel with the slant face 41, by a supporting piece 76 underneath the face 75. Further, in order to hang the actuating cam 9 by this hanging plate 72, a stopper 77 is formed in a position in which the actuating cam 9 bumps the upper face 78 of the hanging plate 72. The actuating cam 9 is supported by the hanging plates 72 on both the sides and is hanged by the slide cam 7, bumping the stopper 77 on the upper face 78 of the hanging plate 72.

Operation of this die will be next described.

As shown in Fig. 1, the work 13 is placed on the positioning member 14, and the upper die 1 is made to go down. Fig. 1 shows a state of the die at its upper dead-end point, where the slide cam 7, which is slidably provided on the tetrahedron guide portion 43 of the slide cam base 5 mounted on the base 2 of the upper die 1, bumps the stopper pin 47, and furthermore the actuating cam 9 is hanged by the slide cam 7 in such a way that its stopper 77 engages with the upper face 78 of the hanging plate 72.

In this state, when the upper die 1 goes down, the actuating cam 9 also goes down, first contacting its rear face 27 with the wear plate 28 of the vertical wall 23 of the guide member 24 in the lower die 11, and sliding. Then the positioning groove 10 or the bottom face 32 of the actuating cam 9 contacts completely with the positioning protrusion 12 of the lower die 11, and a position of the actuating cam 9 to the lower die 11 is determined. As the upper die 1 subsequently goes down, the slide cam 7 advances toward the work 13 between the actuating cam 9 and slide cam base 5 and then pierces the holes 15 in the work 13 by the punches 6. The state of the upper die 1 at the lower dead-end point where the holes 15 are pierced is shown in Fig. 5.

After that, when the upper die 1 goes up, the energizing force of the elastic body 8 is transmitted from the supporting plate 66 to the slide cam 7, and the slide cam 7 is retracted, then the stopper pin 47 of the slide cam 7 contacts with the end portion 69 of the stop groove 68 to stop the slide cam 7. Due to retreat of the slide cam 7, the stopper 77 engages with the upper face 78 of the supporting plate 72, and the actuating cam 9 is hanged by the slide cam 7.

In the above embodiment, piercing processing was described as an example, but of course the present invention may be applied to other working such as forming and bending.

Further, when dimensions of the slide cam base 5, slide cam 7, actuating cam 9 and the guide member 24 are standardized, these components can promptly upper die with various works of different dimensions.

As mentioned above, the present invention proposes a die having triple-structural hanging cams comprising: a slide cam base which is fixed to a base of a upper die and is formed into a polyhedron guide portion of the slide cam base and slides the polyhedron guide portion and carries a machining member like a punch; an elastic body which is interposed between the slide cam base and slide cam and energizes the slide cam; an actuating cam which contacts with the slide cam to drive it, a plurality of positioning grooves are formed on an undersurface of the actuating cam, said die further comprises positioning protrusions which are provided in lower die portions facing said positioning grooves of the actuating cam and engage said positioning grooves, while the upper die has triple-structural hanging cams of the slide cam base, slide cam, and the actuating cam, and the lower die has no actuating cam of a large height, thus the die of the invention greatly facilitates feeding and taking-out of works.

Furthermore, a plurality of the positioning grooves are formed on the undersurface of the actuating cam and the positioning protrusions which engage with said positioning grooves are provided in the lower die portions facing said positioning grooves of the actuating cam, thus when machining a steep slant face of a work, the position of the actuating cam is precisely determined, and this enables precise machining.

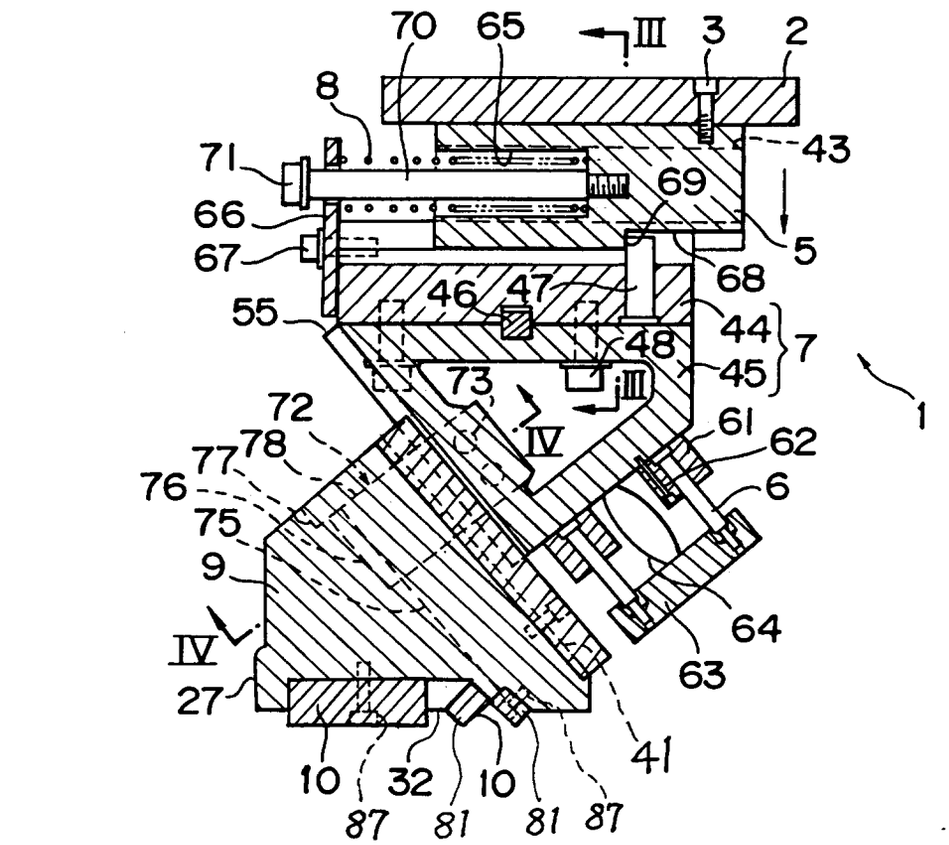
Moreover, when the cam components are standardized, the die of the present invention can upper die with machining of works having different dimensions.

Still furthermore, in a die having conventional cams, slant faces of the cams bump on each other and generate large sounds, thus becoming a cause of noise. But in the present invention, the slide cam is driven bumping the positioning grooves of the actuating cam undersurface on the positioning protrusions of the lower die, thus a bumping area in machining is greatly reduced as compared with that of the die having the conventional cams, and generated sound is also low, thus relatively quiet press working can be effected, and the invention can satisfactorily cope with the low noise which the society pursues.

Claims

1. A die having triple-structural hanging cams comprising: a slide cam base which is fixed to a base of a upper die and is formed into a polyhedron guide portion at its end; a slide cam which holds the polyhedron guide portion of the slide cam base and slides the polyhedron guide portion and carries a machining member like a punch; an elastic body which is interposed between the slide cam base and the slide cam and energizes the slide cam; and an actuating cam which contacts with the slide cam to drive it, a plurality of positioning grooves are formed on an undersurface of the actuating cam, said die further comprises positioning protrusions which are provided in lower die portions facing said positioning grooves of the actuating cam and engage said positioning grooves.

Fig. 1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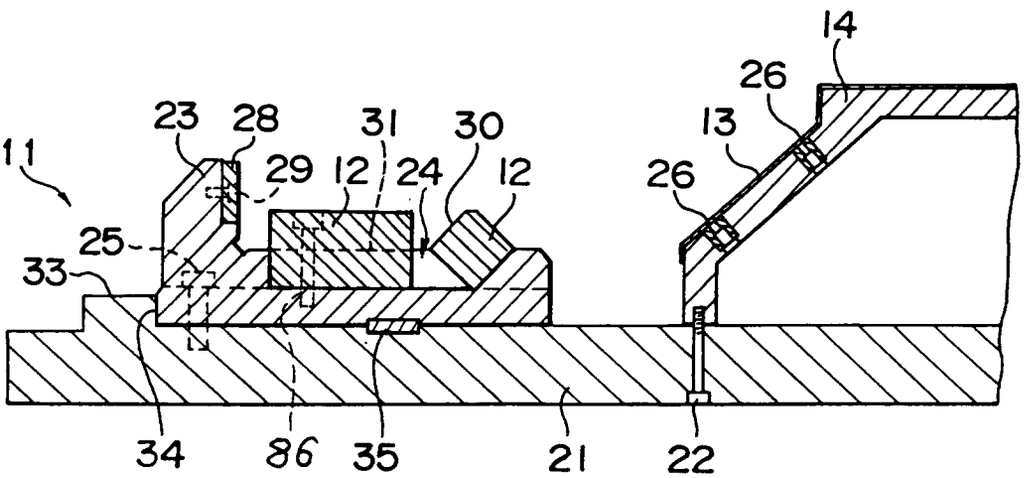
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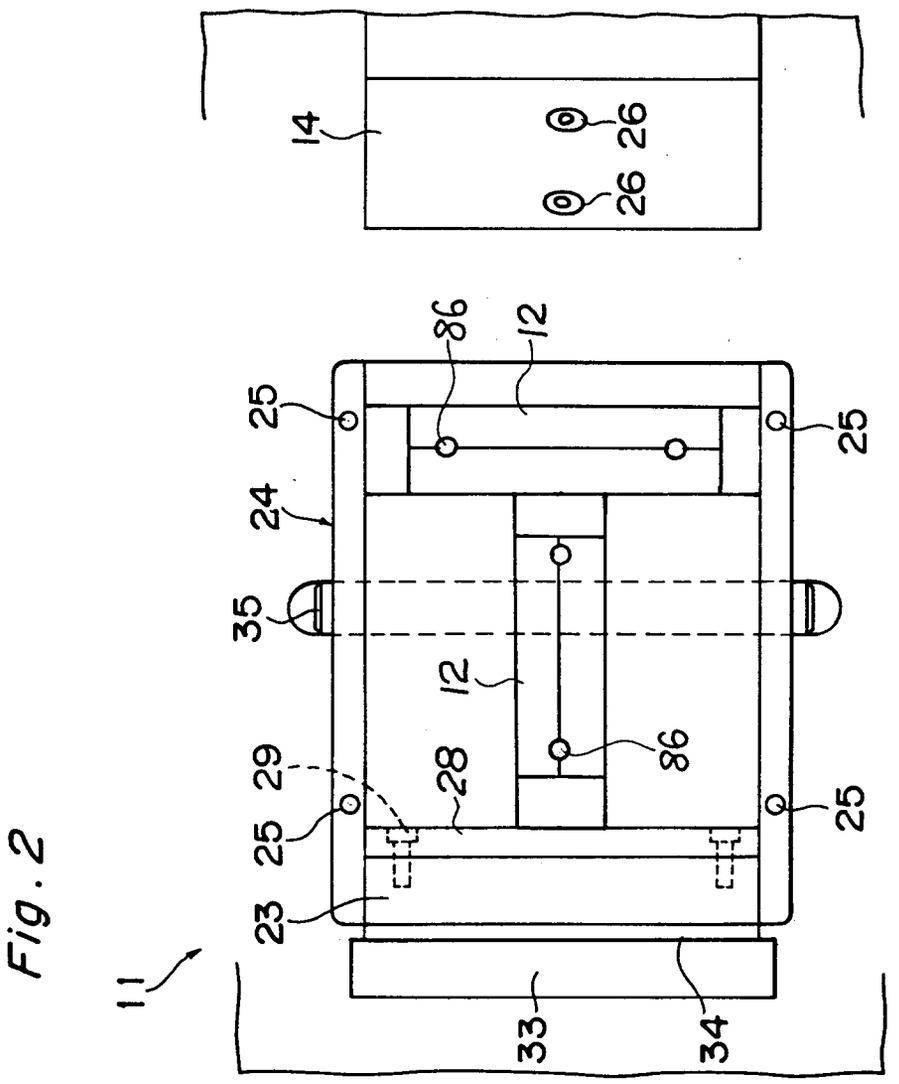


Fig. 2

Fig. 3

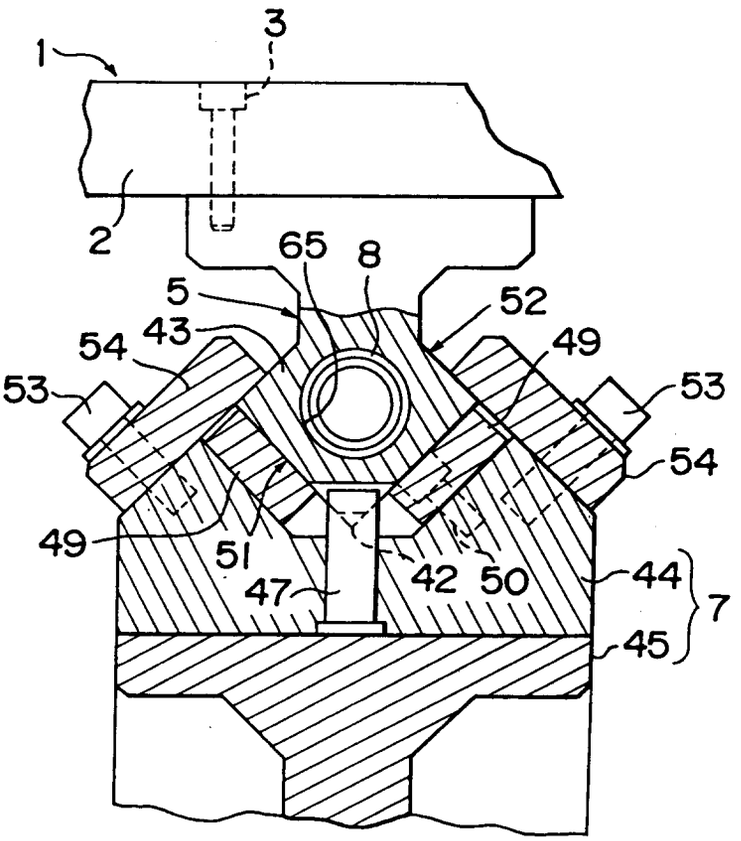


Fig. 4

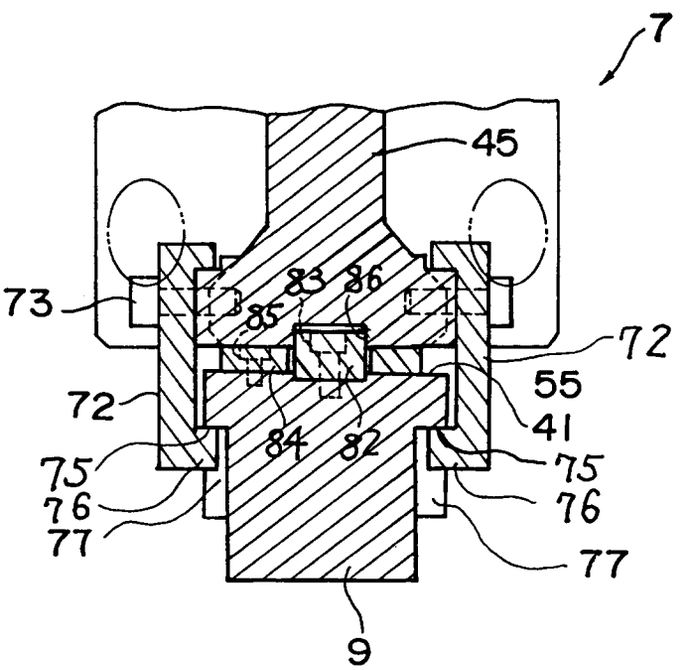
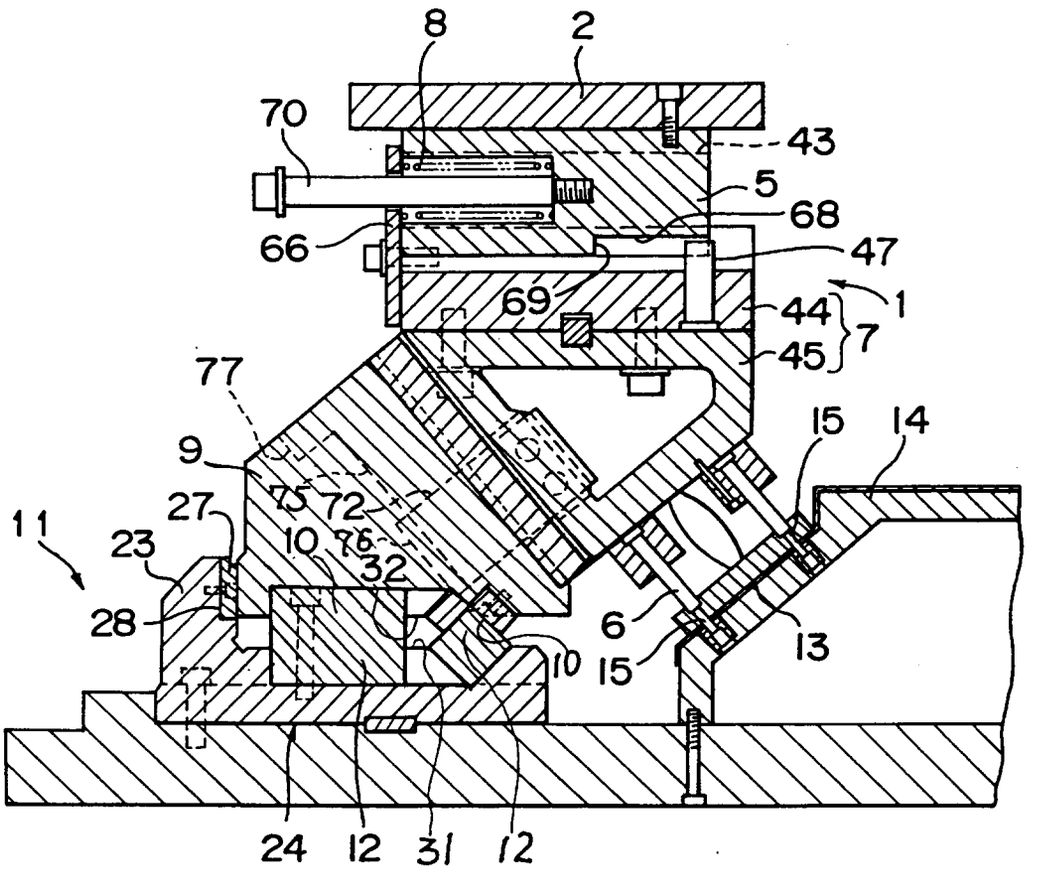


Fig.5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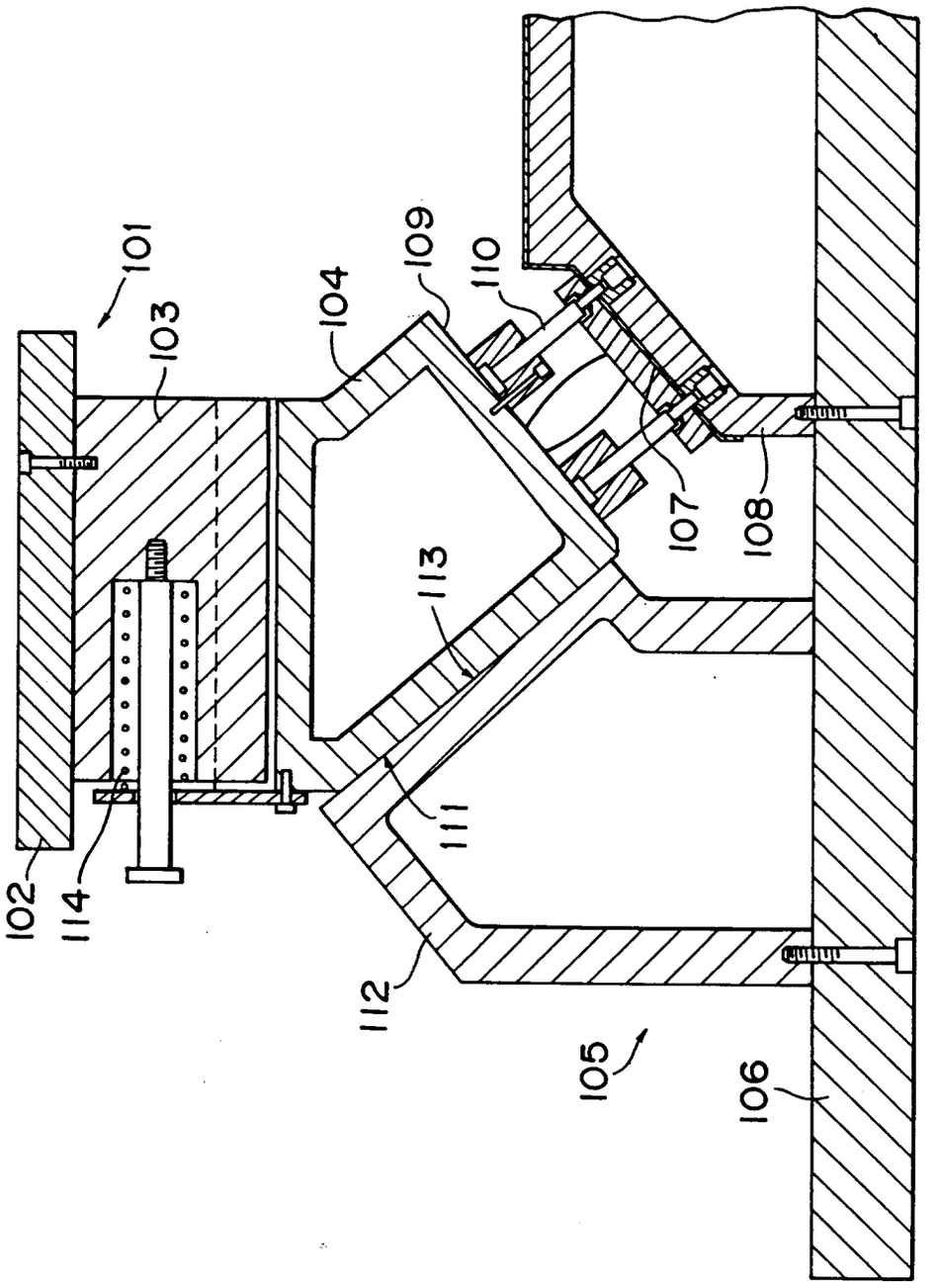

Fig.6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 10 3279

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)
X	PATENT ABSTRACTS OF JAPAN vol. 5, no. 93 (M-74)(765) 17 June 1981 & JP-A-56 041 030 (NISSAN JIDOSHA KK) * abstract *	1	B21D28/32
X	US-A-2 700 407 (TRIMBLE) 25 January 1955 * the whole document *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B21D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 OCTOBER 1992	GERARD O.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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