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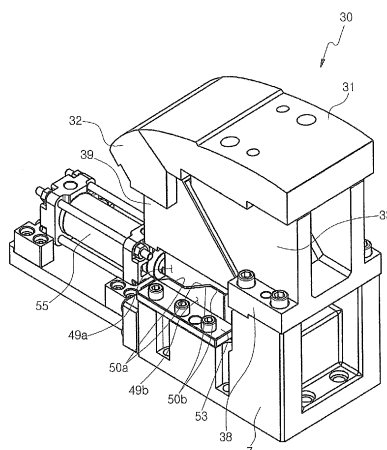
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(54) **RELIEF FORMING APPARATUS**

(57) Disclosed is a relief forming apparatus. In the relief forming apparatus, a relief die block and a main die block cooperating with a panel supporting pad fixed to a lower end of an upper mold vertically moved down through a press operation are separated from each other in opposition to the panel supporting pad. When the panel supporting pad and the cam slide are returned to the original positions thereof as the upper mold is moved up, the die fixing block coupled with upper and lower ends of the spring and fixedly supporting a lower end of the main die block and the slide block fixedly installed at the lower end of the relief die block are mutually slidably coupled with each other, and relief die driving blocks are installed at the lower end of the slide block to support the relief die block and the slide block and to control a lifting operation of the slide block according to variation in a length of an air cylinder, so that, as the length of the rod of the air cylinder is extended, the locking of relief die driving blocks is released and both of a slide block and the relief die block are moved in such a manner that the slide block and the relief die block are inclined downward due to the elastic force of the spring, thereby more simply taking up the panel, which is subject to the relief forming work, from the relief die block. When comparing with conventional relief forming cam schemes including a rotary cam scheme of rotating a rotary cam corresponding to a cam slide in one direction, or a swing cam scheme in which a swing cam corresponding to the cam slide is rotatably swung in one direction about a cam axis, which is coupled eccentrically from one side of a center and serves as a support point, through an actuating cylinder,

in order to separate a bent panel from a die after performing the relief forming work of bending the end of the panel according to a punching work of the cam slide in a cam housing of a cam base, as the length of an air cylinder is extended, the locking of relief die driving blocks is released and both of a slide block and the relief die block are moved from the main die block and the die fixing block, respectively, due to the elastic force of the spring in such a manner that the slide block and the relief die block are inclined downward. Accordingly, a worker can more simply take out the primarily molded panel, which is subject to the relief forming work, from the relief die block.

【Fig. 2】



Description

[Technical Field]

[0001] The present invention relates to a relief forming apparatus, and more particularly to a relief forming apparatus in which a primarily molded panel is fixed through cooperation among a panel supporting pad fixed to a lower end of an upper mold vertically moved down through a press operation, and a relief die block and a main die block provided in opposition to each other, and a cam slide supporting base adjacent to the panel supporting pad is moved down to press a cam slide slidably coupled with a cam driver fixed to a lower mold and to slidably move the cam slide to the relief die block, so that the primarily molded panel, which is fixed, is bent, thereby performing a relief forming work, and a die fixing block, which is coupled with an upper end of a spring and fixedly supports a lower end of the main die block, is mutually slidably coupled with a slide block coupled with a lower end of the spring and fixedly installed with a lower end of the relief die block when the panel supporting pad and the cam slide are returned to original positions thereof as the upper mold is moved up, and relief die driving blocks are installed at the lower end of the slide block to support the relief die block and the slide block and to control a lifting operation of the slide block according to variation in a length of an air cylinder, so that, as the length of the air cylinder is extended, the locking of relief die driving blocks is released and both of a slide block and the relief die block are moved in such a manner that the slide block and the relief die block are inclined downward from the main die block and the die fixing block, respectively, thereby allowing a worker to more simply take up the primarily molded panel, which is subject to the relief forming work, from the relief die block, when comparing with conventional relief forming cam schemes including a rotary cam scheme of rotating a rotary cam corresponding to a cam slide in one direction, or a swing cam scheme in which a swing cam corresponding to the cam slide is rotatably swung in one direction about a cam axis, which is coupled eccentrically from one side of a center and serves as a support point, through an actuating cylinder, in order to separate a bent panel from a die block after performing the relief forming work of bending the end of the panel according to a punching work of the cam slide in the cam housing of the cam base.

[Background Art]

[0002] In general, for a device for performing a relief forming work of bending an end of a panel P, which is fixed between a panel support pad 9, which is fixed to a lower end of an upper mold (not shown) by a press operation and vertically moved down, and a die block (cam housing) 8 or 8a, that is, a panel (P) primarily molded in a preset shape in a prior process, and for more simply separating the panel P, which has been subject to the

relief forming work, from the die block, that is, the cam housing 8 or 8a, there are mainly used a rotary cam scheme 10 of rotating a rotary cam 11 corresponding to a cam slide 6 in one direction as shown in FIG. 1a, or a swing cam scheme 20 in which a swing cam 21 corresponding to the cam slide 6 is rotatably swung in one direction about a support point (swing axis 22) of a cam axis eccentrically located from a center as shown in FIG. 1b as a length of an actuating cylinder 23 is varied, in order to separate the bent panel P from a die after performing the relief forming work of bending the end of the panel P according to a punching work of the cam slide 6 in the cam housing 8 of the cam base 7.

[0003] However, in the case of the rotary cam scheme 10 of the relief forming cam schemes according to the related art as described above, the whole structure is simplified, and an axis position is simply selected. On the contrary, as a cylinder boring machining work is performed a cam operating groove 8b inside the cam housing 8, in which the rotary cam 11 is rotatably installed, in the shape of an arc, the machining work is very difficult and inconvenient, and the machining cost is increased due to the cylinder boring machining work. Accordingly, the cost of the whole apparatus is increased. When foreign matters are introduced between the rotary cam 11 and the cam operating groove 8b inside the cam housing 8, as the rotary cam 11 is rotated, the foreign matters adhere to an outer circumference of the rotary cam 11 or to an inner part of the cam operating groove 8b inside the cam housing 8, so that the rotary cam 11 may be caught into the cam operating groove 8b inside the cam housing 8, or the rotation of the rotary cam 11 in the cam operating groove 8b inside the cam housing 8 may be impossible. In order to repair the rotary cam 11 in an inoperable status described above, or replace parts with new one, the whole structure of the relief forming apparatus must be disassembled and re-assembled, so that the maintenance work for the relief forming apparatus employing the rotary cam scheme 10 is cumbersome and inconvenient. Niche tolerance occurs between the rotary cam 11 and the cam operating groove 8b in the cam housing 8 due to the boring machining work, so that the rotary cam 11 is slightly pushed into the cam operating groove 8b in the cam housing 8 when performing the relief forming work of bending the end of the panel P according to the punching work of the cam slide 6, so that the quality for the relief forming work of the panel P may be degraded. When a return cylinder (not shown) coupled with the rotary cam 11 through a cam base 7 is erroneously operated, the rotary cam 11 may frequently be broken due to the collision between the rotary cam 11 and peripheral parts thereof, so that a safety factor may be significantly degraded. Finally, the parting selection of the cam housing 8 is significantly difficult and inconvenient with respect to the rotary cam 11 having a circular shape corresponding to the cam operating groove 8b inside the cam housing 8.

[0004] In addition, in the case of the swing cam scheme

20, similarly to the rotary cam scheme 10, as the inner part of the cam housing 8 is machined in the form of a straight line according to the shape of a swing cam 21 instead of the form of a curved surface, a machining work for the inner part of the cam housing 8a is significantly simple and the machining cost of the machining work is lowered, so that the whole apparatus cost may be reduced. As the inner part of the cam housing 8 is machined in the form of a straight line, a repair process is significantly simpler than that of the rotary cam scheme 10. In addition, differently from the rotary cam scheme 10, the foreign matters do not adhere to the rotary cam 11 or the cam operating groove 8b inside the cam housing 8 even if the foreign matters are introduced into the space between the rotary cam 11 and the cam operating groove 8b inside the cam housing 8. Accordingly, it is unnecessary to disassemble the whole relief forming apparatus in order to repair the swing cam 21 or replace parts with new one, so that the maintenance work for the relief forming apparatus employing the swing cam scheme 20 is easy and simple. As the inner part of the cam housing 8a is machined in the form of a straight line, the swing cam 21 closely makes contact with the cam housing 8a when the relief forming work of bending the end of the panel P according to the punching work of the cam slide 6 is performed, so that a pushing phenomenon is less represented differently from the rotary cam scheme 10. Accordingly, the quality for the relief forming work of the panel P can be improved. Although the swing cam 21 is rotatably swung at a predetermined angle about the swing axis 22 inserted into the swing cam 21 serving as a rotation point due to the actuating cylinder 23, the rotational angle of the swing cam 21 is smaller than that of the rotary cam scheme 10, so that the amount of the rotation of the swing axis 22 is reduced. As the inner part of the cam housing 8a and the upper end of the swing cam 21 are machined in the form of a straight line as described above, the center of the swing axis 22 and the parting of the cam housing 8a for the swing cam 21 are freely selected. On the contrary, the operating structure and the operating mechanism in the swing cam scheme 20 are significantly complex and difficult as compared with the rotary cam scheme 10. When the actuating cylinder 23 is moved back and forth, noise is caused, and the torsion of the swing cam 21 according to the return operation of the swing cam 21 is applied to the swing axis 22, so that the rebound phenomenon occurs. In addition, when the actuating cylinder 23 is driven, a cam driver (not shown) of a lower mold provided in the relief forming part is involved to cause unnecessary resistance.

[Disclosure]

[Technical Problem]

[0005] The present invention is made while keeping in mind the above problems occurring in the related art, and the object of the present invention is to provide a relief

forming apparatus in which an end of a primarily molded panel fixed through cooperation among a panel supporting pad vertically moved down through a press operation, and a relief die block and a main die block is bent by a cam slide pressed by a cam slide supporting base moved down to slidably move to the relief die block along a slide face of a cam driver, thereby performing a relief forming work, and then, when the panel supporting pad and the cam slide are returned to original positions, a die fixing block, which is coupled with an upper end of a spring and fixedly supports a lower end of the main die block, is mutually slidably coupled with a slide block coupled with a lower end of the spring fixedly installed with a lower end of the relief die block, and relief die driving blocks are installed at the lower end of the slide block to support the relief die block and the slide block and to control a lifting operation of the slide block according to variation in a length of an air cylinder, so that, as the length of the air cylinder is extended, the locking of relief die driving blocks is released and both of a slide block and the relief die block are moved through the elastic force of the spring in such a manner that the slide block and the relief die block are inclined downward from the main die block and the die fixing block, respectively, thereby allowing a worker to more simply take up the primarily molded panel, which is subject to the relief forming work, from the relief die block, when comparing with a rotary cam scheme or a swing cam scheme among conventional relief forming cam schemes.

[0006] Another object of the present invention is to reduce machining cost and manufacturing cost, simplify a modification process and maintenance, and maximize the utilization of a space in a mold as a simpler structure is employed, when comparing with a rotary cam scheme of rotating a rotary cam corresponding to a cam slide in one direction in order to separate a bent panel from a die block after performing a relief forming work of bending the end of the panel according to a punching work of a cam slide in a cam housing of a cam base among conventional relief forming cam schemes, because a slide block and a relief die block according to the present invention have slide structures in which the slide block and the relief die block are linearly moved from the main die block and the die fixing block in such a manner that the slide block and the relief die block are inclined downward, due to the release of the locking of the relief die driving block according to the extension in the length of the air cylinder and the elastic force of the spring.

[0007] Still another object of the present invention is to provide more simplify a parting line of a relief die block as compared with a rotary cam scheme or a swing cam scheme according to the related art as both of a slide block and a relief die block according to the present invention have a slide structure in which the slide block and the relief die block are linearly moved in such a manner that the slide block and the relief die block are inclined downward from a main die block and a die fixing block, respectively.

[Technical Solution]

[0008] In order to accomplish the above objects of the present invention, there is provided a relief forming apparatus in which a relief die block and a main die block cooperating with a panel supporting pad fixed to a lower end of an upper mold vertically moved down through a press operation are separated from each other in opposition to the panel supporting pad. As the upper mold is moved up, when the panel supporting pad and the cam slide are returned to the original positions thereof, the die fixing block coupled with an upper end of the spring and fixedly supporting a lower end of the main die block and the slide block coupled with the lower end of the spring and fixedly installed at the lower end of the relief die block are mutually slidably coupled with each other, and relief die driving blocks are installed at the lower end of the slide block to support the relief die block and the slide block and to control a lifting operation of the slide block according to variation in a length of an air cylinder, so that, as the length of the rod of the air cylinder is extended, the locking of relief die driving blocks is released and both of a slide block and the relief die block are moved in such a manner that the slide block and the relief die block are inclined downward due to the elastic force of the spring, thereby more simply taking up the panel, which is subject to the relief forming work, from the relief die block.

[Advantageous Effects]

[0009] As described above, according to the present invention, when comparing with a rotary cam scheme or the swing cam among the conventional relief forming cam schemes, both of the slide block and the relief die block are moved from the main die block and the die fixing block in such a manner that the slide block and the relief die block are inclined downward due to the release of the locking of the relief die block according to the extension in the length of the air cylinder and the elastic force of the spring, thereby allowing the worker to more simply take out the primarily molded panel, which is subject to the relief forming work, from the relief die block.

[0010] In addition, since the slide block and the relief die block have slide structures in which the slide block and the relief die block are linearly moved from the main die block and the die fixing block in such a manner that the slide block and the relief die block are inclined downward, due to the release of the locking of the relief die driving block according to the extension in the length of the air cylinder and the elastic force of the spring, as the structure is simpler, when comparing with the rotary cam scheme of rotating the rotary cam corresponding to the cam slide in one direction in order to separate the bent panel from the die after performing a relief forming work of bending the end of the panel according to the punching work of the cam slide in the cam housing of the cam base among conventional relief forming cam schemes, there-

by reducing machining cost and manufacturing cost, simplifying a modification process and maintenance, and maximizing the utilization of a space in a mold

[0011] Further, as both of the slide block and the relief die block have the slide structure in which the slide block and the relief die block are linearly moved in such a manner that the slide block and the relief die block are inclined downward from the main die block and the die fixing block, respectively, a parting line of a relief die block can be more simplified as compared with the rotary cam scheme or the swing cam scheme according to the related art.

[Description of Drawings]

[0012]

FIG. 1a schematically illustrates the structure and the operation of a relief forming apparatus according to the related art.

FIG. 1b schematically illustrates the structure and the operation of another relief forming apparatus according to the related art.

FIG. 2 is a perspective view schematically showing a relief forming die according to the present invention.

FIG. 3 is an exploded perspective view showing the relief forming die according to the present invention.

FIG. 4 is an assembly section view showing the relief forming die according to the present invention.

FIG. 5 is a detailed view showing a slide block and a die fixing block coupled with lower and upper ends of a spring in the relief forming apparatus according to the present invention.

FIGS. 6a to 6d are views showing the operating procedure of the relief forming apparatus according to the present invention.

[Best Mode]

[Mode for Invention]

[0013] A relief forming apparatus according to the present invention will be described with reference to accompanying drawings.

[0014] FIG. 2 is a perspective view schematically showing a relief forming die according to the present invention. FIG. 3 is an exploded perspective view showing the relief forming die according to the present invention. FIG. 4 is an assembly section view showing the relief forming die according to the present invention.

[0015] According to the relief forming apparatus 30 of the present invention, when comparing with a conventional technology including a rotary cam scheme 10 of rotating a rotary cam 11 corresponding to a cam slide 6 in one direction, or a swing cam scheme 20 in which a swing cam 21 corresponding to the cam slide 6 is rotatably swung in one direction about a cam axis 22, which

is coupled eccentrically from one side of a center and serves as a support point, through an actuating cylinder 23, in order to separate a bent panel P from a die block after performing the relief forming work of bending the end of the panel P according to a punching work of the cam slide 6 in a cam housing 8 or 8a of the cam base 7, as the length of a rod 56 of an air cylinder 55 is extended, the locking of relief die driving blocks 49a and 49b is released and both of a slide block 39 and a relief die block 32 are moved in such a manner that the slide block 39 and the relief die block 32 are downward inclined from a main die block 31 and a die fixing block 33, respectively. Accordingly, a worker can more simply take up the primarily molded panel P, which is subject to the relief forming work, from the relief die block 32. As shown in FIGS. 2 to 4, the primarily molded panel P is fixed through co-operation among a panel supporting pad 9, which is fixed to a lower end of an upper mold 1 and vertically moved down by a press operation, and the relief die block 32 and the main die block 31 for seating the panel P which is primarily molded in a desirable shape, thereon. Simultaneously, a cam slide supporting base 4 fixed adjacent to the panel supporting pad 9 is moved down to press the cam slide 6 slidably coupled with a cam drive 5 fixed to a lower mold 2 so that the cam slide 6 is slidably moved to a relief die block 32 to bend an end of the primarily molded panel P fixed among the relief die block 32, the main die block 31, and the panel supporting pad 9, which performs a relief forming work. Thereafter, when the panel supporting pad 9 and the cam slide 6 are returned to the original positions thereof as the upper mold 1 is moved up, the die fixing block 33, which are coupled with an upper end of a spring 48 while fixedly supporting a lower end of the main die block 31, is mutually slidably coupled with a slide block 39 which is coupled with a lower end of the spring 48 and fixedly installed at a lower end of the relief die block 32. The slide block 39 is provided at a lower end thereof with relief die driving blocks 49a and 49b which support the relief die block 32 and the slide block 39 and control a lifting operation of the slide block 39 according to the variation in the length of the rod 56 of the air cylinder 55.

[0016] In this case, the main die block 31 and the relief die block 32, which are separated from each other, are positioned in opposition to the panel supporting pad 9 and fixedly supported by the slide block 39 and the die fixing block 33, respectively. Accordingly, as the length of the rod 56 of the air cylinder 55 is extended, in the locking state that the relief die driving blocks 49a and 49b, that is, the upper and lower relief die driving blocks 49a and 49b are combined with each other to block and prevent the relief die block 32 and the slide block 39 from being moved downward, the lower relief die driving block 49b is moved forward from the upper relief die driving block 49a so that the lower relief die driving block 49b is separated from the upper relief die driving block 49a, thereby releasing the locking state of the relief die driving blocks 49a and 49b for the relief die block 32 and the

slide block 39. In addition, due to the elastic force of the spring having the upper and lower ends coupled between the die fixing block 33, which fixedly supports the main die block 31, and the slide block 39, which fixedly supports the relief die block 32, the slide block 39 is moved from the die fixing block 33 while being inclined downward, and the relief die block 32 is moved from the main die block 31 while being inclined downward in a direction the same as that of the slide block 39. Therefore, a worker can more simply take up the primarily molded panel P, which is subject to the relief forming work, from the relief die block 32.

[0017] In the case of a cam unit 3 including the cam slide supporting base 4, the cam slide 6, and a cam driver 5, the cam slide supporting base 4 and the cam driver 5 having a slide surface coupled with the cam slide 6 are fixed to the upper mold 1 and the lower mold 2 installed in a press, respectively, so that the cam slide supporting base 4 is vertically moved down together with the upper mold 1 according to the press operation to press the cam slide 6, the pressed cam slide 6 is slidably moved forward along the slide surface of the cam driver 5, and a punch fixed to a front surface of the cam slide 6 bends or pierces a distal end or an end portion provided at a required position of the primarily molded panel P fixed among the relief die block 32, the main die block 31, and the panel supporting pad 9. It can be generally understood by those skilled in the art that the operating scheme of the cam unit 3 may be variously modified according to the molded shape of the panel or the punch fixed to the front surface of the cam slide 6 may be variously machined for the use thereof.

[0018] The die fixing block 33 is a component fixed to a lower end of the main die block 31 by a bolt to support the main die block 31. As shown in FIG. 5, the die fixing block 33 is overall provided in a triangular block structure having an inclined slide face 34 vertically and inward inclined and having a substantially C-shape when viewed in a plan view so that the slide operation is performed in the state that one side of the die fixing block 33 makes surface contact with an opposite side of the slide block 39. In this case, the inclined slide face 34 of the die fixing block 33 has a slide hole 35 which is formed through the center thereof and fitted around a guide protrusion 41 protruding in a longitudinal direction from an upper end of the slide block 39, so that the slide block 39 may be vertically slidably moved from the die fixing block 33. An upper bracket fixing groove 36 is formed in a rectangular shape above the slide hole 35 and used to fix an upper fixed bracket 45, which supports one end of the spring 48, thereto by using a bolt.

[0019] In addition, a main die mounting part 37 is formed in the shape of a step at both sides of an upper end of the die fixing block 33 so that the main die block 31 is mounted on the main die mounting part 37. The main die mounting part 37 is provided therein with a bolt coupling hole 37a used to fix the main die block 31 to the main die mounting part 37 by a bolt. Both left and right

sides of a lower end of the die fixing block 33 are formed integrally with flange parts 38 having bolt coupling holes 38a formed through the flange parts 38 so that the die fixing block 33 is fixed to an upper end of the cam base 7, which is installed adjacent to the air cylinder 55 at a front of the rod 56 of the air cylinder 55, by using a bolt.

[0020] In addition, the slide block 39 is a component fixed to a lower end of the relieve die block 32 by a bolt to support the relief die block 32. As shown in FIG. 5, similarly to the die fixing block 33, the slide block 39 is overall provided in a triangular block structure having an inclined slide face 40 vertically outward inclined and having an arrow shape when viewed at a lateral side thereof so that the slide operation of the slide block 39 can be smoothly performed along the inclined slide face 34 of the die fixing block 33 in the state that the opposite side of the slide block 39 makes surface contact with the inclined slide face 34 of the one side of the die fixing block 33. In this case, the inclined slide face 40 of the slide block 39 is provided at the center thereof with a guide protrusion 41 fitted into the slide hole 35 formed through the center of the inclined slide face 34 of the die fixing block 33, so that the slide block 39 may be vertically slidably moved from the die fixing block 33. The guide protrusion 41 is provided at a lower portion thereof with a lower bracket fixing groove 42 having a rectangular shape to fix a lower fixed bracket 46, which supports the opposite end of the spring 48, by a bolt. Reference numerals 43 and 44, which are not described, represent a slide member 43 fixed to the inclined slide face 40 of the slide block 39 and a relief die mounting part 44 formed in a rectangular shape to mount the relief die block 32 on the upper end of the slide block 39 and fix the relief die block 32 to the slide block 39 by a bolt.

[0021] In addition, the upper fixed bracket 45 and the lower fixed bracket 46 are fixed to an upper bracket fixing groove 36 of the die fixing block 33 and the lower bracket fixing groove 42 of the slide block 39, respectively, by using bolts to support both of the upper and lower ends of the spring 48. Among them, the upper fixed bracket 45 overall has a substantially reversed-L shape in which a bolt insertion hole 45a is formed through an upper end thereof, and the lower fixed bracket 46 overall has a T shape in which a bolt insertion hole 46a is formed through an upper end of the lower fixed bracket 46. Spring locking bolts 47 are fixed to respective surfaces of the upper fixed bracket 45 and the lower fixed bracket 46, which are fixed to the upper bracket fixing groove 36 of the die fixing block 33 and the lower bracket fixing groove 42 of the slide block 39, respectively, by bolts to support both of the upper and lower ends of the spring 48, in opposition to each other for the purpose of the locking operation and the anti-separation of the spring 48 installed between the upper fixed bracket 45 and the lower fixed bracket 46.

[0022] Meanwhile, the relief die driving blocks 49a and 49b are provided in the structure in which two blocks symmetrical to each other are provided in one group, fixed to the lower end of the slide block 39 and the rod

56 of the air cylinder 55, respectively, in opposition to each other, and provided in the combined structure between the blocks. In this case, inclined concave-convex parts 50a and 50b are provided at upper and lower ends of the relief die driving blocks 49a and 49b, respectively, and positioned in opposition to each other while being symmetrical to each other. Accordingly, while the lower relief die driving block 49b of two relief die driving blocks 49a and 49b is linearly moved from the upper relief die driving block 49a when the length of the rod 56 of the air cylinder 55 is varied, the upper and lower relief die driving blocks 49a and 49b are combined to make a locking state to support the relief die block 32 and the slide block 39 when the length of the rod 56 of the air cylinder 55 is shortened, but the lower relief die driving block 49b is out of the upper relieve die driving block 49a to release the locking state of the relief die block 32 and the slide block 39 when the length of the rod 56 of the air cylinder 55 is extended.

[0023] In addition, an elastic member 51 is fixedly installed at a front surface of the lower relief die driving block 49b of the two relief die driving blocks 49a and 49b, which is connected to the rod 56 of the air cylinder 55 to prevent one end of the cam base 7 installed adjacent to the air cylinder 55 at the front of the air cylinder 55 from colliding with the lower relief die driving block 49b. The lower relief die driving block 49b is provided at both lower ends thereof with locking steps 52 and guide members 53 are installed to be coupled with the locking steps 52, respectively, in order to prevent the lower relief die driving block 49b linearly moved into the cam base 7 when the length of the rod 56 of the air cylinder 55 is extended from being placed out of the cam base 7. The guide members 53 guide the lower relief die driving block 49b and are fixed to both side ends of the cam base 7 by bolts so that the guide members 53 can be stably supported. Reference number 54, which is not described yet, represents a slide member 54 which is fixed to an inner part of the cam base 7 so that the lower relief die driving block 49b can be smoothly linearly moved into the cam base 7 as the length of the rod 56 of the air cylinder 55 is extended.

[0024] Hereinafter, the operating procedure of the relief forming apparatus according to an exemplary embodiment of the present invention will be described with reference to accompanying drawings.

[0025] FIGS. 6a to 6d are views showing the operating procedure of the relief forming apparatus according to the present invention.

[0026] First, in order to perform a relief forming work of bending an end of the panel P, which is primarily molded in a preset shape through a prior process, by using the relief forming apparatus 30 according to the present invention configured as shown in FIGS. 2 to 4, a press is operated after the primarily molded panel P is seated on the relief die block 32 and the main die block 31 in the relief forming apparatus 30 according to the present invention, in detail, the upper ends of the relief die block 32 and the main die block 31, which are separated from

each other while making surface contact with each other in opposition to the panel supporting pad 9 fixed to a lower end of the upper mold 1 and vertically moved down through press operation. In this case, as shown in FIGS. 6a, together with the press operation, the upper mold 1 and the panel supporting pad 9 fixed to the lower end of the upper mold 1 are vertically moved down toward the relief die block 32 and the main die block 31 having the primarily molded panel P seated thereon to allow the relief die block 32 and the main die block 31 having the primarily molded panel P mounted thereon to closely make contact with the panel supporting pad 9, which is a corresponding action, thereby fixing the primarily molded panel P, so that the primarily molded panel P is not moved. Simultaneously, the cam unit 3 fixed to the lower end of the upper mold 1 adjacent to the panel supporting pad 9, that is, the cam slide supporting base 4 among components of the cam unit 3, which includes the cam slide supporting base 4, the cam slide 6, and the cam driver 5, is vertically moved down in the same direction to press the cam slide 6 slidably coupled with the cam driver 5 fixed to the lower mold 2 and to slidably move the cam slide 6 to the relief die block 32, so that the cam slide 6 bends the end of the primarily molded panel P fixed among the relief die block 32, the main die block 31, and the panel supporting panel 9, thereby performing the relief forming work.

[0027] After the relief forming work of the cam slide 6 for the end of the primarily molded panel P has been finished, the panel supporting pad 9, which is vertically moved down toward the relief die block 32 and the main die block 31 to closely make contact with the relief die block 32 and the main die block 31 as shown in FIG. 6b, and the cam slide 6, which has performed the relief forming work of bending the end of the primarily molded panel P, are returned to the original positions thereof together with the upper mold through the press operation as shown in FIG. 6c.

[0028] Then, after the panel supporting pad 9 and the cam slide 6 are returned to the original positions thereof, in order to take up the primarily molded panel P, which is seated on the relief die block 32 and the main die block 31 in the state that the end of the panel P is subject to the relief forming work by the cam slide 6, from the relief die block 32 and the main die block 31, the lower relief die driving block 49b, which is combined with the upper relief die driving block 49a in opposition to the upper relief die driving block 49a while making contact with the upper relief die driving block 49a, which is fixed, by using a bolt, to the lower end of the slide block 39 coupled with the lower end of the spring 48, fixedly installed to the lower end of the relief die block 32 and mutually slidably coupled with the die fixing block 33 coupled with the upper end of the spring 48 and fixedly supporting the lower end of the main die block 31 as shown in FIG. 6d, in the upper and lower relief die driving blocks 49a and 49b having the structure in which two blocks are provided in one group, is separated from the relief die driving block 49a

as the length of the rod 56 of the air cylinder 55 is extended so that the lower relief die driving block 49b is moved toward the cam base 7 located at the front thereof. In this case, as the lower relief die driving block 49b is linearly moved into the case base 7 according to the guidance of the guide members 53 coupled with the respective locking steps 52 formed at both of lower ends of the lower relief die driving block 49b, so that the locking between the relief die block 32 and the slid block 39 resulting from the combination of the upper and lower relief die driving blocks 49a and 49b is released.

[0029] Next, the lower relief die driving block 49b is linearly moved into the cam base 7 from the upper relief die driving block 49a as the length of the rod 56 of the air cylinder 55 is extended as described above, so that the relief die block 32 is unlocked from the slid block 39. In this case, the locking between the upper and lower relief die driving blocks 49a and 49b is released as the length of the rod 56 of the air cylinder 55 is extended. Simultaneously, as the slide block 39 is moved from the die fixing block 33 while being inclined down due to the elastic force of the spring 48 having the upper and lower ends coupled between the die fixing block 33 fixedly supporting the main die block 31 and the slide block 39 fixedly supporting the relief die block 32, in detail, the spring 48 positioned between the upper fixed bracket 45 and the lower fixed bracket 46 fixed to the upper bracket fixing groove 36 of the die fixing block 33 and the lower bracket fixing groove 42 of the slide block 39 by using bolts and having both ends fixedly supported to the respective surfaces of the upper and lower fixed brackets 45 and 46 by the spring locking bolts 47 coupled with the respective surfaces in opposition to each other, the relief die block 32 is moved from the main die block 31 in the same direction as that of the slide block 39 while being inclined downward, so that the relief die block 32 is separated from the primarily molded plane P which is subject to the relief forming work. Accordingly, a worker can more simply take up the primarily molded panel P, which is subject to the relief forming work, from the relief die block 32 moved while being inclined downward together with the slide block 39, thereby completing the take-up procedure of the primarily molded panel P, which is subject to the relief forming work, by using the relief forming apparatus 30 according to the present invention.

[0030] Although an exemplary embodiment according to the present invention has been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

[Industrial Applicability]

[0031] According to the relief forming apparatus of the present invention, when comparing with conventional relief forming cam schemes including a rotary cam scheme of rotating a rotary cam corresponding to a cam slide in

one direction, or a swing cam scheme in which a swing cam corresponding to the cam slide is rotatably swung in one direction about a cam axis, which is coupled eccentrically from one side of a center and serves as a support point, through an actuating cylinder, in order to separate a bent panel from a die block after performing the relief forming work of bending the end of the panel according to a punching work of the cam slide in the cam housing of the cam base, as the length of an air cylinder is extended, the locking of relief die driving blocks is released and both of a slide block and the relief die block are moved in such a manner that the slide block and the relief die block are inclined downward from the main die block and the die fixing block, respectively. Accordingly, a worker can more simply pick up the primarily molded panel, which is subject to the relief forming work, from the relief die block.

Claims

1. A relief forming apparatus (30) comprising a panel supporting pad (9), which is fixed to a lower end of an upper mold (1) vertically moved down by a press operation, and a relief die block (32) and a main die block (31) provided in opposition to the panel supporting pad (9) to fix a primarily molded panel (P) through cooperation among the panel supporting pad (9), the relief die block (32), and the main die block (31) and to bend an end of the primarily molded panel (P) fixed among the panel supporting pad (9), the relief die block (32), and the main die block (31) as a cam slide supporting base (4) fixed adjacent to the panel supporting pad (9) is moved down to press a cam slide (6) slidably coupled with a cam driver (5) fixed to a lower mold (2) and to slidably move to the relief die block (32), wherein the relief die block (32) and the main die block (31) are separated from each other and provided in opposition to the panel supporting pad (9), a die fixing block (33), which is coupled with upper and lower ends of a spring (48) and fixedly supports a lower end of the main die block (31) is mutually slidably coupled with a slide block (39) fixedly installed with a lower end of the relief die block (32) when the panel supporting pad (9) and the cam slide (6) are returned to original positions thereof as the upper mold (1) is moved up, and relief die driving blocks (49a and 49b) are installed to support the relief die block (32) and the slide block (39) and to control a lifting operation of the slide block (39) according to variation in a length of a rod (56) of an air cylinder (55), such that locking of the relief die driving blocks (49a and 49b) is released as the length of the rod (56) of the air cylinder (55) is extended and both of the slide block (39) and the relief die block (32) are moved while being inclined downward to more simply pick up the panel (P), which is subject to a relief forming work, from the relief die

block (32), and

wherein the die fixing block (33) is overall provided in a triangular block structure having an inclined slide face (34) inclined vertically and inward and having a substantially C-shape when viewed in a plan view such that a slide operation is performed in a state that one side of the die fixing block (33) makes surface contact with an opposite side of the slide block (39).

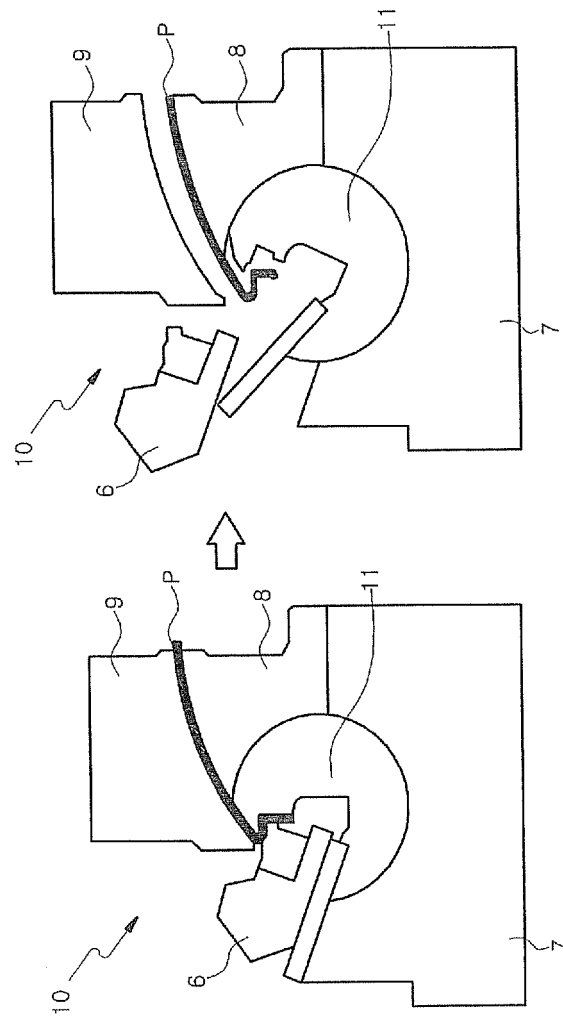
2. The relief forming apparatus of claim 1, wherein the inclined slide face (34) of the die fixing block (33) has a slide hole (35) which is formed through a center thereof and is fitted with the slide block (39) such that the slide block (39) is vertically and slidably moved from the die fixing block (33), an upper bracket fixing groove (36) is formed in a rectangular shape above the slide hole (35) to fix an upper fixed bracket (45), which supports one end of the spring (48), thereto by using a bolt, and a main die mounting part (37) is formed in a shape of a step at both sides of an upper end of the die fixing block (33) to mount the main die block (31) thereon.
3. The relief forming apparatus of claim 2, wherein the main die mounting part (37) is provided therein with a bolt coupling hole (37a) used to fix the main die block (31) by using a bolt, and both left and right sides of a lower end of the die fixing block (33) are formed integrally with flange parts (38) having bolt coupling holes (38a) formed through the flange parts (38) such that the die fixing block (33) is fixed to an upper end of the cam base (7), which is installed adjacent to the air cylinder (55) at a front of the air cylinder (55), by using a bolt.
4. The relief forming apparatus of claim 2, wherein the slide block (39) is overall provided in a triangular block structure having an inclined slide face (40) vertically outward inclined and having an arrow shape when viewed at a lateral side thereof such that a slide operation of the slide block (39) is smoothly performed along the inclined slide face (34) of the die fixing block (33) in a state that the opposite side of the slide block (39) makes surface contact with the inclined slide face (34) of the one side of the die fixing block (33).
5. The relief forming apparatus of claim 4, wherein the inclined slide face (40) of the slide block (39) is provided at a center thereof with a guide protrusion (41) fitted into the slide hole (35) formed through the center of the inclined slide face (34) of the die fixing block (33), such that the slide block (39) is vertically slidably moved from the die fixing block (33), and the guide protrusion (41) is provided at a lower portion thereof with a lower bracket fixing groove (42) having a rectangular shape and used to fix a lower fixed

bracket (46), which supports an opposite end of the spring (48), by using a bolt.

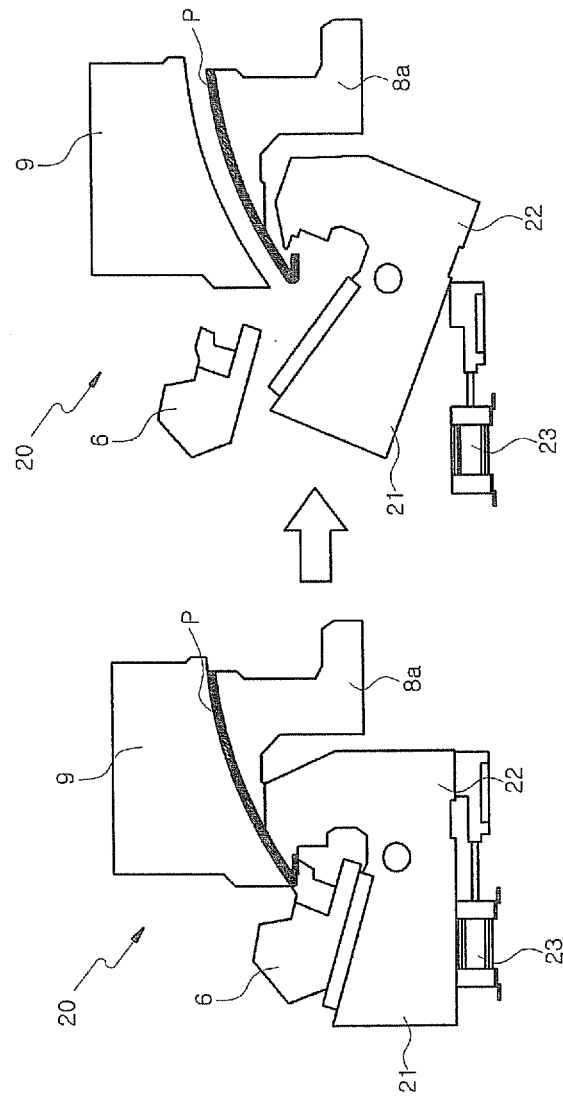
6. The relief forming apparatus of claim 5, further comprising spring locking bolts (47) fixed to respective surfaces of the upper fixed bracket (45) and the lower fixed bracket (46), which are fixed to the upper bracket fixing groove (36) of the die fixing block (33) and the lower bracket fixing groove (42) of the slide block (39), respectively, by using bolts to support both of the upper and lower ends of the spring (48), in opposition to each other for a locking operation and an anti-separation of the spring (48) installed between the upper fixed bracket (45) and the lower fixed bracket (46). 5 10 15
7. The relief forming apparatus of claim 1, wherein the relief die driving blocks (49a and 49b) are provided in a structure in which two blocks symmetrical to each other are provided in one group, fixed to a lower end of the slide block (39) and the rod (56) of the air cylinder (55), respectively, in opposition to each other, and provided in a mutually combined structure between the blocks. 20 25
8. The relief forming apparatus of claim 7, further comprising inclined concave-convex parts (50a and 50b) provided at upper and lower ends of the relief die driving blocks (49a and 49b), respectively, and positioned in opposition to each other while being symmetrical to each other, such that, while a lower relief die driving block (49b) of the two relief die driving blocks (49a and 49b) is linearly moved from the upper relief die driving block (49a) when a length of the rod (56) of the air cylinder (55) is varied, the upper and lower relief die driving blocks (49a and 49b) are combined to make a locking state to support the relief die block (32) and the slide block (39) when the length of the rod (56) of the air cylinder (55) is shortened, but the lower relief die driving block (49b) is positioned out of the upper relieve die driving block (49a) to release a locking state of the relief die block (32) and the slide block (39) when the length of the rod (56) of the air cylinder (55) is extended. 30 35 40 45
9. The relief forming apparatus of claim 7, further comprising an elastic member (51) fixedly installed at a front surface of the lower relief die driving block (49b) of the two relief die driving blocks (49a and 49b), which is connected to the rod (56) of the air cylinder (55) to prevent one end of the cam base (7) installed adjacent to the air cylinder (55) at a front of the air cylinder (55) from colliding with the lower relief die driving block (49b). 50 55
10. The relief forming apparatus of claim 9, wherein the lower relief die driving block (49b) is provided at both lower ends thereof with locking steps (52), and guide

members (53), which are coupled with the locking steps (52), respectively, are fixed to both side ends of the cam base (7) by using bolts to prevent the lower relief die driving block (49b) linearly moved into the cam base (7) when the length of the rod (56) of the air cylinder (55) is extended from being placed out of the cam base (7).

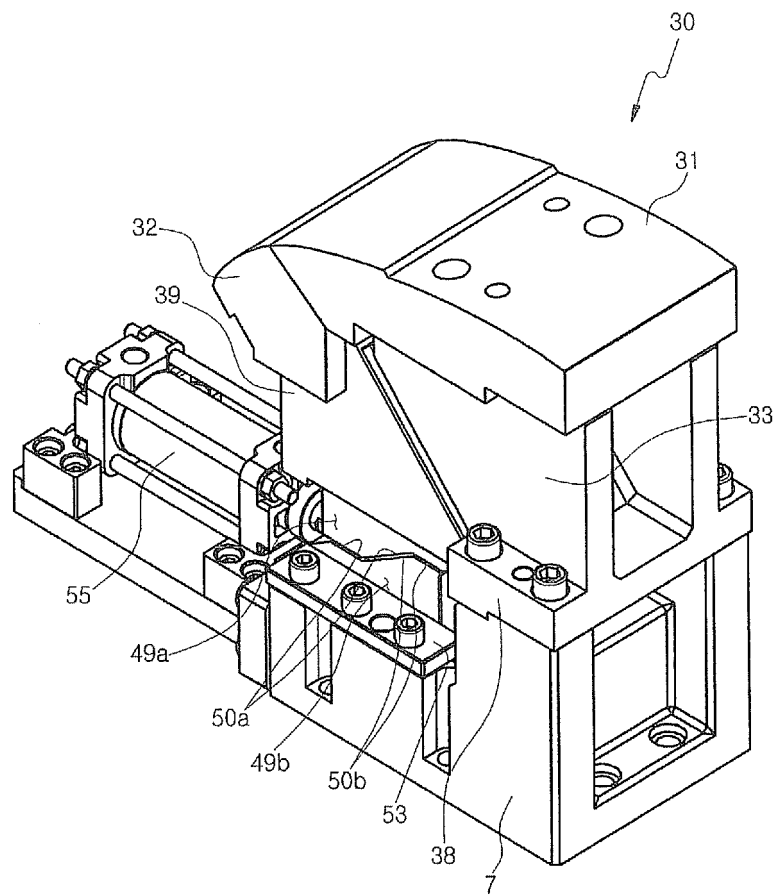
【Fig. 1a】



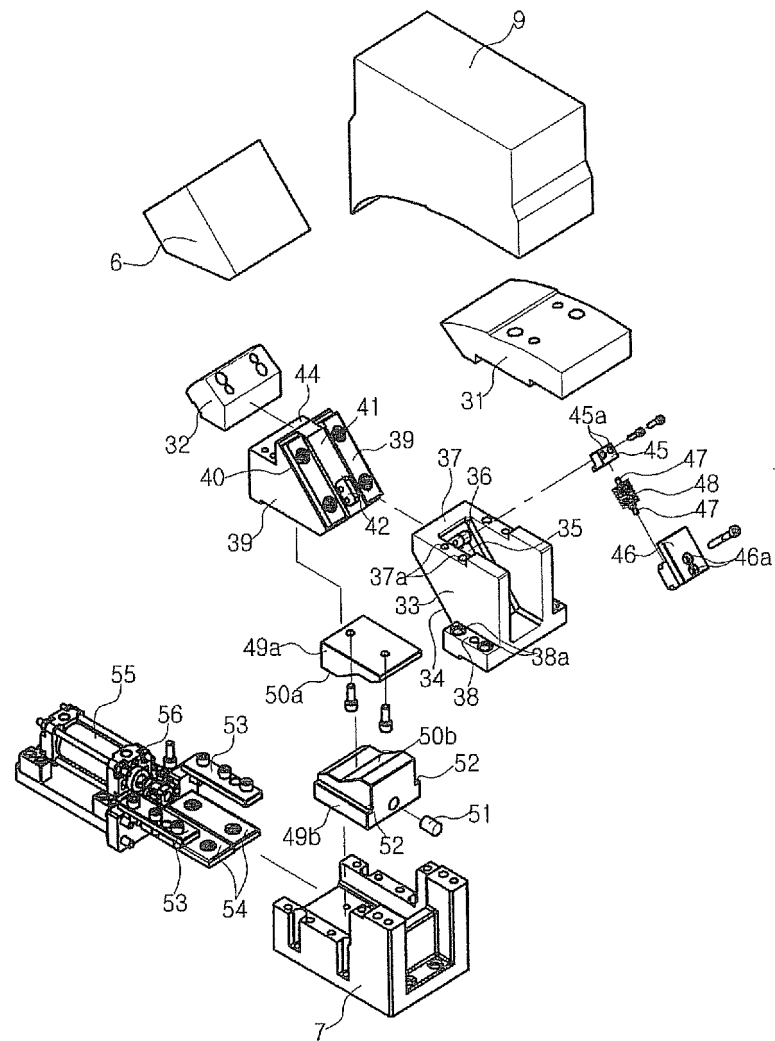
【Fig. 1b】



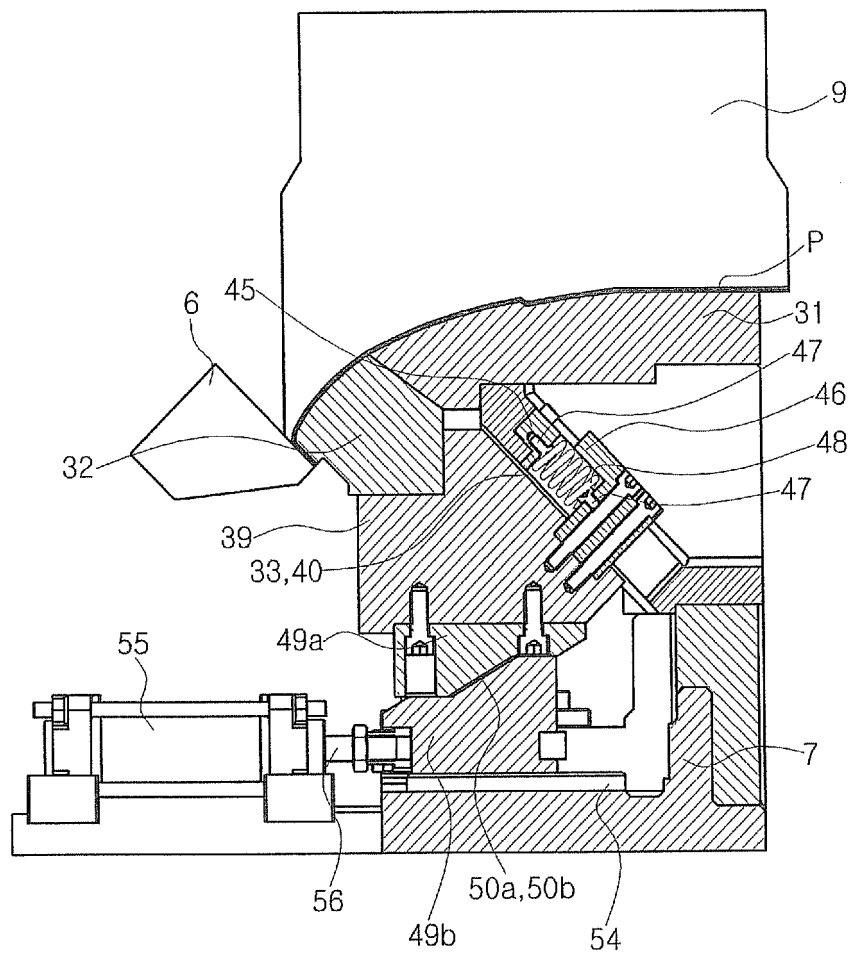
【Fig. 2】



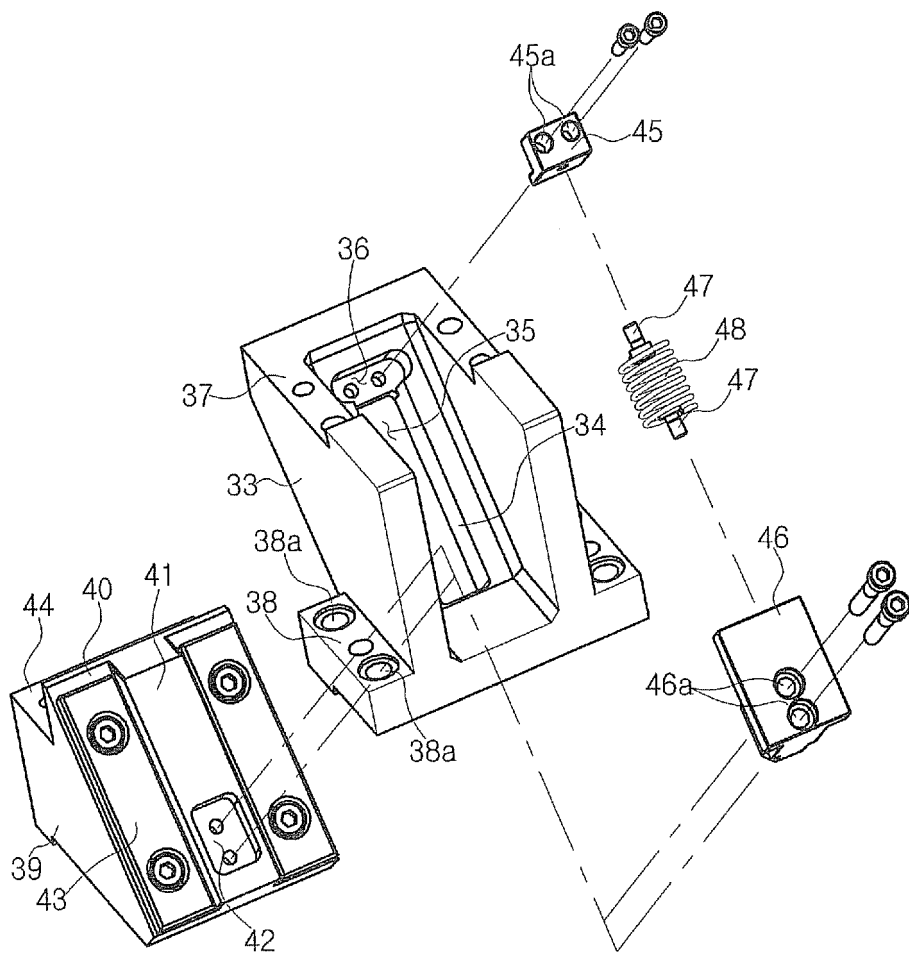
【Fig. 3】



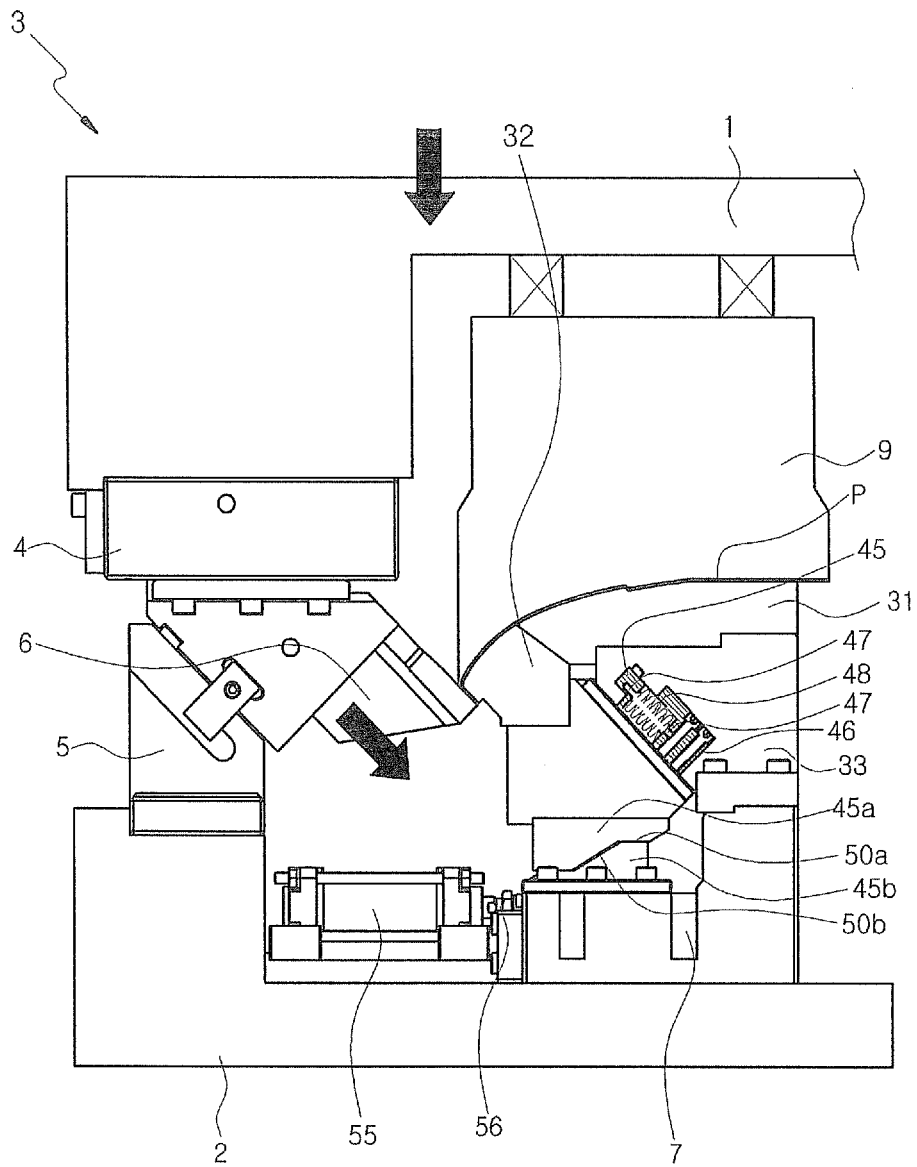
【Fig. 4】



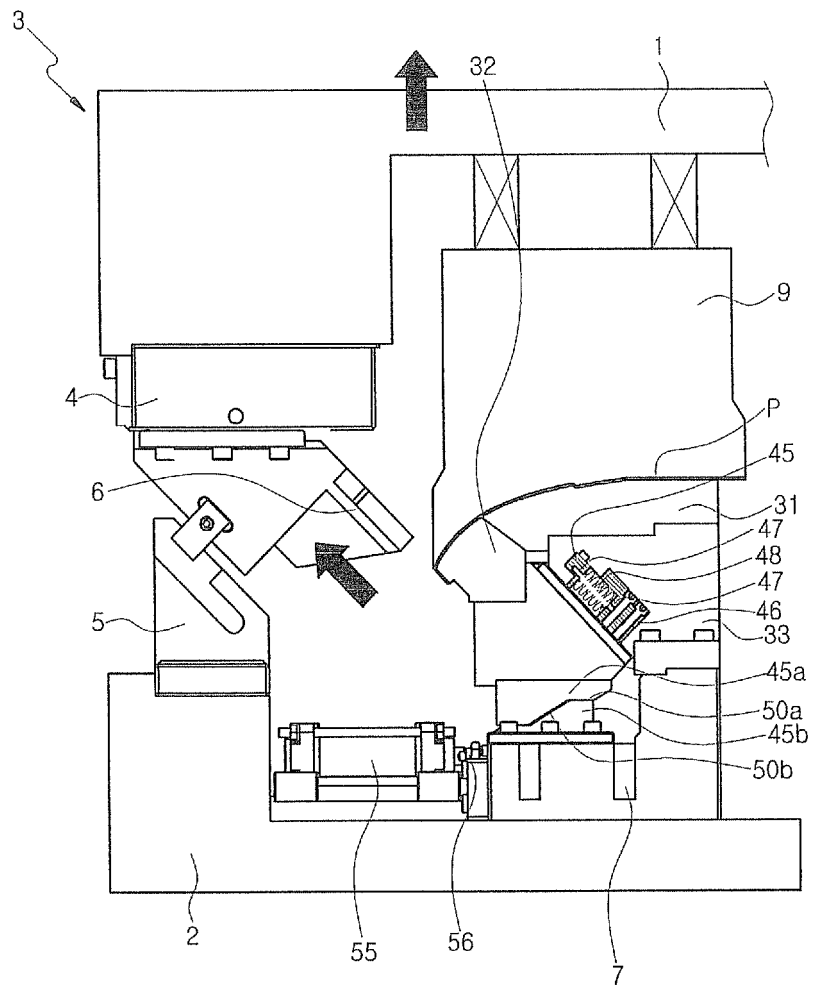
【Fig. 5】



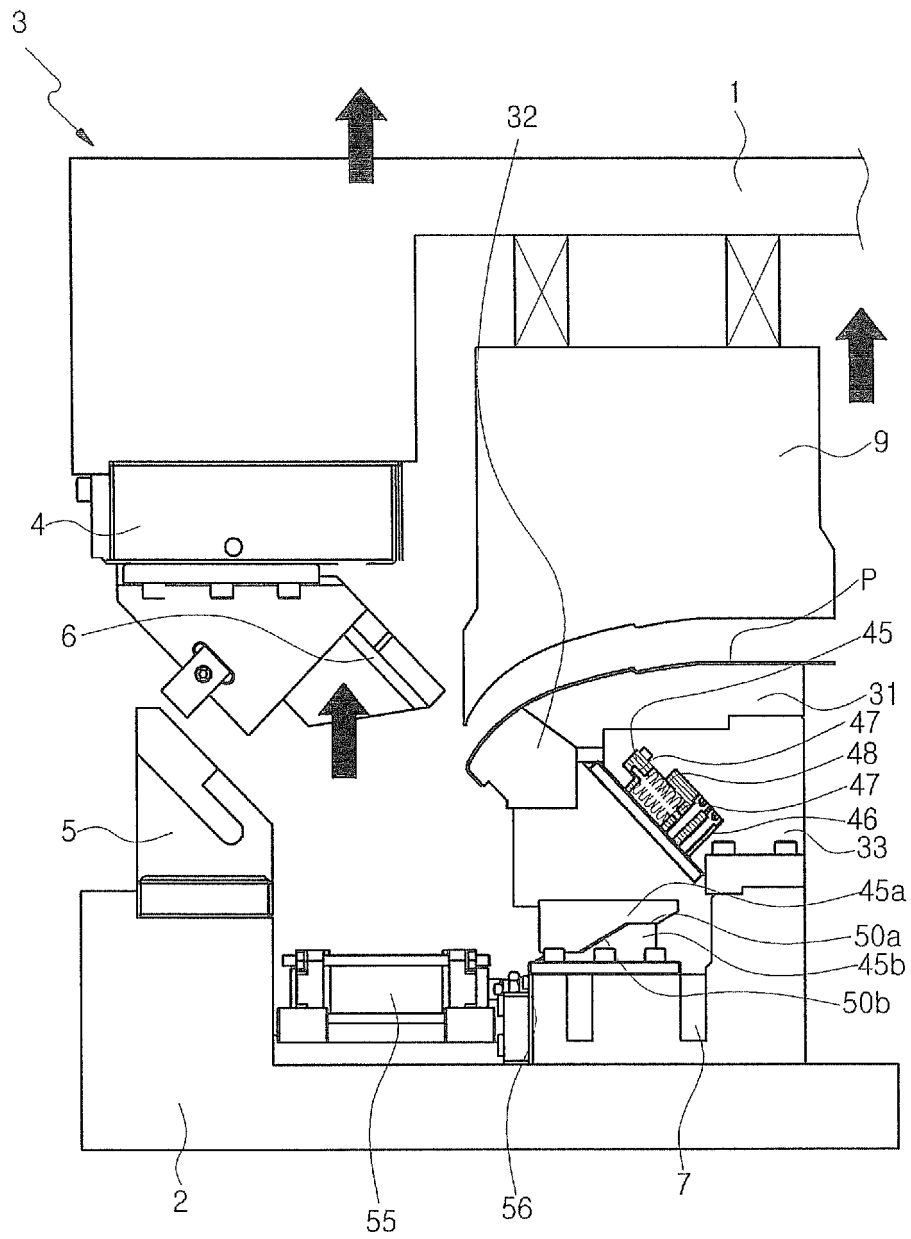
【Fig. 6a】



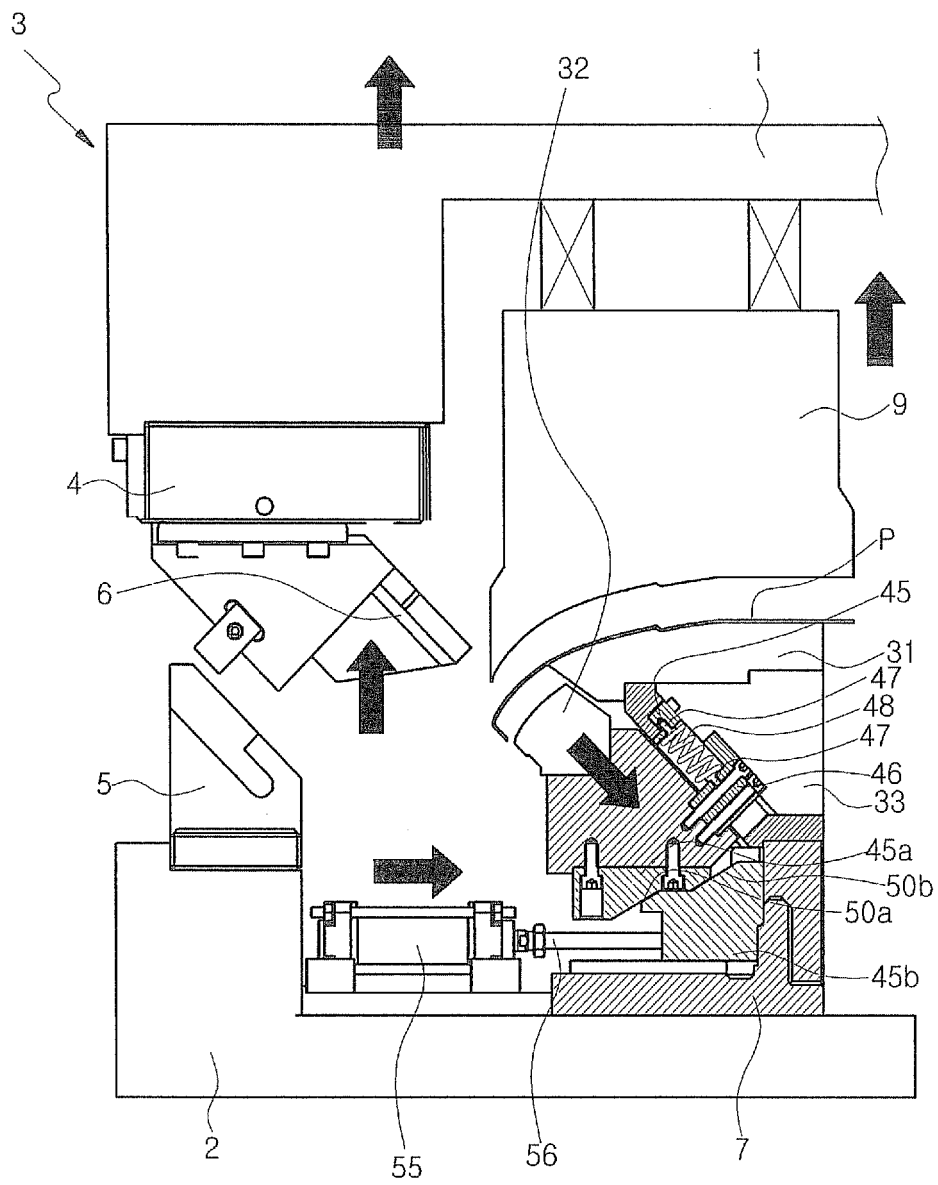
【Fig. 6b】



【Fig. 6c】



【Fig. 6d】



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2012/011586

A. CLASSIFICATION OF SUBJECT MATTER

B21D 5/01(2006.01)i, B21D 19/08(2006.01)i, B21D 24/00(2006.01)i, B30B 15/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B21D 5/01; B21D 37/08; B30B 1/26; B21D 19/08; B26D 5/16

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for Utility models: IPC as above

Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & Keywords: relief, molding device, board, die, forging, spring

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2009-113078 A (YOUR BUSINESS:KK) 28 May 2009 See abstract, claims 1-3 and figure 1.	1-10
A	KR 10-2002-0071426 A (UMIX CO., LTD) 12 September 2002 See the detailed description page 6 and figures 2, 3.	1
A	JP 2000-301242 A (UMIX KK) 31 October 2000 See abstract and figures 2, 3.	1-3
A	KR 10-1995-0002096 B1 (UMIX CO., LTD) 13 March 1995 See the detailed description page 3 and figure 1.	1,4-6

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

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Date of the actual completion of the international search

08 FEBRUARY 2013 (08.02.2013)

Date of mailing of the international search report

13 FEBRUARY 2013 (13.02.2013)

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INTERNATIONAL SEARCH REPORT
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