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(54) Aerial cam for forming dies

Luftnockenaufbau für Umformwerkzeuge

Came aérienne pour outils de formage

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Description

Background of the invention

[0001] The present invention relates to an aerial cam for dies for forming sheet metal having a top half-die and a bottom half-die that are mobile with respect to one another in a vertical direction between an open position and a closed position, according to the preamble of claim 1.

[0002] In dies for cold plastic deformation of sheet metal it is frequently necessary to carry out machining operations, such as for example drilling or shearing in directions inclined with respect to the direction of movement of the half-dies. To carry out said machining operations, so-called aerial cams are used. An aerial cam comprises a slide that is mobile in a direction inclined with respect to the direction of movement of the half-dies. The slide carries at least one tool for machining the sheet metal and is mobile between a resting position and a working position in a direction inclined with respect to the direction of movement of the half-dies. The slide co-operates with a top guide unit, which is to be fixed to the top half-die, and with a bottom guide unit, which is to be fixed to the bottom half-die. During the movement of closing of the half-dies, the slide is compressed between opposite guide surfaces of the top and bottom guide units, said guide surfaces being inclined with respect to the direction of movement of the half-dies. As a result of the compression between the inclined guide surfaces of the top guide unit and the bottom guide unit, during closing of the half-dies the slide is displaced from its resting position to its working position against the action of elastic means that tend to keep it in the resting position.

[0003] Aerial cams are always equipped with arrest means that define a contrast surface, against which the slide is pushed by the aforesaid elastic means into the resting position. In the known solutions, said arrest means are provided on the top guide unit and are generally set for co-operating with a rear surface of the slide. In the known solutions, to obtain a rigid arrest of the slide in the resting position it is necessary to make the top guide unit with a shape that envelops the slide. Consequently, in the known solutions the top guide unit is formed by a massive body that requires complex machining operations. A solution of this type is known, for example, from the document No. EP 1 197 319 on which the preamble of claim 1 is based.

[0004] Also known are solutions in which an arrest element is provided, fixed to the top guide unit by means of screws. In some solutions of this second type, the stresses caused by arrest of the slide are discharged on the fixing screws, a fact that renders the aerial cam non-compliant with the main standards, amongst which the German standard VDI. In other solutions, the positioning of the arrest element entails the addition of material to the top guide unit to obtain an efficient mechanical reaction.

Summary of the invention

[0005] The object of the present invention is to provide a more compact aerial cam, which will have a more contained cost as compared to known solutions and in which the element for arrest of the slide in the resting position is rigid and has a simple structure and that does not require complex machining operations.

[0006] According to the present invention, said object is achieved by an aerial cam having the characteristics forming the subject-matter of Claim 1.

[0007] According to the present invention, the arrest means against which the slide is pushed elastically into the resting position are provided on side vices that connect the slide to the top guide unit in a mobile way.

[0008] This arrangement enables reduction of the dimensions and weight of the top guide unit and simplification of the operations for machining the top guide unit.

[0009] Thanks to this solution, it is possible to obtain a simpler aerial cam, which is compact and has a more contained cost.

Brief description of the drawings

[0010] Further characteristics and advantages of the present invention will emerge clearly in the course of the ensuing detailed description, which is provided purely by way of example, with reference to the attached drawings, wherein:

- Figure 1 is a perspective view of an aerial cam according to a preferred embodiment of the present invention;
- Figure 2 is an exploded perspective view of the aerial cam of Figure 1;
- Figures 3 and 4 are side views of the aerial cam of Figure 1 in the resting position and in working position, respectively; and
- Figures 5 and 6 are sections according to the lines V-V and VI-VI of Figure 4, respectively.

Description of a preferred embodiment

[0011] Designated by 10 in the figures is an aerial cam for dies for forming sheet metal, in particular for cold plastic deformation of sheet metal. The aerial cam 10 is to be used in a die having a top half-die and a bottom half-die that are mobile with respect to one another in a vertical direction between an open position and a closed position.

[0012] The aerial cam 10 comprises a top guide unit 12, which is to be fixed to a top half-die (not illustrated), and a bottom guide unit 14, which is to be fixed to a bottom half-die (not illustrated either). With particular reference to Figure 2, the top guide unit 12 has a first guide 16. In the example illustrated, the first guide 16 is a concave V-shaped guide provided with two applied slide plates 18. The bottom guide unit 14 is provided with a second guide 20. In the example illustrated, the second

guide 20 is a convex V-shaped guide including two applied slide plates 22.

[0013] The aerial cam 10 comprises a slide 24 carried by the top guide unit 12. The slide 24 has a third guide 26 that co-operates with the first guide 16 of the top guide unit 12. In the example illustrated, the third guide 26 is a convex V-shaped guide preferably provided with applied slide plates 28. The slide 24 has a front surface 28 and two mutually parallel side surfaces 30. A tool 32 (Figure 2) is to be fixed on the front surface 28 of the slide 24.

[0014] The slide 24 has a fourth guide 34, which co-operates with the second guide 20 of the bottom guide unit 14 during the step of closing of the die. In the example illustrated, the fourth guide 34 is a concave V-shaped guide and is preferably provided with applied slide plates 36.

[0015] The slide 24 is connected to the top guide unit 12 by means of two side vices 38 set on opposite sides of the slide 24. Each side vice 38 has on an inner surface a substantially L-shaped projection 40 that engages with precise geometrical and dimensional fit a corresponding L-shaped seat 42 formed in a side wall 44 of the top guide unit 12. The side vices 38 are fixed to the top guide unit 12 by means of screws 46. The precise geometrical and dimensional fit between the projections 40 and the corresponding seats 42 means that the forces applied to the vices 38 in directions orthogonal to the axes of the screws 46 have no repercussions on the screws themselves.

[0016] Each side vice 38 is moreover equipped on its inner surface with a retention projection 48, which slidably engages a corresponding retention groove 50 formed in the corresponding side wall 30 of the slide 24. The retention projections 48 and the retention grooves 50 are parallel to the guides 16 and 26. On the retention projections 48 there may be applied slide plates fixed by means of screws and mechanically countered.

[0017] An elastic element 52 is set between the top guide unit 12 and the slide 24. The elastic element 52 exerts on the slide 24 a force parallel to the guides 16 and 26 and oriented in the direction indicated by the arrows 54 in Figures 3 and 4. The elastic element 52 can be constituted by a helical spring, by a gas-operated spring, or by any other member designed to apply an elastic force.

[0018] Each side vice 38 carries a respective arrest member 56. Each arrest member 56 is inserted with precise geometrical and dimensional fit into a housing 58 formed in a bottom wall 60 of the respective side vice 38. Each arrest member 56 is fixed to the respective side vice 38 by means of screws 62. The precise geometrical and dimensional fit between the arrest member 56 and the housing 58 means that the forces acting on the arrest member 56 in a direction parallel to the guides 16, 26 have no repercussion on the fixing screws 62. Each arrest member 56 has a front arrest wall 64 orthogonal to the direction of the guides 16, 26. Preferably, applied on the front arrest wall 64 are elastomeric damping elements 66.

[0019] Each arrest member 56 is inserted with clearance in a respective elongated seat 68 formed in the side wall 30 of the slide 24. Each elongated groove 68 has a respective front wall 70 that is to co-operate in a relationship of arrest with the front surface 64 of the arrest member 56.

[0020] The slide 24 is mobile with respect to the top guide unit 12 between a resting position illustrated in Figure 3 and a working position illustrated in Figure 4. The elastic element 52 tends constantly to push the slide 24 towards the resting position, in the direction indicated by the arrow 54 in Figure 3. In the resting position, the slide 24 is in contact of arrest against the arrest members 56 via the front surfaces 70 and 64, with interposition of the damping members 66.

[0021] In the position of die open, the slide 24 is in the resting position. During the movement of closing of the half-dies, the slide 24 is compressed between the guide 16 of the top guide unit 12 and the guide 20 of the bottom guide unit 14. The slide 24 moves from the resting position illustrated in Figure 3 to the working position illustrated in Figure 4 during closing of the half-dies. During this travel from the resting position to the working position, the tool 32 carries out a machining operation on the sheet metal compressed between the half-dies, for example a drilling or a shearing operation.

[0022] During the movement of opening of the half-dies, the elastic element 52 brings the slide 24 back into the resting position. The arrest members 56 absorb the force with which the slide 24 is pushed towards the resting position. Said force is discharged on the top guide unit 12 through the side vices 38. However, the force with which the slide 24 impacts against the arrest members 56 does not stress either the fixing screws 62 of the arrest members 56 or the fixing screws 46 of the side vices 38.

[0023] The fact of providing the arrest members 56 on the side vices 38 enables simplification and lightening of the top guide unit 12 as compared to known solutions in which the arrest element of the slide 24 is provided in the rear part of the top guide unit. In fact, the arrangement of the arrest members 56 on the side vices 38 avoids the need for top guide unit 12 to have a shape that envelops the slide 24 in the rear part. The present invention moreover enables simplification of the machining operations to be carried out both on the top guide unit 12 and on the slide 24.

[0024] Of course, without prejudice to the principle of the invention, the details of construction and the embodiments may vary widely with respect to what has been described and illustrated herein, without thereby departing from the scope of the present invention, as defined by the appended claims.

Claims

1. An aerial cam for dies for forming sheet metal having a top half-die and a bottom half-die that are mobile with respect to one another in a vertical direction

between an open position and a closed position, said cam comprising:

- a top guide unit (12), which is to be fixed to the top half-die and has a first guide (16);
- a bottom guide unit (14), which is to be fixed to the bottom half-die and has a second guide (20);
- a slide (24), carried by the top guide unit (12) and having a third guide (26) that co-operates with said first guide (16) and a fourth guide (34) that co-operates with said second guide (20) during closing of said half-dies, in which the slide (24) is mobile with respect to the top guide unit (12) between a resting position and a working position;
- a pair of side vices (38) for connecting in a mobile way the slide (24) to the top guide unit (12), said vices (38) being set laterally and on opposite sides of the slide (24); and
- elastic means (52), set between the top guide unit (12) and the slide (24) for pushing the slide (24) elastically against arrest means (56) in said resting position,

characterized in that said arrest means (56) are provided on said side vices (38).

2. The aerial cam according to Claim 1, **characterized in that** said arrest means (56) are integral or fixed by means of screws (62) to said side vices (38).

3. The aerial cam according to Claim 1, **characterized in that** said arrest means comprise an arrest member (56) projecting from a bottom wall (60) of each side vice (38).

4. The aerial cam according to Claim 3, **characterized in that** each of said arrest members (56) engages with clearance a respective elongated seat (68) formed on a respective side wall (30) of the slide (24).

5. The aerial cam according to Claim 4, **characterized in that** each of said arrest members (56) has a front arrest surface (64) facing a corresponding front surface (70) of the respective elongated seat (68), said front surfaces (64, 70) being orthogonal to said first and third guides (16, 26).

6. The aerial cam according to Claim 3, **characterized in that** each of said arrest members (56) is fixed in a housing (58) formed in the bottom wall (60) of the respective vice (38).

7. The aerial cam according to Claim 1, **characterized in that** each of said side vices (38) has a substantially L-shaped projection (40) that engages a corresponding L-shaped seat (42) made in a respective side wall (44) of the top guide unit (12).

Patentansprüche

1. Luftnockenaufbau für Umformwerkzeuge zum Umformen von Metallblech mit einer oberen Werkzeughälfte und einer unteren Werkzeughälfte, die in einer vertikalen Richtung zwischen einer offenen Position und einer geschlossenen Position zueinander beweglich sind, wobei der Nockenaufbau folgendes aufweist:

- eine obere Führungseinheit (12), die an der oberen Werkzeughälfte zu befestigen ist und eine erste Führung (16) aufweist;
- eine untere Führungseinheit (14), die an der unteren Werkzeughälfte zu befestigen ist und eine zweite Führung (20) aufweist;
- eine Gleiteinrichtung (24), die von der oberen Führungseinheit (12) getragen ist und eine dritte Führung (26), die mit der ersten Führung (16) zusammenarbeitet, und eine vierte Führung (34) aufweist, die mit der zweiten Führung (20) zusammenarbeitet, während eines Schließens der Werkzeughälften, wobei die Gleiteinrichtung (24) zwischen einer Ruheposition und einer Arbeitsposition hinsichtlich der oberen Führungseinheit (12) beweglich ist;
- ein Paar von seitlichen Einspannbacken (38) zum Verbinden der Gleiteinrichtung (24) mit der oberen Führungseinheit (12) in einer beweglichen Art und Weise, wobei die Einspannbacken (38) seitlich und auf entgegengesetzten Seiten der Gleiteinrichtung (24) eingestellt sind; und
- eine elastische Einrichtung (52), die zwischen die obere Führungseinheit (12) und die Gleiteinrichtung (24) zum Drücken der Gleiteinrichtung (24) elastisch gegen Fangeinrichtungen (56) in der Ruheposition gesetzt ist,

dadurch gekennzeichnet, dass die Fangeinrichtungen (56) an den seitlichen Einspannbacken (38) vorgesehen sind.

2. Luftnockenaufbau nach Anspruch 1, **dadurch gekennzeichnet, dass** die Fangeinrichtungen (56) an den seitlichen Einspannbacken (38) einstückig oder mittels Schrauben (62) fixiert sind.

3. Luftnockenaufbau nach Anspruch 1, **dadurch gekennzeichnet, dass** die Fangeinrichtungen ein Fangbauteil (56) aufweisen, das von einer Bodenwand (60) von jeder seitlichen Einspannbacke (38) vorragt.

4. Luftnockenaufbau nach Anspruch 3, **dadurch gekennzeichnet, dass** jedes Fangbauteil (56) mit einem Abstand mit einem entsprechenden länglichen Sitz (68) in Eingriff steht, der an einer entsprechenden Seitenwand (30) der Gleiteinrichtung (24) ausgebildet ist.

5. Luftnockenaufbau nach Anspruch 4, **dadurch gekennzeichnet, dass** jedes der Fangbauteile (56) eine vordere Fangfläche (64) aufweist, die einer entsprechenden vorderen Fläche (70) des entsprechenden länglichen Sitzes (68) zugewandt ist, wobei die vorderen Flächen (64, 70) orthogonal zu der ersten und der dritten Führung (16, 26) sind.

6. Luftnockenaufbau nach Anspruch 3, **dadurch gekennzeichnet, dass** jedes der Fangbauteile (56) in einem Gehäuse (58) fixiert ist, das in der Bodenwand (60) der entsprechenden Einspannbacke (38) ausgebildet ist.

7. Luftnockenaufbau nach Anspruch 1, **dadurch gekennzeichnet, dass** jede der seitlichen Einspannbacken (38) einen im Wesentlichen L-förmigen Vorsprung (40) aufweist, der mit einem entsprechenden L-förmigen Sitz (42) in Eingriff steht, der in einer entsprechenden Seitenwand (44) der oberen Führungseinheit (12) ausgebildet ist.

Revendications

1. Came aérienne pour des matrices pour former de la tôle comportant une demi-matrice supérieure et une demi-matrice inférieure qui sont mobiles l'une par rapport à l'autre dans une direction verticale entre une position ouverte et une position fermée, ladite came comprenant :

   - une unité de guide supérieure (12), qui est destinée à être fixée à la demi-matrice supérieure et qui comporte un premier guide (16) ;
   - une unité de guide inférieure (14), qui est destinée à être fixée à la demi-matrice inférieure et qui comporte un deuxième guide (20) ;
   - un coulisseau (24), supporté par l'unité de guide supérieure (12) et comportant un troisième guide (26) qui coopère avec ledit premier guide (16) et un quatrième guide (34) qui coopère avec ledit deuxième guide (20) pendant la fermeture desdites demi-matrices, dans laquelle le coulisseau (24) est mobile par rapport à l'unité de guide supérieure (12) entre une position de repos et une position de travail ;
   - une paire d'étaux latéraux (38) pour relier d'une manière mobile le coulisseau (24) à l'unité de guide supérieure (12), lesdits étaux (38) étant placés latéralement et sur les côtés opposés du coulisseau (24) ; et
   - des moyens élastiques (52), placés entre l'unité de guide supérieure (12) et le coulisseau (24) pour pousser le coulisseau (24) de manière élastique contre des moyens d'arrêt (56) à ladite position de repos,

   caractérisée en ce que lesdits moyens d'arrêt (56) sont prévus sur lesdits étaux latéraux (38).

2. Came aérienne selon la revendication 1, **caractérisée en ce que** lesdits moyens d'arrêt (56) sont d'un seul tenant avec lesdits étaux latéraux (38) ou sont fixés à ceux-ci au moyen de vis (62).

3. Came aérienne selon la revendication 1, **caractérisée en ce que** lesdits moyens d'arrêt comprennent un élément d'arrêt (56) faisant saillie d'une paroi inférieure (60) de chaque étau latéral (38).

4. Came aérienne selon la revendication 3, **caractérisée en ce que** chacun desdits éléments d'arrêt (56) vient en prise, avec un jeu, avec un siège allongé (68) respectif formé sur une paroi latérale (30) respective du coulisseau (24).

5. Came aérienne selon la revendication 4, **caractérisée en ce que** chacun desdits éléments d'arrêt (56) a une surface d'arrêt avant (64) faisant face à une surface avant (70) correspondante du siège allongé (68) respectif, lesdites surfaces avant (64, 70) étant orthogonales aux dits premier et troisième guides (16, 26).

6. Came aérienne selon la revendication 3, **caractérisée en ce que** chacun desdits éléments d'arrêt (56) est fixé dans un logement (58) formé dans la paroi inférieure (60) de l'étau (38) respectif.

7. Came aérienne selon la revendication 1, **caractérisée en ce que** chacun desdits étaux latéraux (38) comporte une protubérance sensiblement en forme de L (40) qui vient en prise avec un siège sensiblement en forme de L (42) correspondant formé dans une paroi latérale (44) respective de l'unité de guide supérieure (12).

FIG. 1

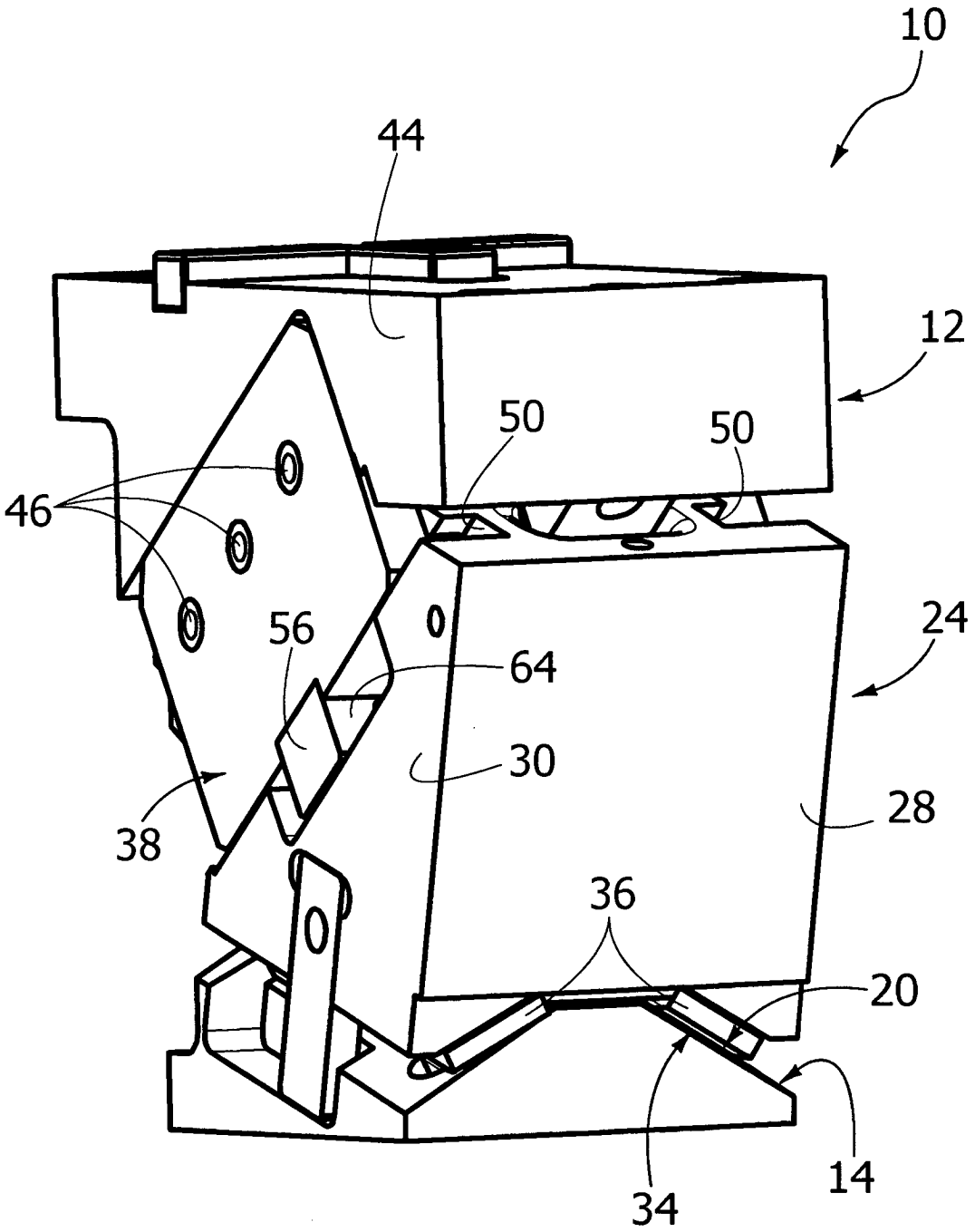


FIG. 2

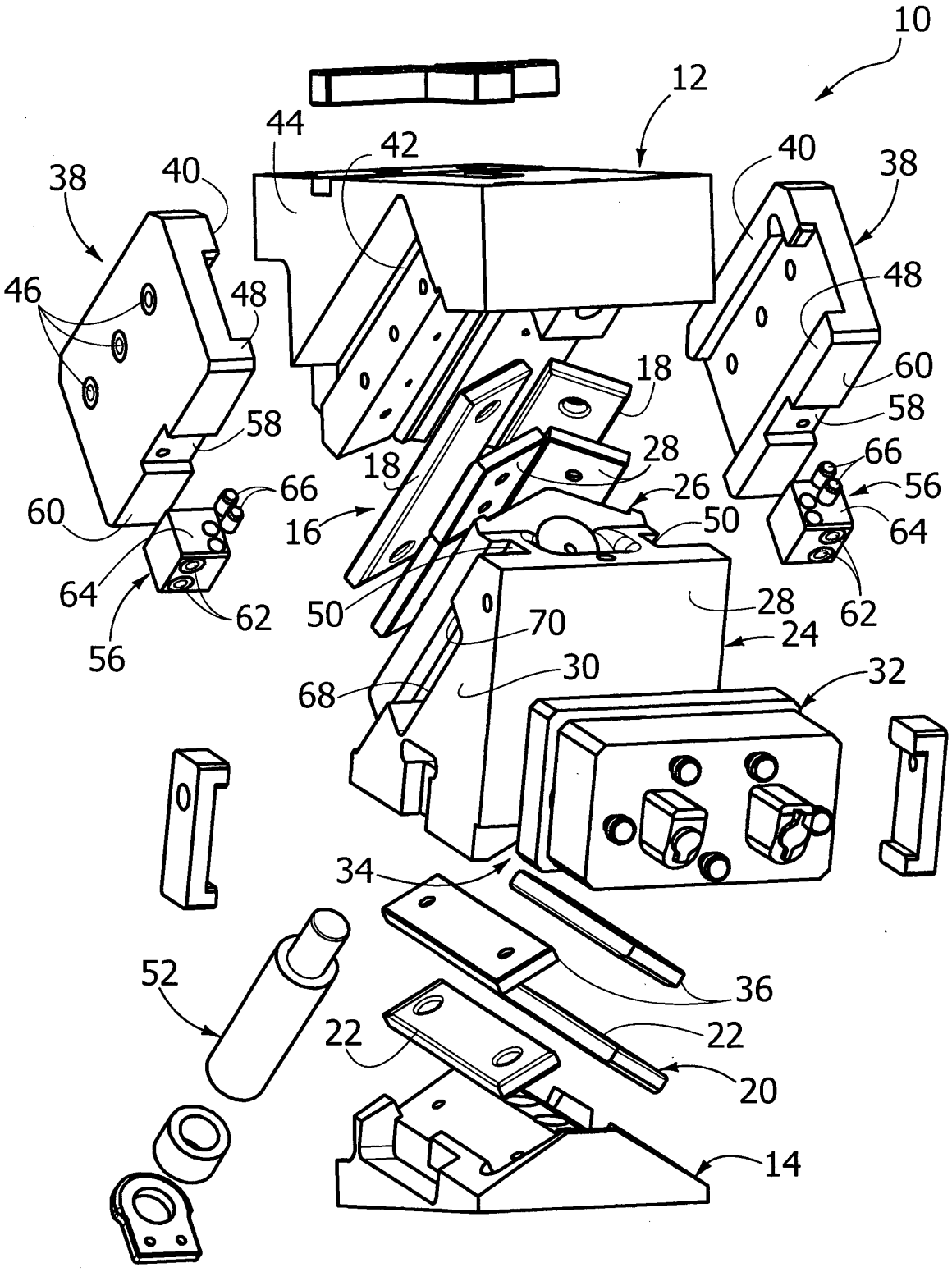

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FIG. 3

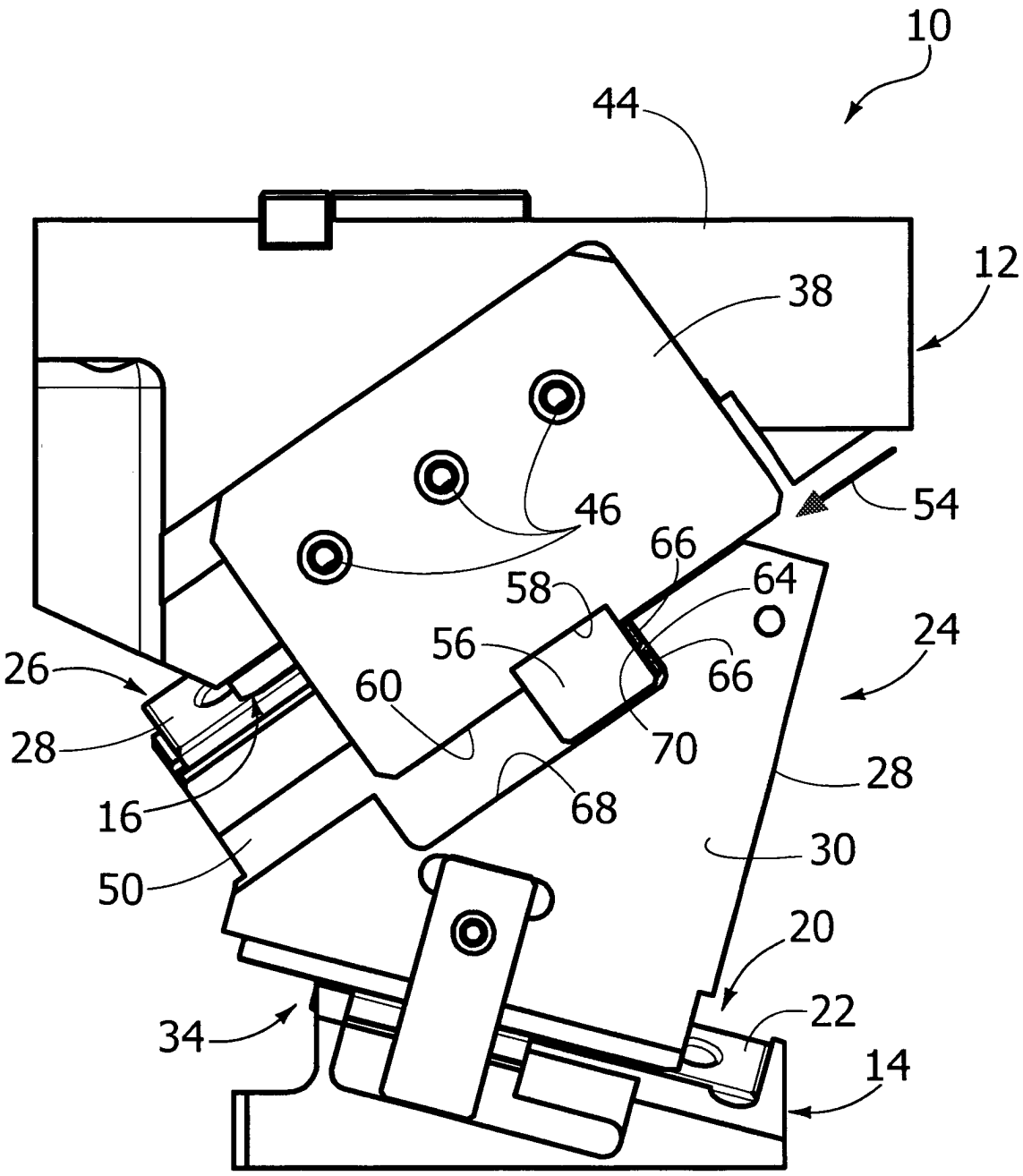

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FIG. 4

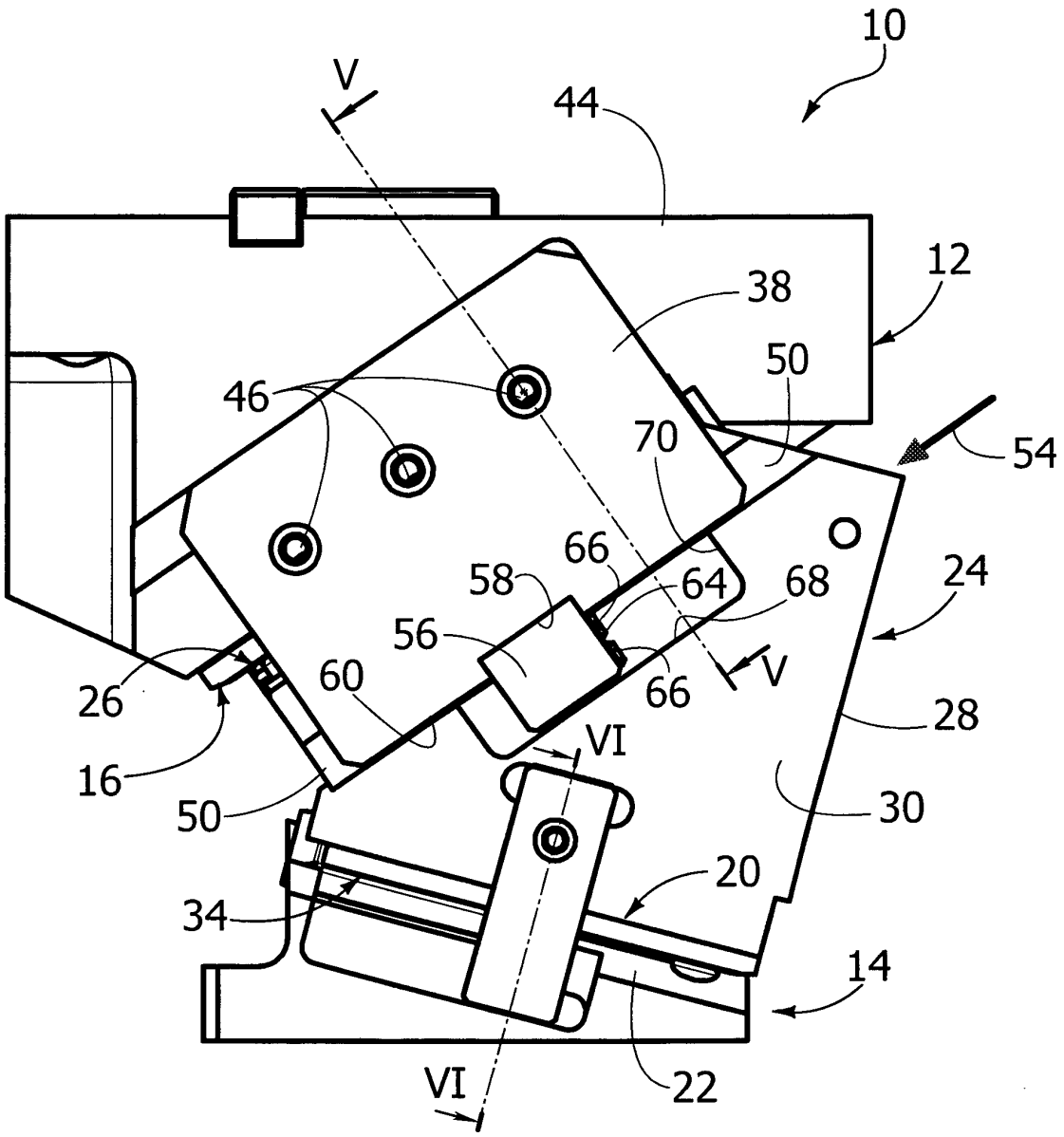

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FIG. 5

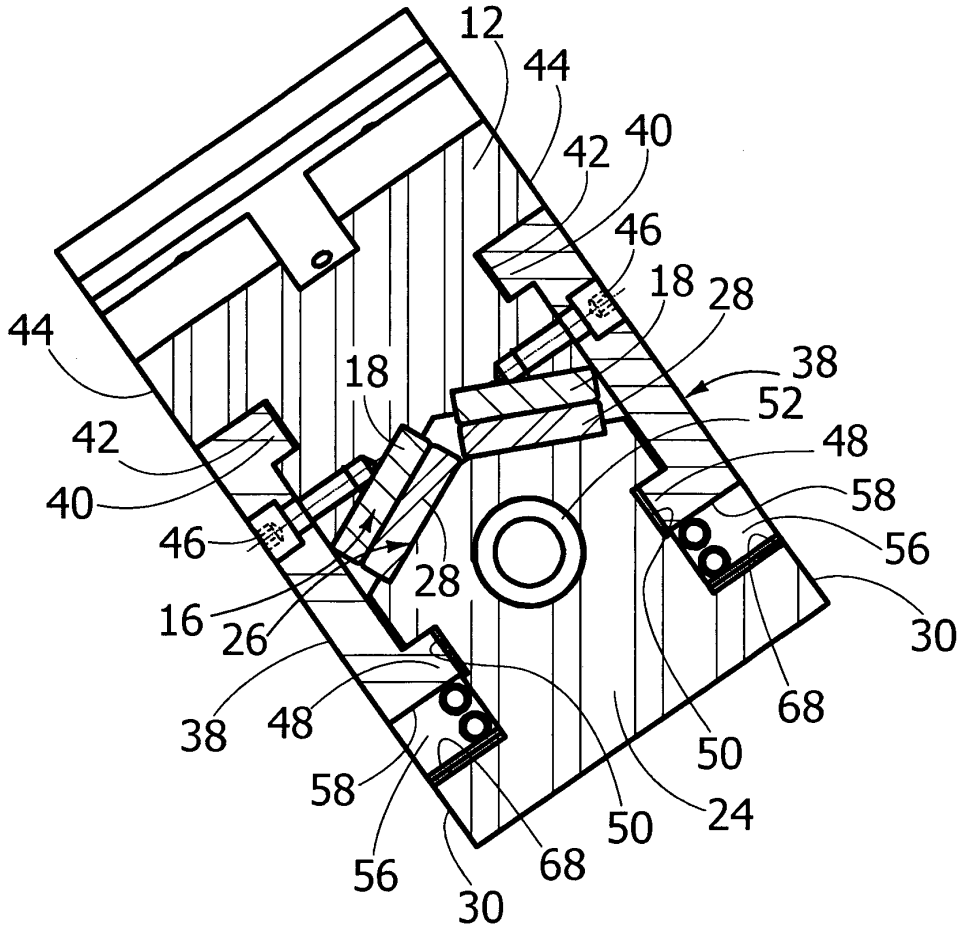
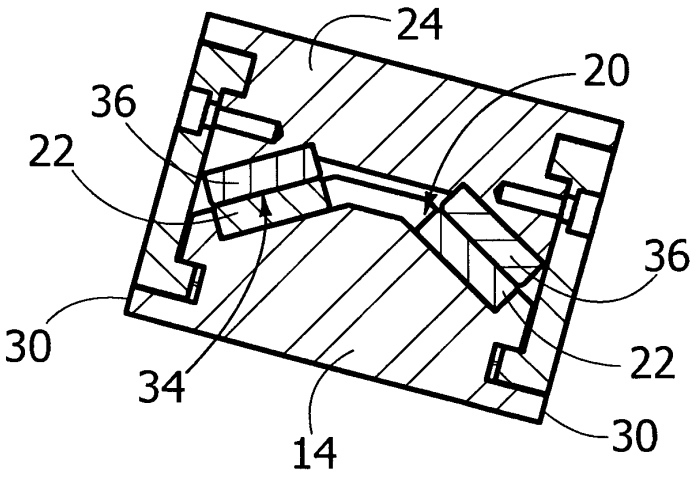

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FIG. 6


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REFERENCES CITED IN THE DESCRIPTION

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