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(54) **Cam unit equipped with self-centering means**

Selbstzentrierender Führungsschlitten

Coulisseau à auto-centrage

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(56) References cited:
EP-A- 0 484 588
EP-A- 0 983 808
US-A- 5 904 064

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Description

[0001] The present invention relates to a cam unit for metal mold tools, such as a horizontal cam unit or an inclined cam unit for use in giving a desired bent form to a pressed plate at its selected edge or end to provide a car body shape.

[0002] Referring to Figs.4a and 4b, particularly Fig. 4a, a conventional horizontal cam unit comprises a cam driver 10 to be fixed to the upper movable mold tool, a cam slider 11 whose inclined slide surface abuts on the inclined cam surface of the cam driver 10, and a cam base 12 supporting the cam slider 11, and fixed to the lower stationary mold tool. The rising and lowering of the cam driver will make the cam slider 11 to move a predetermined distance right and left.

[0003] The cam slider 11 has a projection formed on its bottom side. The projection slidably fits in the recess of the cam base 12, and the projection has a return spring 13 fixed to its spring pin rod 11a.

[0004] In operation the rising and lowering of the cam driver 10 makes the cam slider 11 having a machining tool fixed to its front end to reciprocate right and left, thereby performing a required machining on a pressed plate article. The rising of the cam driver 10 permits the cam slider 11 to return leftward to the original rest position under the influence of the return spring 13.

[0005] As seen from Fig.4b, the lower part 11a of the cam slider 11 is sandwiched between the opposite upright portions 12a of the cam base 12, and is fastened to the opposite upright portions 12a by applying retainer pieces 14 both to the side projections 11b of the lower part 11a of the cam slider 11 and the top surfaces of the opposite upright portions 12a, thus providing a guide arrangement which permits the cam slider 11 to move smoothly.

[0006] As seen from Fig.4b, the size "b" from the front to rear side, or width of the cam base 12 is much larger than the width "a" of the cam slider 11, and accordingly the weight of the cam unit increases. The sliding surface of the lower part 11a of the cam slider is horizontal, and the counter surface of the cam base 12 is horizontal, too. If uneven wearing is caused on the horizontal surfaces of the confronting parts 11 and 12, the overlying part 11 may be inclined somewhat forward or backward, thus causing the moving parts 10 and 11 to be sticky in motion. Also, if it is desired that the pressing force is increased significantly, the sizes of the cam slider 11 and cam base 12 need to be increased accordingly.

[0007] EP-A-0 983 808 discloses a cam slide driving apparatus including a cam driver having a sliding surface with a V-shaped cross section, a cam slide having a sliding surface of a shape complementary to the sliding surface of the cam driver in such a manner as to be slidably brought into contact with the sliding surface of the cam driver. The apparatus further includes a cam slide supporting base for movably supporting the cam slide so that the cam slide can move while being guided by the sliding surface of the cam driver as the sliding surface of the cam slide and the sliding surface of the cam driver are brought into contact with each other. The cam slide is disposed with a gap with respect to the cam-slide supporting base such a manner as to be movable in a transverse direction perpendicular to the moving direction of the cam slide.

[0008] US-A-5 904 064 discloses a cam assembly for use in a pressing machine having a lower cam fixed to the base of the pressing machine, a spring-biased sliding cam whose front surface is allotted to fix a machining tool and a cam holder to be fixed to the upper frame of the pressing machine. The sliding cam is operatively combined with the lower cam to slide on the inclined surface of the lower cam synchronously with the rising and descending of the upper frame of the pressing machine, whereas the cam holder and the sliding cam is so combined as to leave a predetermined space defined therebetween, thereby permitting the sliding cam to be slidably held in the cam holder. The cam assembly further has a spacer to be inserted in the predetermined space and detachable fastening means to fix the sliding mean of the cam holder as if the slider were like with the upper frame of the pressing machine staying at its lower dead end.

[0009] EP-A-0 484 588 discloses a die including a slide cam and a cam member, respectively, comprising a slide cam base on the top of which a polyhedral guide portion is formed wherein the slide cam holds and supports the polyhedral guide portion of the slide cam base and slides along the polyhedral guide portion. Machining tools such as a punch and a trimming edge are mounted onto the slide cam. Further, an elastic body is interposed between the slide cam base and the slide cam for urging the slide cam. The die further includes a driving cam in contact with the slide cam for driving the same.

[0010] One object of the present invention is to provide a cam unit which is free of such defects as described above.

[0011] To attain this object a cam unit to be mounted to a stationary metal mold tool and a movable metal mold tool for use in effecting a required machining on a pressed article, comprising a cam driver to be fixed to the movable metal mold, a cam slider to be driven by the cam driver and a cam base to be fixed to the stationary mold tool for supporting slidably the cam slider, is improved according to the present invention in that it further comprises self-centering means on the sliding surfaces of the cam slider and cam base.

[0012] The self-centering means may comprise an inverted "V"-shaped section formed on the cam base with the ridge of the inverted "V"-shaped section extending along the center longitudinal line of the cam base, running parallel to the sliding direction in which the cam slider moves, and an inverted "V"-shaped sliding surface formed on the bottom of the cam slider, which inverted "V"-shaped sliding surface rides closely on the inverted

"V"-shaped section of the cam base.

[0013] The cam slider may have the same or substantially same width as the cam base, the width being measured in the direction perpendicular to the sliding direction in which the cam slider moves.

[0014] Thanks to use of the overlapping inverted "V"-shaped sliding surfaces as self-centering means the cam slider can be repeatedly moved on the cam base without causing such an uneven wearing as would be experienced in the horizontal-to-horizontal sliding surfaces in the conventional cam unit structure, thus assuring the stable work all the time. Also advantageously, the cam slider can have the same width as the cam base, permitting the machining tool attaching surface of the cam slider to be increased significantly in comparison with the conventional cam unit structure, in which the cam slider is sandwiched between the opposite projections standing upright from the cam base. Also, the size and weight of the cam unit can be reduced substantially in comparison with the conventional cam unit.

[0015] Other objects and advantages of the present invention will be understood from the following description of a cam unit according to one preferred embodiment of the present invention, which is shown in accompanying drawings.

Fig.1 is a perspective view of a cam unit according to the present invention;
Fig.2 is another perspective view of the cam unit as viewed from its rear side;
Fig.3 is an end view of the cam unit with the cam driver removed; and
Figs. 4a and 4b are a front view and an end view of a conventional cam unit respectively.

[0016] Referring to Fig.1, a cam unit 1 comprises a cam driver 10 to be mounted to an upper movable mold tool, a cam slider 2 and a cam base 3 to be mounted to a lower stationary metal mold tool. The cam driver 10 has an inclined cam surface 10a. Likewise, the cam slider 2 has an inclined surface, and is combined with the cam driver 10 with their inclined surfaces laid on each other, thereby permitting the cam slider 2 to move left or right as a counter action to the rising or lowering of the cam driver 10. The cam base 3 supports the cam slider 2 slidably.

[0017] The cam base 3 has an inverted "V"-shaped upper surface with its ridge extending along the center longitudinal line of the cam base, running parallel to the sliding direction in which the cam slider 2 moves. Likewise, the cam slider 2 has an inverted "V"-shaped bottom. The inverted "V"-shaped sliding bottom surface of the cam slider 2 rides closely on the inverted "V"-shaped top section of the cam base 3.

[0018] Specifically the cam slider 2 has oblique bottom surface halves 2a and 2b sloping up from its opposite longitudinal edges into its longitudinal center line, thus forming a roof-like sliding surface on its bottom side.

[0019] The inclined cam surface 2d of the cam slider 2 is slidably laid on the inclined cam surface 10a of the cam driver 10. The cam slider 2 has tow forcedly returning followers 4 bolted to its opposite sides for jerking the cam slider 2 toward its original position subsequent to the cam action.

[0020] The cam base 3 comprises a base body 3c to be bolted to the lower stationary mold tool, and two guide blocks 3a and 3b parallel-arranged, leaving a longitudinal space therebetween, running in the sliding direction (see Fig.3). The guide blocks 3a and 3b has two reinforcement plates 6 bolted to their opposite ends. A spring pin rod 8 for a return spring appears on the reinforcement plate 6.

[0021] As best seen from Fig.3, each guide block 3a or 3b has an inclined top surface 3d or 3e, which slopes up from its outer longitudinal edge toward the top center line. The so formed roof-like shape is exactly same as the roof-like shape defined by the oblique bottom surface halves 2a and 2b of the cam slider 2. Thus, the self-centering means is provided. The parallel arrangement of two confronting guide blocks 3a and 3b with a given longitudinal space left therebetween makes it possible to reduce substantially the size of the cam base 3 in comparison with the overlying cam slider 2, accordingly permitting the saving of the material and weight of the cam base 3.

[0022] As seen from Fig.3, the size from the front side to rear side, or width of the cam base 3 perpendicular to the direction in which the cam slider 2 slidably moves is substantially equal to that of the overlying cam slider 2. What is intended to mean here by saying "substantially equal" is that the minimum difference therebetween is 10 millimeters or below.

[0023] As may be understood from the above, the rising and descending of the cam driver 10 will make the machining tool bearing cam slider 2 to move slidably on the cam base 3 without fear of the center deviation of the cam slider 2 which, otherwise, would be caused by the wearing of the sliding surfaces of the counter parts 2 and 3; the inverted "V"-shaped sliding surfaces will not cause any deviation of their center ridges even if a significant wearing is caused between the sliding surfaces of the counter parts 2 and 3.

[0024] The inverted "V"-shaped surfaces of the counter sliding parts 2 and 3 will increase significantly their sliding areas over those of the horizontal surfaces of the counter sliding parts 11 and 12 (Figs.4a and 4b), accordingly increasing the resistance to the pressing force. Also advantageously, the machining tool bearing area of the cam slider 2 can be increased by setting its dimension from front to rear side to be equal to the width of the cam base 3, thus permitting the fixing of machining tools of increased size.

[0025] As may be understood from the above, a cam unit equipped with self-centering means according to the present invention is guaranteed to be free of any de-

centering of the cam slider even if a significant wearing is caused between the sliding surfaces of the counter sliding parts.

[0026] The inverted "V"-shaped forms of the counter sliding parts have the effect of increasing the area of the cam unit to which the pressing force is applied, and hence, increasing the resistance to the pressing force applied to the cam unit.

[0027] The size from the front side to rear side or width of the cam base perpendicular to the direction in which the cam slider moves is substantially equal to that of the cam slider. This permits the machining tool bearing area of the cam slider to be increased significantly. The parallel arrangement of two confronting guide blocks with a given longitudinal space left therebetween makes it possible to reduce the weight of the whole cam unit to approximately one third of the weight of the conventional cam unit.

Claims

1. A cam unit (1) to be mounted to a stationary metal mold tool and a movable metal mold tool for use in effecting a required machining on a pressed article, comprising a cam driver (10) to be fixed to the movable metal mold, a cam slider (2) to be driven by the cam driver (10) and a cam base (3) to be fixed to the stationary mold tool for supporting slidably the cam slider (2), **characterized in that** it further comprises self-centering means (2a,2b,3d,3e) on the sliding surfaces of the cam slider (2) and cam base (3).

2. A cam unit (1) according to claim 1, wherein the self-centering means (2a,2b,3d,3c) comprises an inverted "V"-shaped section formed on the top of the cam base (3) with the ridge of the inverted "V"-shape extending along the center longitudinal line of the cam base (3), running parallel to the sliding direction in which the cam slider (2) moves, and an inverted "V"-shaped sliding surface formed on the bottom of the cam slider (2), which inverted "V"-shaped sliding surface rides closely on the inverted "V"-shaped section of the cam base (3).

3. A cam unit (1) according to claim 1 or 2, wherein the cam slider (2) has the same or substantially same width as the cam base (3), the width being measured in the direction perpendicular to the sliding direction in which the cam slider (2) moves.

Patentansprüche

1. Führungsschlitten bzw. Nockeneinheit (1), die zur Verwendung in ein feststehendes Metallformungswerkzeug und ein bewegliches Metallformungswerkzeug einbaubar ist, um eine erforderliche Bearbeitung an einem gepressten Gegenstand zu bewirken, aufweisend ein Nockenantriebsteil (10), das an der beweglichen Metallform zu befestigen ist, einen Nockenschieber (2), der vom Nockenantriebsteil (10) anzutreiben ist und ein Nockenunterteil (3), das am feststehenden Formungswerkzeug zu befestigen ist, um den Nockenschieber (2) verschiebbar zu lagern,
dadurch gekennzeichnet, dass
sie außerdem eine selbstzentrierende Einrichtung (2a, 2b, 3d, 3e) auf den Gleitflächen des Nockenschiebers (2) und des Nockenunterteils (3) aufweist.

2. Führungsschlitten (1) nach Anspruch 1, wobei die selbstzentrierende Einrichtung (2a, 2b, 3d, 3e) ein umgekehrtes "V"-förmiges Profil, das auf der Oberseite des Nockenunterteils ausgebildet ist, wobei sich der Rand der umgekehrten "V"-Form längs der längsgerichteten Mittellinie des Nockenunterteils (3) erstreckt, die parallel zu der Gleitrichtung verläuft, in der sich der Nockenschieber (2) bewegt, und eine umgekehrte "V"-förmige Gleitfläche aufweist, die an der Unterseite des Nockenschiebers (2) ausgebildet ist, dessen umgekehrte "V"-förmige Gleitfläche
nah auf dem umgekehrten "V"-förmigen Abschnitt des Nockenunterteils (3) fährt.

3. Führungsschlitten (1) nach Anspruch 1 oder 2, wobei der Nockenschieber (2) die gleiche oder die im Wesentlichen gleiche Breite aufweist wie das Nokkenunterteil (3), wobei die Breite in der Richtung rechtwinklig zu der Gleitrichtung gemessen wird, in der sich der Nockenschieber (2) bewegt.

Revendications

1. Unité de came (1) à monter dans un outil à moule métallique stationnaire et un outil à moule métallique mobile pour être utilisée en effectuant un usinage requis sur un article formé à la presse, comprenant un moteur d'entraînement de came (10) à fixer au moule métallique mobile, une glissière de came (2) devant être entraînée par le moteur d'entraînement de came (10) et un socle de came (3) à fixer à l'outil à moule stationnaire pour supporter de manière coulissante la glissière de came (2), **caractérisé en ce qu'**elle comprend en outre des moyens de centrage automatique (2a, 2b, 3d, 3e) sur les surfaces coulissantes de la glissière de came (2) et du socle de came (3).

2. Unité de came (1) selon la revendication 1, dans laquelle les moyens de centrage automatique (2a, 2b, 3d, 3e) comprennent une coupe inversée en for-

me de « V » formée sur le sommet du socle de came (3) avec la rive de la forme en « V » inversée s'étendant le long de la ligne longitudinale centrale du socle de came (3) ; courant parallèlement à la direction coulissante dans laquelle la glissière de came (2) se déplace, et une surface coulissante inversée en forme de « V » formée sur la base de la glissière de came (2) ; laquelle surface coulissante inversée en forme de « V » avance étroitement sur la coupe inversée en forme de « V » du socle de came (3).

3. Unité de came (1) selon la revendication 1 ou 2, dans laquelle la glissière de came (2) présente la même ou sensiblement la même largeur que le socle de came (3) ; la largeur étant mesurée dans la direction perpendiculaire à la direction coulissante dans laquelle la glissière de came (2) se déplace.

FIG. 1

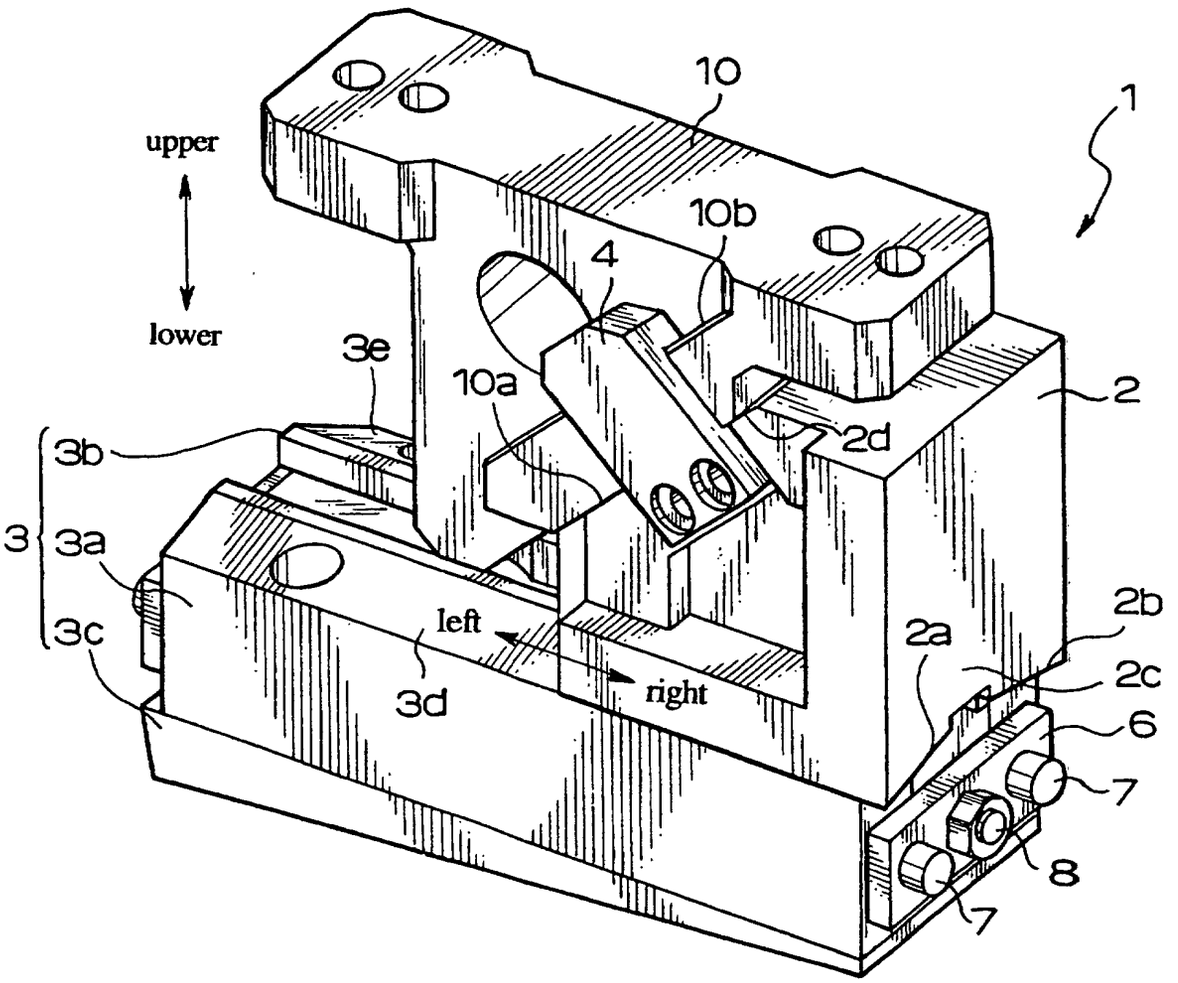
10
1
upper
lower
10b
4
3e
10a
2
2d
3b
3
3a
3c
left
right
3d
2a
2b
2c
6
7
8
7

FIG. 2

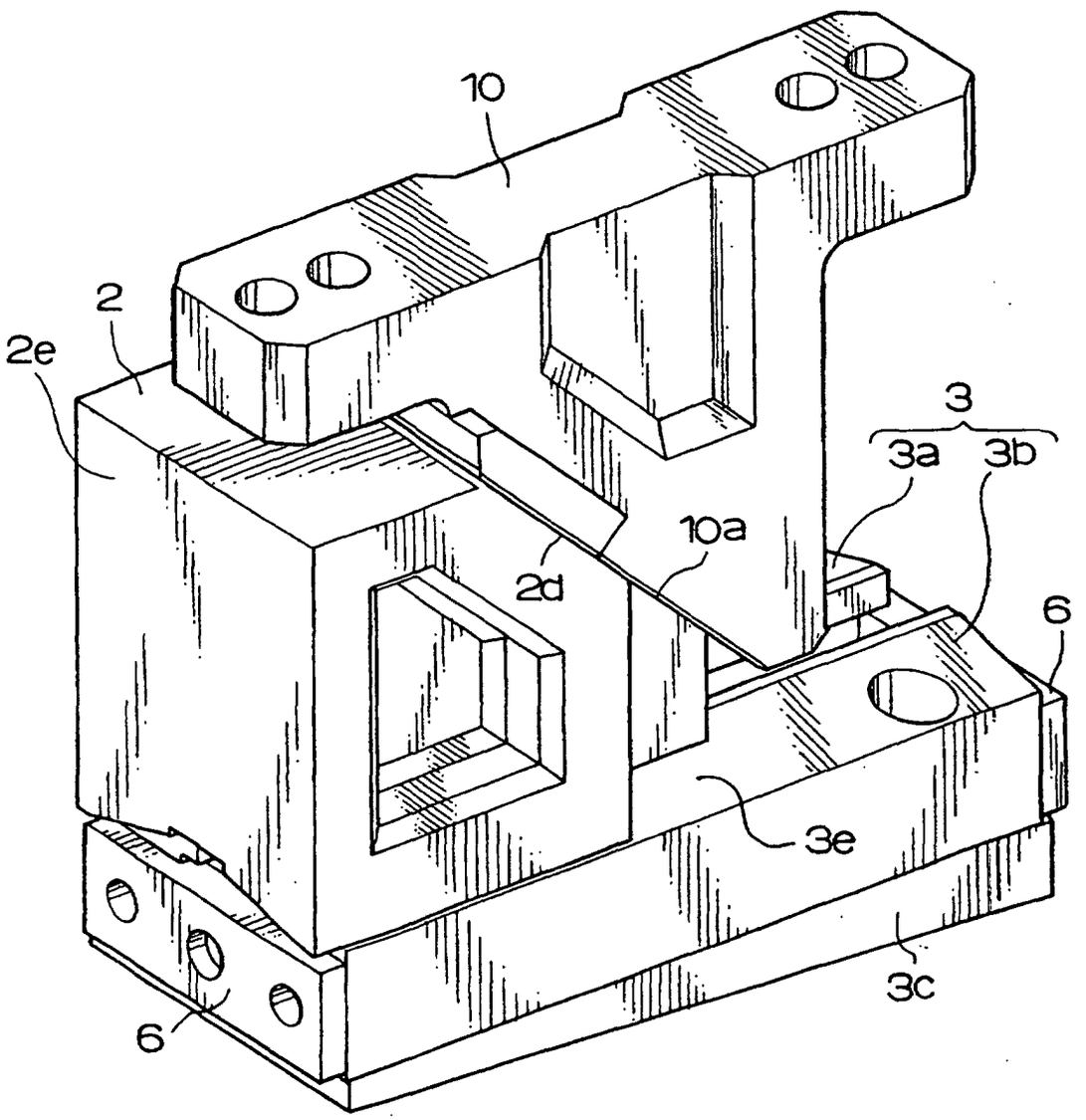

FIG. 3

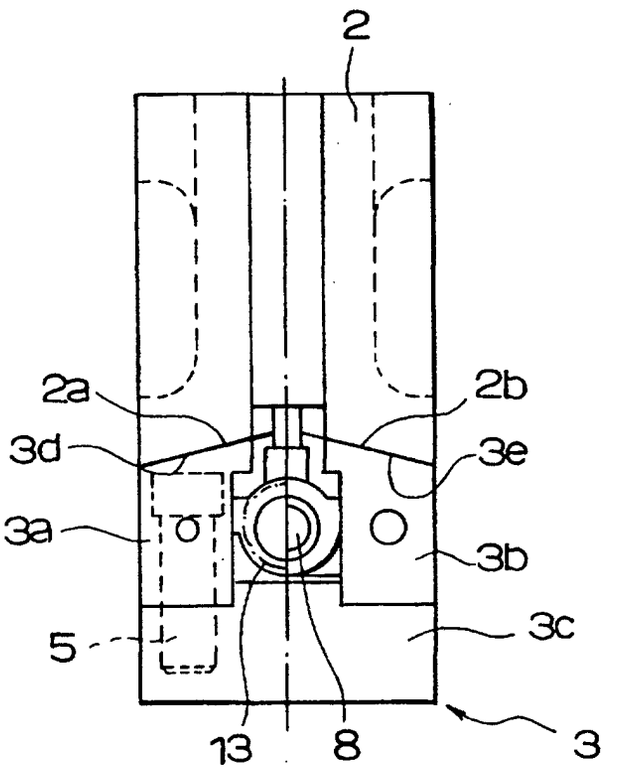

FIG. 4A
PRIOR ART

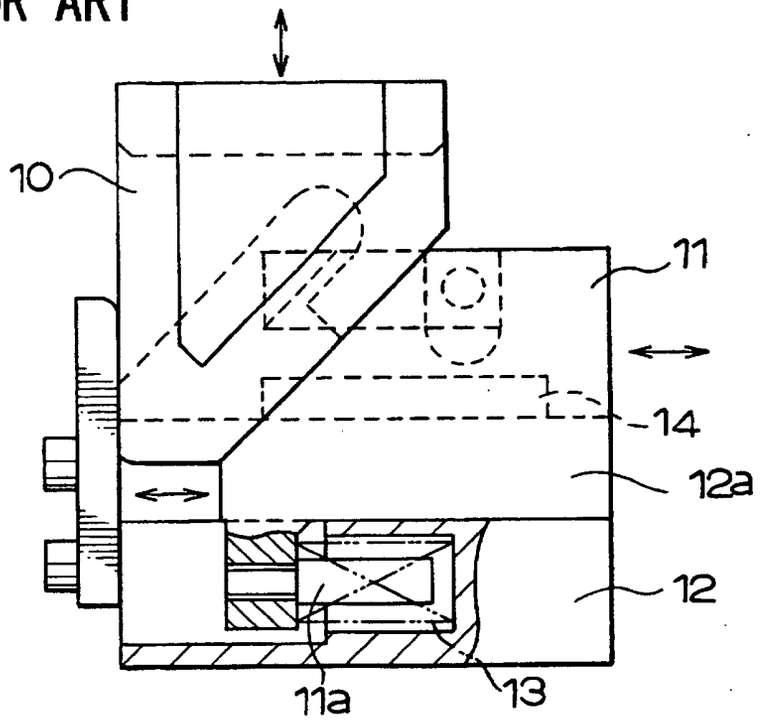

FIG. 4B
PRIOR ART