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(54) Clamping device having a hook-shaped clamping member

(57) A hook clamping device for hooking workpieces, particularly sheets, comprises a body (10) having a relatively wide opening (18) from which a hook clamping member extends with a clearance (30), which is movable between a rear position and a forward position in which a workpiece is clamped. A translatable guard member (48) having a narrow opening (52), which is also engaged by the hook clamping member (30), is associated with the body (10) close to a wide opening (18). The guard member (48) and the hook clamping member (30) cooperate with the relatively wide opening (18) in order to keep the gap between the wide opening (18) and the hook clamping member (30) closed. The device comprises movement means (20, 22, 24, 26, 28, 32, 38, 42) including a toggle mechanism, and adapted to move the hook clamping member (30) according to an angular movement in such a manner that, in its position of rest, it is arranged substantially within the body (10).

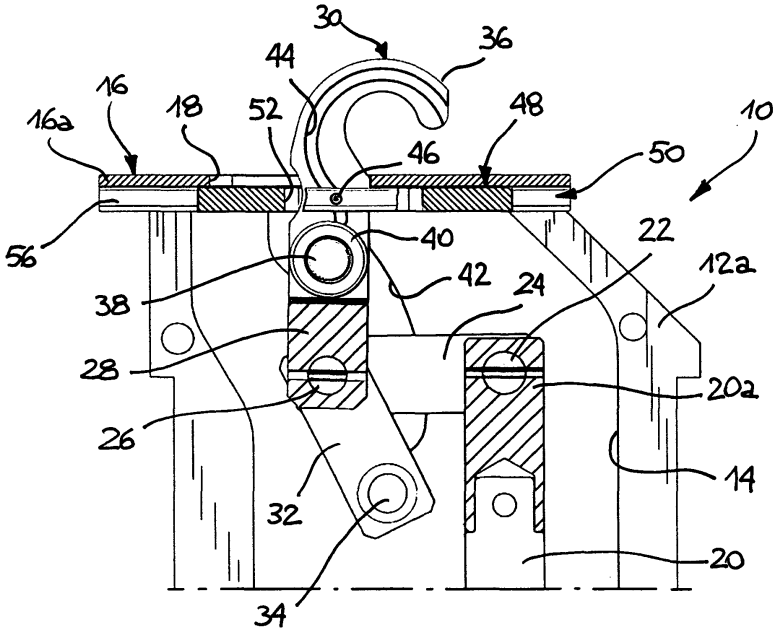

Fig. 2

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Description

[0001] The present invention refers in general to hook clamping devices for hooking workpieces, such as metal sheets, which are intended to engage the edge of a workpiece during a work, for example a side edge thereof or the edge of a hole formed in the workpiece, in order to keep the workpiece in a predetermined position.

[0002] These devices, intended to be used in industrial machining lines, typically during welding or bending operations of workpieces, are usually exposed to environmental conditions in which working slags and powder are present, that could penetrate within their body, with the risk of endangering their operation.

[0003] EP-1 393 861 describes a hook clamping device comprising a hook clamping member movable between a back and raised position of rest, and a forward and lowered position for clamping a workpiece, which projects from the device through a relatively wide opening. The movement of the hook clamping member is controlled by a four-bar linkage, so that it translates remaining parallel to itself. The linkage includes a toggle mechanism in order to make irreversible the locking position of the hook clamping member, so that a force applied to the workpiece, when it is clamped by the hook clamping member, cannot cause an accidental movement of the hook clamping member from such a position. A movable member for closing the aforesaid opening is associated with the hook clamping member. The movable member is biased by resilient means and has a sealing lip which remains into contact with a side of the hook clamping member in order to close a gap between the wide opening and the hook clamping member during the movement of the latter, so that penetration of foreign bodies within the body of the device through such a gap is avoided.

[0004] The hook clamping member of this known device always projects in a considerable manner outside of the body, in all the positions thereof. Moreover, both the mechanism which controls the movement of the hook clamping member and the system for closing the wide opening of the body, are relatively complex and therefore expensive to be manufactured and potentially not much reliable in operation.

[0005] More particularly, the invention relates to a hook clamping member of the type defined in the preamble of appended claim 1.

[0006] EP-1 683 606 discloses such a device which comprises a hook clamping member movable between a rear and raised position of rest and a forward and lowered clamping position of a workpiece, which hook clamping member projects from the body through a relatively wide opening. A fluid controlled actuator provided with a slidable rod for controlling the movement of the hook clamping member between two end positions, is associated with the body of the device. A mechanism of articulation, interposed between the hook clamping member and the rod of the actuator, includes a transverse guide pin fixed to the body and engaging a shaped slit formed in the lower portion of the hook clamping member, which lower portion is furthermore articulated to the upper end of the rod. A slidable guard member, mounted above the wide opening of the body, has a narrow opening crossed by the hook clamping member for closing the gap between the wide opening and the hook clamping member, in order to prevent foreign bodies, which could hinder the movement of the hook clamping member, to enter into the body.

[0007] The device of this document has several disadvantages. In fact, the hook clamping member moves between its two end positions while it remains almost parallel to itself, so that a remarkable portion thereof projects always from the body of the device. As a result, this device is not adapted to be used for applications in which the hook clamping member, in its position of rest, must remain substantially confined within the body of the device. Moreover, the hook clamping member articulation mechanism of this document does not allow to make irreversible its clamping position, so that a high force applied to the workpiece to be clamped could cause an accidental movement of the hook clamping member with respect to its clamping position.

[0008] In view of overcoming the aforesaid drawbacks, the subject of the invention is a device having the features set forth in the appended claims.

[0009] According to the invention, the hook clamping device comprises movement means adapted to move the hook clamping member according to a mainly angular motion in order to allow the hook clamping member to reach, in its position of rest, a configuration in which it is arranged substantially within the body, the movement means including a toggle mechanism adapted to make irreversible the clamping position of the hook clamping member, and the translation of the guard member being guided by guide means which extend between the guard member and the hook clamping member.

[0010] By virtue of such features, the device of the invention turns out to be highly effective in operation and relatively simple and economic to be manufactured. It allows a wide movement, particularly an angular movement, of the hook clamping member to obtained, thanks to which the hook clamping member can reach a position of rest in which it is almost entirely confined in the body of the device, in order to avoid the most possible any presence of elements projecting from the device, which might hinder the movement of a workpiece to be clamped, when the hook clamping member is in its position of rest.

[0011] According to a preferred feature of the invention, the hook clamping member has a pair of symmetrical loop-shaped grooves, formed on its side opposite surfaces, both such grooves being engaged by respective coaxial pins projecting from the guard member.

[0012] By virtue of such a feature, the device of the invention allow the movement of the hook clamping member and of the guard member to be guided effectively in a simultaneous manner.

[0013] Further characteristics and advantages of the

invention will be made clearer by the following detailed description, provided as a non-limitative example and referred to the appended drawings, in which:

figure 1 is a perspective view of a device according to the invention, in which the hook clamping member is in its forward position for clamping a workpiece,
figure 2 is a sectioned side elevational view of the device of figure 1,
figure 3 is a view similar to figure 1, from which a head plate of the device has been removed,
figure 4 is an enlarged view of a detail indicated by arrow IV in figure 3, lacking of the head plate and of the guard member,
figures 5 and 6 are views similar to figure 2 showing different steps of the movement of the hook clamping member, respectively, of which figure 6 shows such a member in its position of rest,
figure 7 is a view similar to figure 3, lacking of the head plate of the device, the hook clamping member being in its position of rest,
figure 8 is a view similar to figure 1 corresponding to the position of rest of the hook clamping member shown in figure 6, and
figure 9 is a top elevational view from arrow IX of figure 8.

[0014] With reference to the figures, the body of a hook clamping device which can be used for clamping workpieces, typically sheet, in a predetermined position during working operations, is indicated 10. In particular, workpieces are clamped at their perimetral edge or at the edge of a hole formed in the workpiece, in which case the device is usually provided above with an elongated centring member (not shown in the figures as being of a type known per se) intended to be inserted in the aforesaid hole.

[0015] The body 10 usually comprises a pair of half-shells 12a and 12b coupled to each other, which delimitate the inner cavity 14 of the body 10. A rectangular head plate 16 is fixed above the half-shells 12a and 12b, which is intended to allow support of a workpiece to be clamped (not shown). The plate 16 has a relatively wide through opening 18, the shape of which is usually rectangular and elongated in the direction parallel to the side faces of the half-shells 12a and 12b. When the device is provided with the aforesaid elongated centring member intended to be inserted in a hole of a workpiece to be clamped, it is fastened, for example by screws, on the upper surface of the plate 16.

[0016] A fluid controlled actuator, typically a pneumatic actuator, is connected to the body 10 above the half-shells 12a and 12b, which actuator comprises an axially slidable rod 20 extending within the cavity 14. The free end 20a of the rod 20, upper with reference to the figures, is articulated by a transverse pin 22 to an end of a connecting rod 24, or of a pair of parallel connecting rods, the other end of which is articulated to the lower connection portion 28 of a hook clamping member 30, by another pin 26 parallel to the pin 22.

[0017] The pin 26 crosses also the free end of a crank 32, or of a pair of parallel cranks, the opposite end of which is rotatably mounted at 34 with respect to the half-shells 12a and 12b, in order to allow articulation of the portion 28 of the member 30 with respect to such a crank.

[0018] The hook clamping member 30 has a loop portion 36, at its side opposite to the portion 28, intended to allow a workpiece supported on the upper surface of plate 16 to be clamped. The loop portion 36 slidably engages with a longitudinal clearance the wide opening 18 of the plate 16, in order that it can project beyond the upper surface of such a plate in the clamping configuration of a workpiece.

[0019] A transverse pin 38 is inserted at an intermediate portion of the member 30, in such a manner that the ends thereof project from opposite sides from the member 30. These ends, preferably provided with respective rotary bearings 40, slidably engage a pair of symmetrical arched grooves 42 formed in the body 10 on the inner surface of the half-shells 12a and 12b.

[0020] The hook clamping member 30 undergoes a mostly angular movement between a pair of opposite positions, that is a rear and lowered position of rest (figures 6 to 9), in which it is substantially arranged entirely within the body 10, and a forward and raised position for clamping a workpiece (figures 1 to 4), in which its loop portion 36 projects outwardly, as a result of the axial sliding of the rod 20 and by virtue of the movement mechanism consisting of the connecting rod, or the connecting rods, 24 and of the crank, or the cranks, 32, as well as by virtue of the engagement of the ends of the pin 38 in the grooves 42.

[0021] A pair of symmetrical grooves 44 are formed on the opposite side surfaces of the loop portion 36 of the hook clamping member 30, each of which has a loop shaped profile generally corresponding to that of the portion 36. Respective portions of a pair of pins 46 are engaged in the grooves 44, such pins being inserted in respective coaxial holes formed at the opposite sides of a flat guard plate 48 slidably mounted in a longitudinal rectilinear seat 50 of the plate 16, which seat 50 is formed in a position adjacent to and facing the cavity 14 of the body 10. In particular, the portions of the pins 46 inserted in the grooves 44 project transversely and from opposite sides with respect to a rectangular through opening 52 of the guard plate 48, the extension of this opening in the longitudinal direction being smaller than that of the opening 18, and in which the loop portion 36 of the member 30 is inserted with a clearance. In practice, the pins 46, which extend between the guard member 48 and the hook clamping member 30, have the function of guide means for guiding translation of the plate 40 in the longitudinal seat 50.

[0022] Conveniently, the plate 48 has a pair of opposite side ribs 54 slidably engaging respective corresponding grooves 56 formed on the sides of the longitudinal seat

50, in order to promote longitudinal sliding of the slab 48 in the seat 50, and for keeping the plate 48 slightly spaced both from the above portion of the plate 16 and with respect to the half-shells 12a and 12b.

[0023] In the case in which translation of the plate 48 is so extended that a portion thereof, in the rearward position of the member 30, projects beyond the rear wall of the body 10, from the side opposite to the rod 20, the head plate 16 may have an appendage 16a extending beyond the rear wall of the body 10, in order to protect the guard member 48.

[0024] Moreover, both the openings 18 and 52 can have circular undercuttings 18a and 52a at their corners.

[0025] In operation of the device 10, the member 30 can assume a clamping position, as shown in figures 1 to 4, for clamping a workpiece interposed between the forward end of the portion 36 of the member 30 and the plate 16. In this position, the loop portion 36 is arranged mainly above the plate 16.

[0026] As a result of the down movement of the rod 20 (with reference to the figures), the pin 22 drags down the connecting rod 24 causing the crank 32 to rotate and the member 30 to oscillate angularly by means of the pin 26, as well as the end of the pin 38 to slide, together with the relevant bearings 40, in the arched grooves 42. In this manner, the loop portion 36 re-enters within the body 10, passing from the configuration shown in figure 5, until it reaches the configuration shown in figures 6 to 9, in which the portion 36 is practically all arranged within the body 10, so that it does not hinder the movement of a workpiece to be clamped above the plate 16.

[0027] During the movement of the member 30 between its forward clamping position of a workpiece and its back position of rest, and viceversa, sliding of the plate 48, in particular of its narrow opening 52 with respect to the wide opening 18 of the plate 16, allows the opening 18 to be kept substantially close, so that entering of foreign bodies in the cavity 14 of the body 10 is effectively avoided.

Claims

1. Hook clamping device for clamping workpieces, particularly sheets, comprising a body (10) having a relatively wide opening (18) across which a hook clamping member (30) extends with a clearance, said clamping member being movable between a back position of rest and a forward clamping position in which the hook clamping member (30) projects out of the body (10) for clamping a workpiece, a translatable guard member (48) being associated with the body (10) close to said wide opening (18), which guard member has a narrow opening (52) that is also engaged by the hook clamping member (30), the guard member (48) and the hook clamping member (30) cooperating with said wide opening (18) in preventing foreign bodies from entering within the body (10) through the clearance between the wide opening (18) and the hook clamping member (30), **characterized in that** it comprises movement means (20, 22, 24, 26, 28, 32, 38, 42) adapted to move the hook clamping member (30) according to a mainly angular motion in order to allow the hook clamping member (30) to reach, in its position of rest, a configuration in which it is arranged substantially within the body (30), the movement means including a toggle mechanism (20, 22, 24, 26, 28) adapted to make irreversible the clamping position of the hook clamping member (30), and **in that** translation of the guard member (48) is guided by guide means (46) extending between the guard member (48) and the hook clamping member (30).

2. Device according to claim 1, **characterized in that** the guard member (48) is a flat plate slidably mounted within a rectilinear seat (50) of the body (10).

3. Device according to claim 2, **characterized in that** the guard member (48) has at least a side guide rib (54) engaging a corresponding groove (56) formed sideways on said rectilinear seat (50).

4. Device according to claim 2 or 3, **characterized in that** said rectilinear seat (50) is formed in a head plate (16) of the body (10), in a position facing a cavity (14) of the body (10), and **in that** also said wide opening (18) is formed in the head plate (16).

5. Device according to any one of claims 1 to 4, **characterized in that** said guide means comprise at least a pin (46) extending from the guard member (48) and engaging a shaped groove (44) of the hook clamping member (30).

6. Device according to claim 5, **characterized in that** the hook clamping member (30) is generally loop-shaped, and **in that** the profile of said at least one shaped groove (44) of the hook clamping member (30) corresponds generally to the shape of the hook clamping member (30).

7. Device according to claim 6, **characterized in that** the hook clamping member (30) has a pair of loop-profiled symmetrical grooves (44) formed on the opposite side surfaces thereof, both such grooves (44) being engaged by respective coaxial pins (46) projecting from the guard member (48).

8. Device according to any one of claims 1 to 7, **characterized in that** the hook clamping member (30) has, at an end thereof, a loop-shaped hook clamping formation (36) and, at the opposite end, a connection portion (28) articulated both to a crank (32) rotatably mounted about a pin of rotation (34) fixed to the body (10), and to a first end of at least one connecting rod

(24) the second end of which is articulated to a slidable rod (20) of a fluid actuator associated with the body (10).

9. Device according to claim 8, **characterized in that** the hook clamping member (30) is articulated about a transverse pin (38) between the loop-shaped hook clamping formation (36) and the connection portion (28), the opposite ends of said pin engaging symmetrical arched grooves (42) formed in the sides (12a, 12b) of the body (10).

10. Device according to claim 9, **characterized in that** the opposite ends of said transverse pin (38) are provided with rolling bearings (40), and **in that** such bearings (40) engage said arched grooves (42).

11. Device according to any one of claims 1 to 10, **characterized in that** such head plate (16) extends beyond a back wall of the body (10) in order to shield the guard member (48) when, as a result of a translation thereof, it extends beyond said back wall of the body (10).

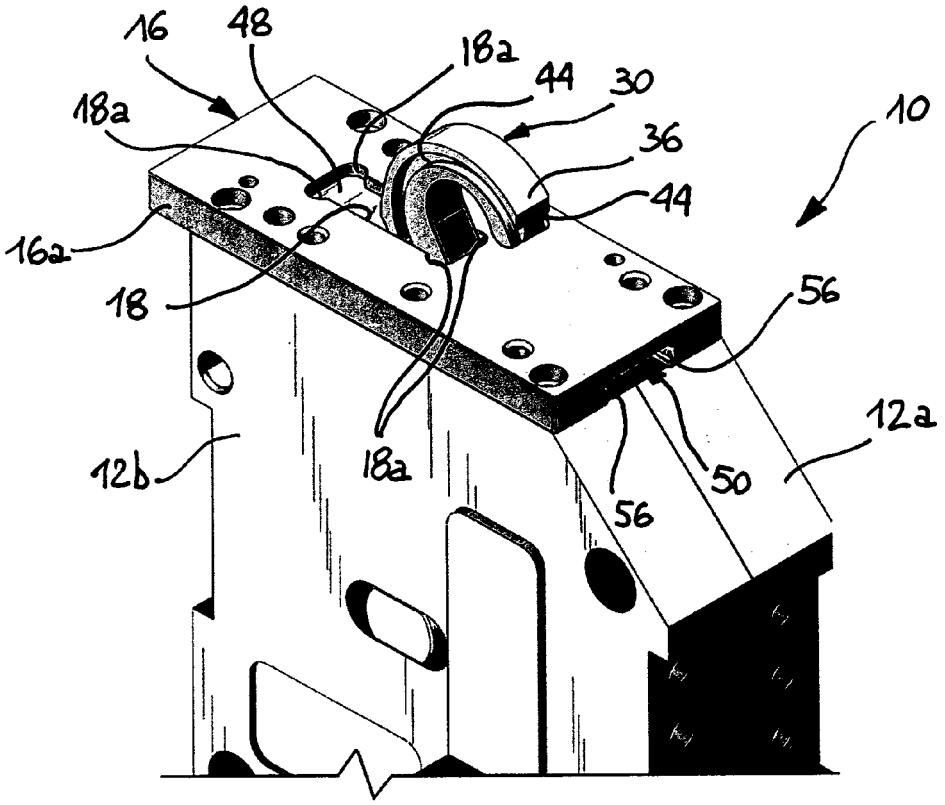
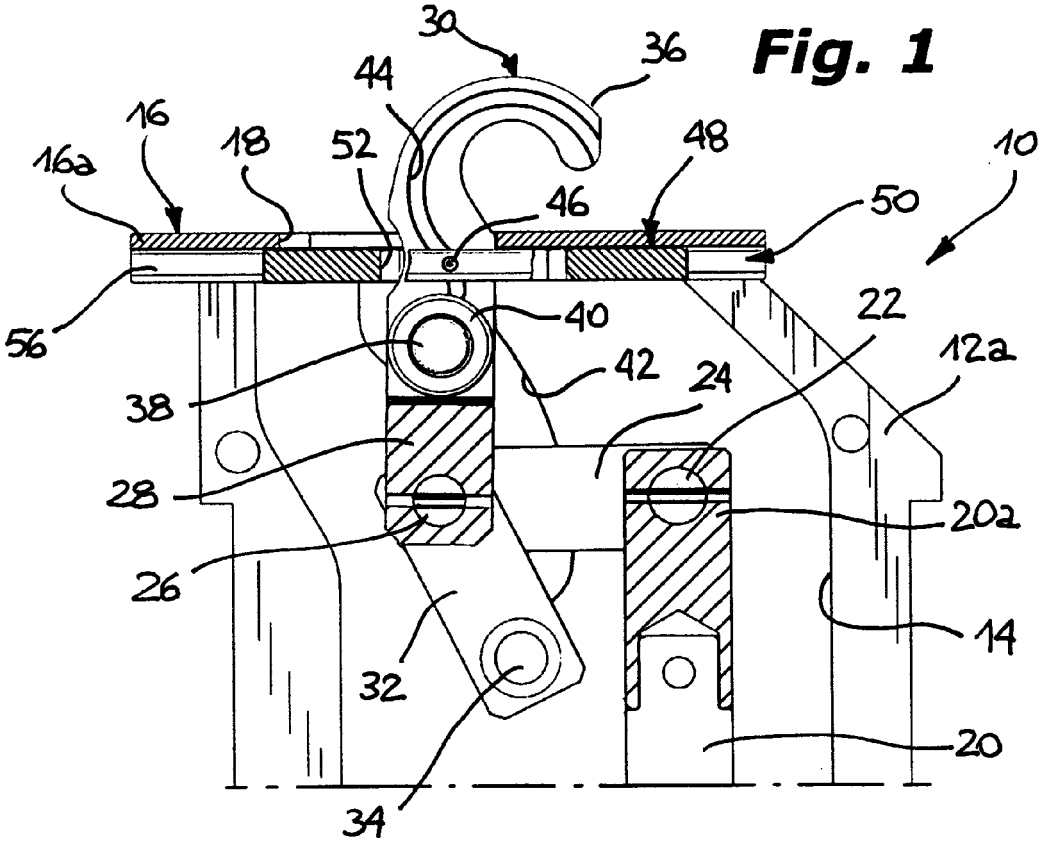

16
48
18a
18a
44
30
36
10
44
16a
18
56
12a
12b
18a
50
56

Fig. 1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52
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16a
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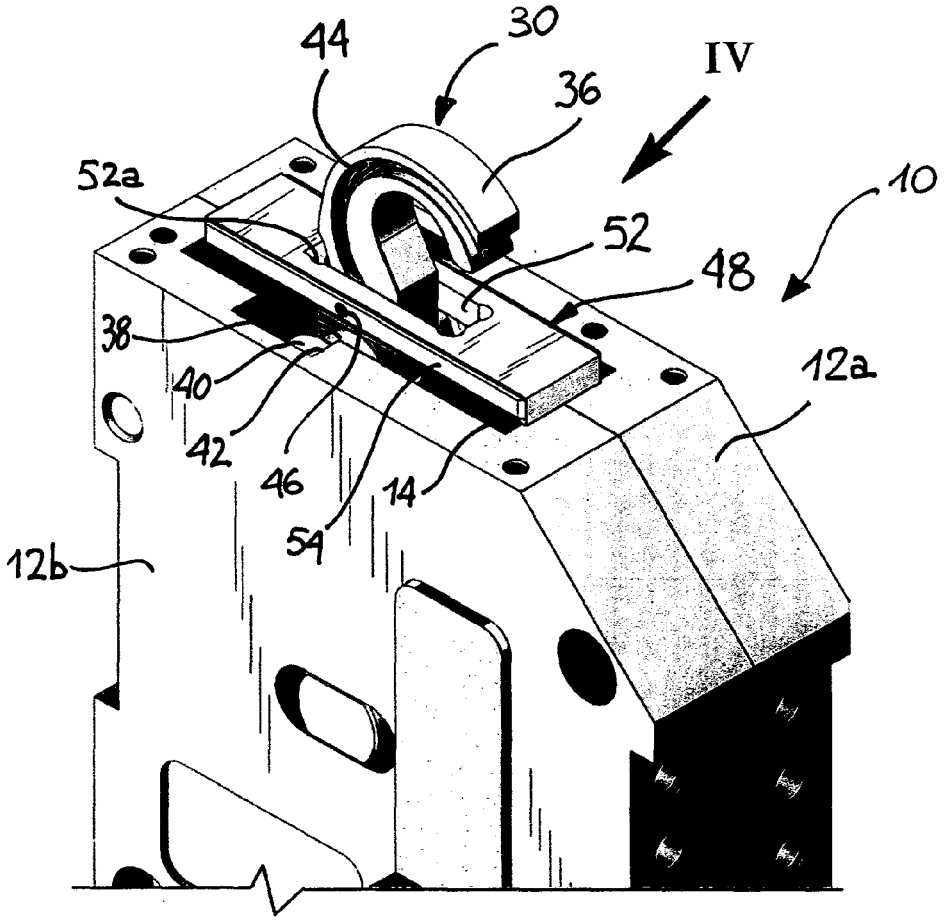
12a
28
20a
26
14
32
20
34

Fig. 2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52a
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52
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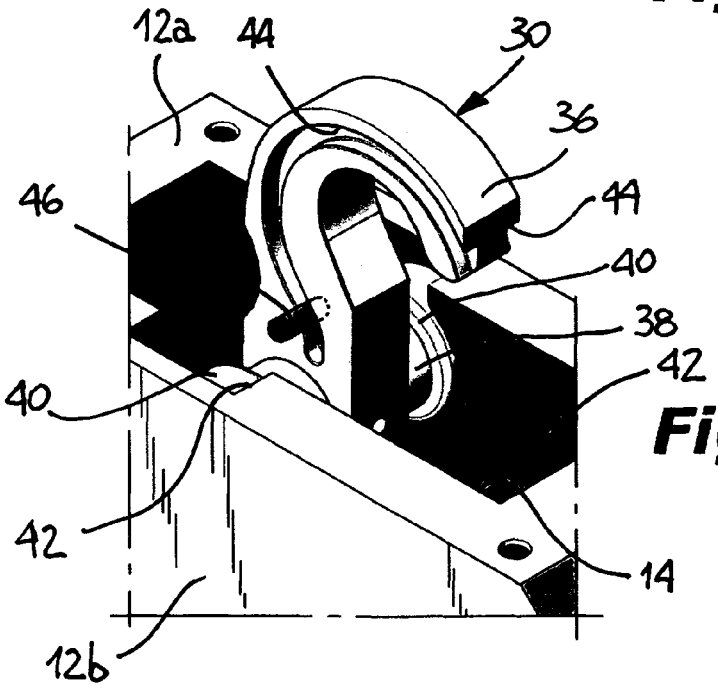
38
12a
40
42
46
14
54
12b

Fig. 3


12a
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30
36
46
44
40
38
42
40
42
14
12b

Fig. 4

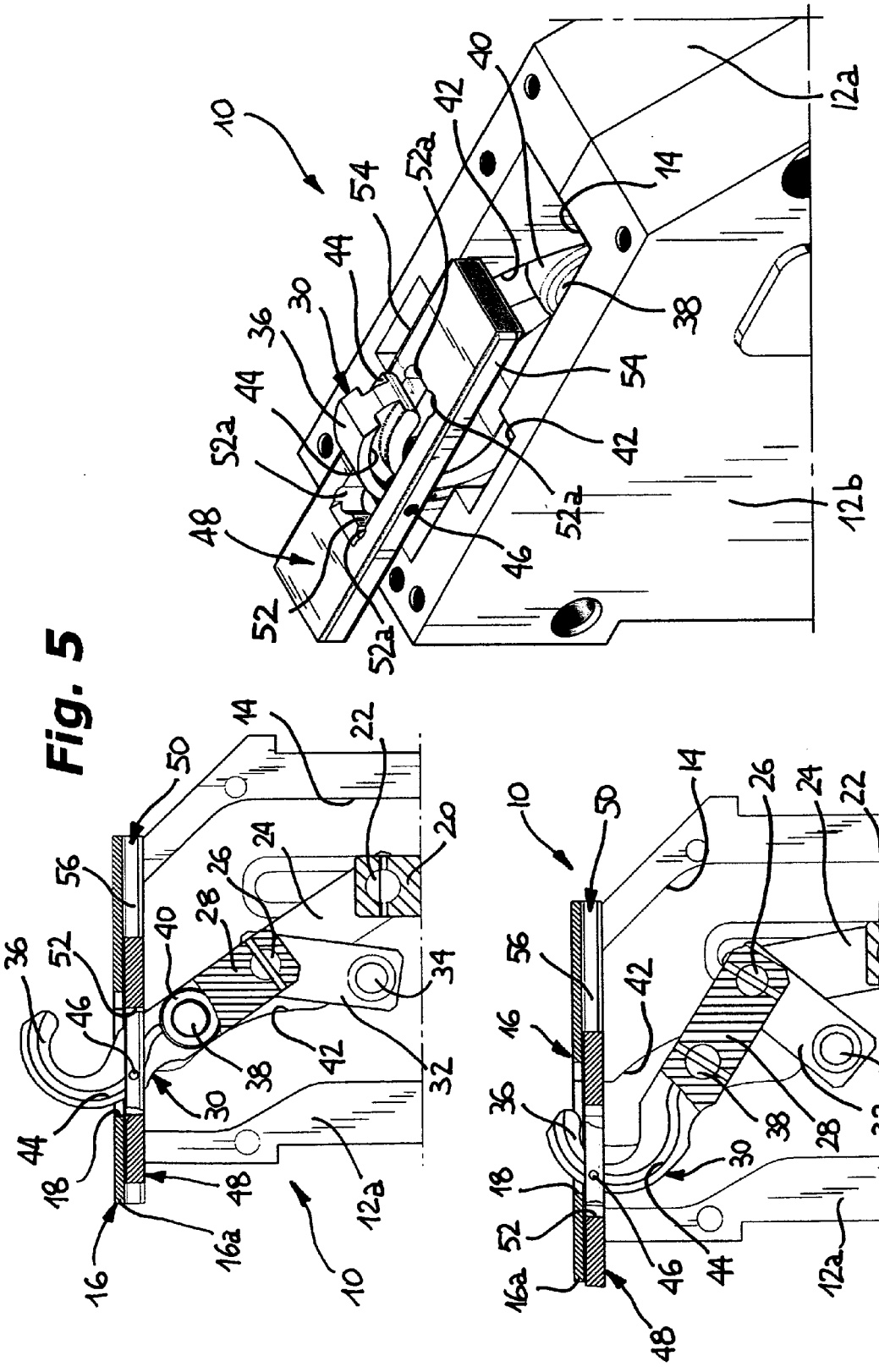

Fig. 5

Fig. 6

Fig. 7

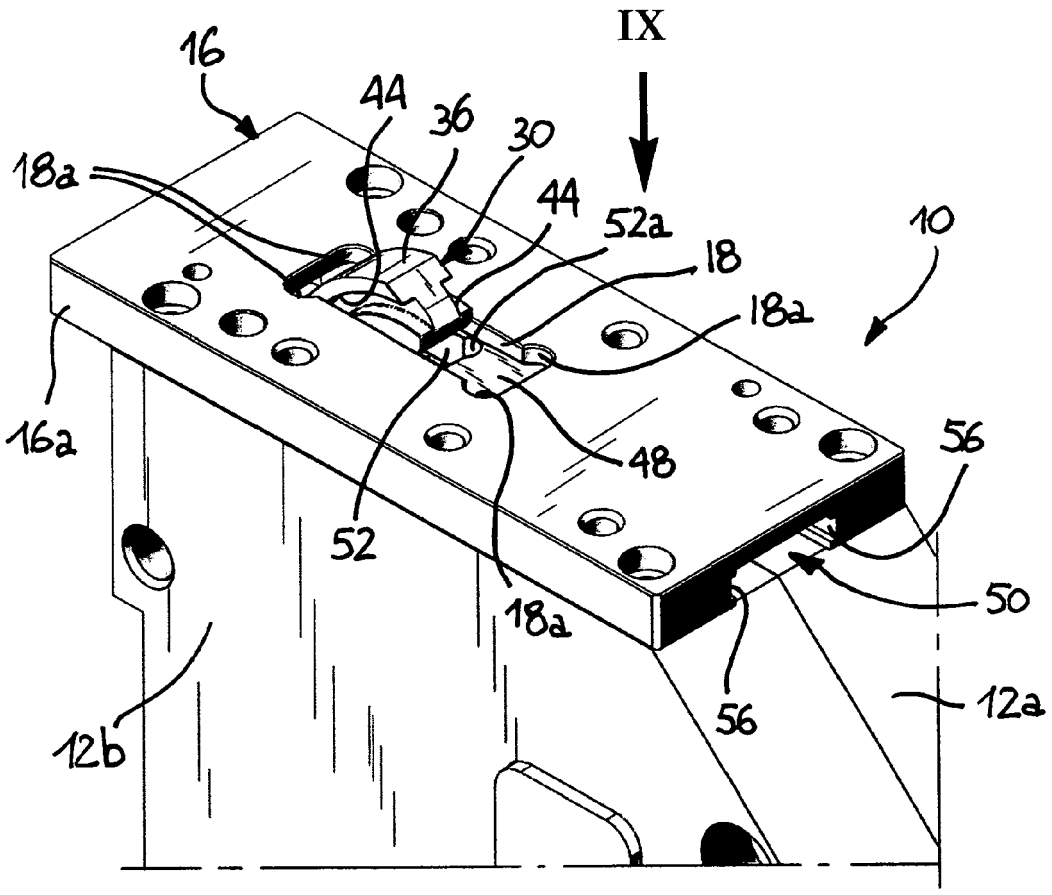
IX
16
44
36
30
18a
44
52a
18
10
18a
16a
48
56
52
18a
50
56
12a
12b

Fig. 8

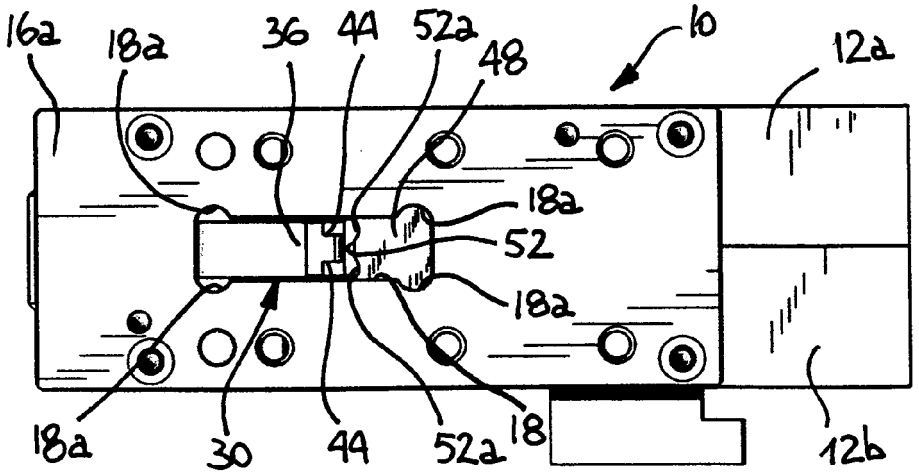
16a
18a
36
44
52a
48
10
12a
18a
52
18a
18a
30
44
52a
18
12b

Fig. 9

REFERENCES CITED IN THE DESCRIPTION

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