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(54) ARRANGEMENT FOR AN ELECTRIC SWITCHING DEVICE

(57) The invention relates to an arrangement (1) for an electric switching device, in particular a relay. Such switching devices are known from the prior art and usually have at least one switching unit (3) which is movable from a first switching position (100) into a second switching position (200). Moreover, they often have a restoring element (6) which, at least in the second switching position (200), exerts a restoring force (60) directed towards the first switching position (100) and acting on the switching unit (3). Such a restoring element (6) can be, for example, a restoring spring. The restoring element (6) attempts to move the switching unit (3) into the first switching position (100). This movement is normally stopped by a stop. However, a loud noise is generated by the impact on the hard stop so that such switching devices have hitherto not been used in environments in which such noises can disturb or distract a user such as, for example, in vehicle interiors. The object of the present invention is to provide a solution in which quieter switching of the arrangement (1) is possible. According to the invention, this is achieved in that the arrangement (1) comprises a return spring (7) which exerts a counterforce (70) acting on the switching unit (3), wherein counterforce (70) and restoring force (60) cancel each other out in the first switching position (100) and wherein the fastening location (8) of the return spring (7) is movable with the switching unit (3).

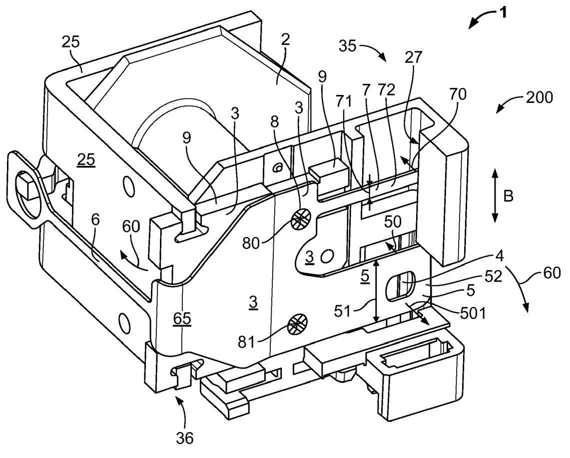

Fig. 1

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Description

[0001] The invention relates to an arrangement for an electric switching device, in particular a relay.

[0002] Such switching devices are known from the prior art and usually have at least one switching unit which is movable from a first switching position into a second switching position. Moreover, they often have a restoring element which, at least in the second switching position, exerts a restoring force directed towards the first switching position and acting on the switching unit. Such a restoring element can be, for example, a restoring spring. The restoring element attempts to move the switching unit into the first switching position. This movement is normally stopped by a stop. However, a loud noise is generated by the impact on the hard stop so that such switching devices have hitherto not been used in environments in which such noises can disturb or distract a user such as, for example, in vehicle interiors.

[0003] The object of the present invention is to provide a solution in which quieter switching of the arrangement is possible.

[0004] According to the invention, this is achieved in that the arrangement comprises a return spring which exerts a counterforce acting on the switching unit, wherein counterforce and restoring force cancel each other out in the first switching position and wherein the fastening location of the return spring is movable with the switching unit.

[0005] The switching unit is braked gently by the return spring so that a switching noise is avoided or at least kept to a minimum.

[0006] The solution according to the invention can be further improved with the following configurations and further developments which are in each case advantageous per se and can be combined as desired with one another.

[0007] At least one of the switching positions can be an open switching position, that is to say, a switching position in which, for example, a connected load circuit is opened. In particular, the first switching position can be an open switching position. One of the switching positions can be a closed switching position, that is to say, a switching position in which, for example, a connected load circuit is closed. In particular, the second switching position can be a closed switching position. More than one, for example, two, in particular all switching positions can be closed switching positions. In the case of such a configuration, for example, various load circuits can be closed with a single switching position.

[0008] In one advantageous configuration, the return spring is fastened to the switching unit. This enables a simple and compact structure.

[0009] In a further advantageous configuration, the switching unit comprises an armature and/or a contact spring. An armature can be an element on which a switching force bears. For example, an armature can be a magnetic element which is attracted by an electromagnet if a current is applied to it. A contact spring can serve to apply an adequate contact force even in the case of small deviations in terms of dimensions which arise for production reasons, for example, in order to securely close a load circuit and/or fix the position of the switching unit in a defined region.

[0010] The return spring can project on the same side as the contact spring. The return spring can be supported on the same side as the contact spring. This allows a simple and compact structure with a good distribution of forces.

[0011] The return spring can be arranged on the contact spring. It can be linked to the contact spring in an I-, C-, U-, L-shape or in a meandering manner. Such a configuration has the advantage that the return spring, in the first switching state, for example, during switching off or disengagement, damps the contact springs and suppresses high-frequency whirring noises of the contact spring. As a result of the integration of the return spring with the contact spring, the return spring thus gains an additional function in the form of a damping element for the contact spring. This is particularly successful if the link is located close to the contact.

[0012] The switching unit can be provided with a folding mechanism. Such a folding mechanism can comprise a bearing or a joint on one side. The at least two switching positions can be reached by tipping or folding.

[0013] The contact spring and/or the return spring and/or the restoring element can be configured in each case as a leaf spring. Such a configuration is compact and easy to produce.

[0014] The contact spring and/or the return spring and/or the restoring element can in each case be in pairs or all three in one piece with one another. The contact spring and/or the return spring and/or the restoring element can be part of a spring element. Such a structure is particularly compact and simple. In particular, several functions can be bundled in a single element. Any desired combinations are possible here. All three elements, i.e. contact spring and return spring and restoring element, are advantageously part of a single spring element. A spring element can be formed, for example, by punching, stamping and/or bending from a metal sheet. The contact spring and/or return spring and/or the restoring element can be shaped as leaf springs.

[0015] In particular, the restoring element can be configured with a spring bulge or a spring coil in order to allow a simple structure with an effective restoring mechanism. In one particularly simple and space-saving structure which enables good transmission of forces, the contact spring and the return spring have parallel limbs.

[0016] In order to enable reliable contacting, the return spring can have a lower spring constant than the contact spring. For example, in particular in the case of a configuration as a leaf spring, it can have a smaller width or thickness or have a longer limb and thus a longer lever arm. It can also be embodied to be L-shaped, S-shaped or to have a meandering form in order to increase the length of the resilient action. It can be manufactured from a different material or be made more flexible by specific processing steps.

[0017] The return spring and contact spring can extend in a common plane in order to enable a particularly compact and easy-to-produce configuration.

[0018] The return spring can also project, as a result of additional bends, out of a plane in which the contact spring lies, for example, as a result of a Z-shaped offset. In particular, parts of the return spring can lie parallel with the plane in order to enable a simple structure.

[0019] The electric switching device can be a relay. A relay can comprise in particular an electromagnet, for example, in the form of a coil. The electromagnet can be configured to activate the switching unit, for example, to move it into the first or second switching state if current is applied to it. In the case of the absence of current in the electromagnet, the switching unit can be pulled automatically into the other switching state, in particular by the restoring element. The arrangement can comprise a load circuit which controls the switching unit. The arrangement can further comprise a load circuit which is switched by the switching unit, for example, opened and closed or moved into different switching states.

[0020] In the first switching state, the arrangement can be stop-free. The switching unit therefore does not abut against a stop, rather is held in resilient equilibrium. The occurrence of a noise can be prevented or minimised as a result during movement into the first switching state. A balance of forces between counterforce and restoring force therefore prevails. Moreover, no external forces such as switching forces, in particular magnetic forces, can be present in a first switching state.

[0021] In the second switching state too, the arrangement can be stop-free so that generation of noise is also reduced during movement into the second switching state. Since, however, a defined contact with high contact forces can be desirable in the switching state, for example, if a load circuit is intended to be securely closed, there can be present a damping element which does not completely absorb the movement, but at least brakes it so that the arising noise is not as loud. In the second switching state, in particular external forces such as switching forces, especially magnetic forces of an electromagnet, can act on the switching device in order to retain it in the second switching position counter to the action of the restoring element.

[0022] The return spring can be pretensioned in order to avoid a development of noise during the movement of the switching unit. In particular, at least in the second switching unit, it can already abut against a supporting surface or a stop and generate at least a small counterforce. As a result, a noise which would occur if the return spring only struck the supporting surface in the course of deflection is prevented.

[0023] The return spring and/or the contact spring and/or the restoring element can have in each case a linear resilient characteristic, at least in the deflection region which is relevant during the movement of the switching unit. In order, for example, to avoid damage and/or in order to keep the deflection of the switching unit small, a progressive resilient characteristic or a different resilient characteristic (declining, graduated, or the like) can also be present.

[0024] A contact spring can comprise a contact element in order to produce a defined contact location.

[0025] The invention is explained below by way of example and in greater detail on the basis of advantageous configurations with reference to the drawings. The shown advantageous configurations may be independent and able to be freely combined with each other.

[0026] In the drawings:

Fig. 1	shows a schematic perspective view of an arrangement according to the invention;
Fig. 2	shows a schematic perspective view of the arrangement from Fig. 1 in a different view;
Fig. 3A, 3B	show travel-force characteristic curves of the arrangement from Figs. 1 and 2;
Fig. 3C	shows travel-force characteristic curves of the arrangement from Figs. 1 and 2 in comparison with travel-force characteristic curves of arrangements from the prior art and corresponding energies;
Fig. 3D	shows characteristic curves of spring elements and magnet drive systems according to the invention;
Fig. 3E	shows characteristic curves of spring elements and magnet drive systems from the prior art;
Fig. 4	shows a schematic perspective view of a further embodiment of a spring element;
Fig. 5	shows a schematic perspective view of a further embodiment of a spring element;
Fig. 6	shows a further schematic perspective view of the embodiment of a spring element from Fig. 4;
Fig. 7	shows a schematic perspective view of a further embodiment of a spring element;
Fig. 8	shows a schematic perspective view of a further embodiment of a spring element;
Fig. 9	shows a schematic perspective view of a further embodiment of a spring element

together with an armature;

Fig. 10 shows a schematic perspective view of a further embodiment of a spring element;

Fig. 11 shows a schematic perspective view of a further embodiment of a spring element;

Fig. 12 shows a schematic perspective view of a further embodiment of a spring element;

Fig. 13 shows a schematic perspective view of a further embodiment of a spring element;

Fig. 14 is a graph which shows the further noise reduction by the embodiments of Figures 10 to 13.

[0027] An arrangement 1 for an electric switching device is shown in Figs. 1 and 2. This can involve in particular a relay. In the illustration in Figs. 1 and 2, some elements are not represented in order to enable a view of the elements relevant to the invention. In particular, for example, only one coil body 2 of a coil, which acts as an electromagnet, is represented. The windings which generate the magnetic field are not represented.

[0028] Arrangement 1 serves to control a load circuit with the aid of a control circuit. The control circuit comprises among other things the coil. When current is applied, it generates a magnetic field which in turn attracts a switching unit 3 and as a result moves it into second switching position 200 represented in Figs. 1 and 2. In second switching position 200, a contact element, not represented, which is fitted in a receiving opening 4 is in contact with an element, also not represented, of a load circuit. A projecting contact spring 5 pushes on the contact element so that it abuts with a sufficiently high force and at a defined position.

[0029] A restoring element 6 exerts a restoring force 60 on switching unit 3. Restoring force 60 attempts to cause switching device 3 to move into a first switching position 100 not represented in Figures 1 and 2.

[0030] Arrangement 1 further has a return spring 7 which exerts a counterforce 70 acting on switching unit 3. If the magnetic force generated by the coil drops by switching off the current, restoring element 6 attempts to push switching unit 3 out of second switching position 200 into first switching position 100. In order to avoid the switching unit generating a noise if it strikes a hard stop at the end of the movement, return spring 7 generates a counterforce 70 which changes with a deflection of switching unit 3 and which counteracts restoring force 60. As a result, the movement of switching unit 3 is braked. In first switching position 100, restoring force 60 and counterforce 70 balance each other out so that a balance of forces prevails and switching unit 3 is held in this balance of forces in a stop-free manner.

[0031] A fastening location 8 of return spring 7 is movable with switching unit 3. Return spring 7 is fastened to switching unit 3. It is retained and fastened via a rivet 80.

[0032] Switching unit 3 comprises contact spring 5 and an armature 9. In the case of an activated coil, armature 9 is attracted by it and as a result closes a magnetic circuit which comprises coil core 20, a yoke 25 and armature 9.

[0033] Return spring 7, contact spring 5 and restoring element 6 are part of a spring element 10. Spring element 10 was manufactured from a metal sheet. For this purpose, the metal sheet was punched and bent. Spring element 10 is fastened to armature 9 via rivet 80 and a further rivet 81. Armature 9 is fastened foldably to yoke 25. Armature 9 and thus switching unit 3 can be moved from first switching position 100 into second switching position 200 by folding.

[0034] Restoring element 6 comprises a spring coil 65 or a spring bulge which, in the fitted state, is spaced apart from armature 9.

[0035] Return spring 7 has a lower spring constant than contact spring 5. This is achieved in the present case in that return spring 7 has a smaller width 71 measured in a width direction B than width 51 of contact spring 5 measured in width direction B. The lever length, that is to say, the spacing between rivet 80 or 81 and a contact location, on which return spring 7 or contact spring 5 is supported, is in each case approximately equal. In another embodiment, a lower spring constant could also be achieved by a longer lever arm, that is to say that in the case of the contact spring the lever arm is shorter than in the case of return spring 7. In order to increase the resilient length, return spring 7 can also be embodied to be L-shaped or in a meandering fashion, see Figures 4 and 5. The thickness of the springs could also be different. Moreover, the springs could be processed differently, for example, made softer or hardened.

[0036] Return spring 7 and contact spring 5 can extend in a common plane E, see Fig. 6, but the return spring can, as a result of additional bends, also project out of this plane, for example, as a result of a Z-shaped offset, as is represented in Fig. 7.

[0037] Contact spring 5 and return spring 7 comprise limbs 52 or 72. Limbs 52, 72 extend parallel with one another in order to enable a simple structure and to keep the flow of forces simple. For example, occurrences of twisting can be kept low as a result. Contact spring 5 and return spring 7 project at a distal end 35 of the switching unit. Distal end 35 is opposite a proximal end 36 on which armature 9 is fitted in an articulated manner on yoke 25. Return spring 7 and contact spring 5 are supported on the same side. Contact spring 5 is supported on the load circuit via the contact element, not shown. Return spring 7 is supported on a supporting surface 27 or a stop. The arrangement can be kept compact as a result of the support on the same side.

[0038] Return spring 7 is pretensioned. It permanently abuts against supporting surface 27. In particular, in second switching position 200 shown here, it also abuts against supporting surface 27 in order to avoid a noise which would be generated if return spring 7 were only to strike supporting surface 27 during the switching movement. In second switching position 200 shown here, a counterforce 70, even though only a small force, therefore already acts on switching unit 3.

[0039] If switching unit 3 is moved from second switching position 200 in the direction of first switching position 100, counterforce 70 is increased. In this case, restoring force 60 simultaneously decreases with increasing deflection. In first switching position 100, counterforce 70 and restoring force 60 compensate for each other and switching device 3 is in a balance of forces. At the same time, no switching force such as a magnetic force acts in first switching position 100.

[0040] Switching device 3 is therefore gently braced and does not strike a stop hard as in the prior art. Development of noise is therefore avoided.

[0041] In order to achieve a particularly simple configuration, supporting surface 27 is located on coil body 2. Coil body 2 can be, for example, an injection-moulding element. Complex mounting processes are avoided by the attachment of supporting surface 27 to coil body 2. In one alternative configuration, supporting surface 27 could also be arranged on another element, for example, on an external element.

[0042] The travel-force characteristic curves are represented in Figs. 3A and 3B in the case of a deflection of switching unit 3. The individual forces are represented in Fig. 3A, while the resultant total force is represented in Fig. 3B. Restoring force 60 decreases from second switching position 200 towards first switching position 100. In the region of second switching position 200, elastic force 501 of contact spring 5 acting counter to contact force 50 is also added to restoring force 60. Contact spring 5 has a higher spring rigidity than restoring spring 6 so that the travel-force characteristic curve extends at a very high gradient in this region. It ends at the ordinate at the location at which the force generated by the springs is equal to the magnetic force of the coil.

[0043] Counterforce 70 of return spring 7 counteracts restoring force 60 and is therefore negative. It increases in terms of magnitude with increasing deflection from second switching position 200 into first switching position 100. Since restoring force 60 reduces simultaneously in terms of magnitude, the point is reached at some time at which the magnitudes of the forces are identical, but the preceding signs are different. A balance of forces between counterforce 70 and restoring force 60 prevails there. First switching position 100 is located at this location. In contrast to the prior art, however, there is no stop here. The arrangement is therefore stop-free at first switching position 100. Switching unit 3 can be resiliently braced in first switching position 100.

[0044] In Fig. 3C, by way of example, resilient characteristic curve 300 of a spring element 10 according to the invention is compared with typical resilient characteristic curve 301 of a make contact relay according to the prior art. The energies required are represented at the top right as inserts.

[0045] As a result of the stop-free characteristic, spring energy E1 of spring element 10 according to the invention, which can be represented by the surface located under the curve, is reduced in comparison with spring energy E2 from the prior art. As a result, it is possible that characteristic curve 400 of a magnet drive system, which is used together with the arrangement according to the invention, has a lower response force than characteristic curve 401 of a magnet drive system from the prior art. A magnet drive system according to characteristic curve 400 can be constructed, as a result of this smaller response force, to be smaller and in a more material-saving manner, for example, in terms of winding and iron cross-section. In Figs. 3D and 3E, spring forces 300 or 301 are represented in each case in pairs together with possible characteristic curves of associated magnet drive systems, such as, for example, coils.

[0046] Fig. 3D shows that resilient characteristic curve 300 of a spring element 10 according to the invention is better adapted in its profile to typical characteristic curve 400 of the magnet drive system, in contrast to Figure 3E, with resilient characteristic curve 301 and magnet drive system characteristic curve 401 from the prior art. Excess energy E3 between resilient characteristic curve 300 according to the invention and magnet drive system characteristic curve 400 in Figure 3D is lower than excess energy E4 in the case of the prior art according to Figure 3E. As a result, the noise during stopping of armature 9 on core 20 can also be reduced in comparison with the prior art.

[0047] A further embodiment of a spring element 10 is represented in Fig. 4. In comparison with the embodiment from Fig. 1, here the return spring is bent into an S- or L-shape in order to give return spring 7 a softer characteristic and to configure the switching process to be even more gentle. Here, return spring 7 has two curves 76 and straight sections 77 in order to allow simple spring characteristics during the switching movement.

[0048] A further embodiment of a spring element 10 is shown in Fig. 5. Return spring 7 is configured to be meandering so that particularly flexible switching characteristics are possible. Here, the return spring has four curves 76. As in the embodiment of Fig. 4, an end section 78 of return spring 7 extends parallel with contact spring 5 in order to make possible simple and reliable contacting.

[0049] The embodiment of Fig. 4 is represented again in Fig. 6. A plane E is additionally indicated in order to show that return spring 7 and contact spring 5 lie in a plane. Curves 76 and straight sections 77 lie in this plane. In the case of such a configuration, a particularly compact structure is possible.

[0050] In the case of the configuration according to Fig. 7, a part of return spring 7 lies outside plane E. A central section 79, which is connected via two 90° steps 74 to end section 78 and a starting section 75, projects perpendicularly out of plane E. Return spring 7 has an approximately Z-shaped profile. End section 78 is parallel with plane E and parallel with contact spring 5 in order to achieve simple switching. Alternatively to the shown configuration with steps 74, return spring 7 can also extend out of plane E via curves.

[0051] Fig. 8 shows a configuration of spring element 10 in which return spring 7 is arranged on contact spring 5. This allows a compact structure which is easy to manufacture. Return spring 7 is located to the side of contact spring 5. It lies in the same plane as contact spring 5. In another embodiment, return spring 7 can also project out of a plane formed by contact spring 5 or extend obliquely thereto.

[0052] A further advantageous configuration of a spring element 10 together with an advantageously configured armature 9 is represented in Fig. 9. Armature 9 has, in the regions in which contact spring 5 or return spring 7 abut against armature 9, two obliquely extending edges 90. Oblique edges 90 extend here at approximately 45° to extension directions 37 of contact spring 5 and return spring 7. As a result, the switching process can be made even quieter. In particular if armature 9 is moved together with contact spring 5 out of a closed state, as is represented as second switching position 200 in Fig. 1, and in which contact spring 5 is braced as a result of the contact force of armature 9, the oblique configuration prevents contact spring 5 from slapping loudly onto armature 9. Instead, contact spring 5 is rolled off gently and with little noise. The contact point between contact spring 5 and armature moves during this opening along oblique edge 90. The same applies to the connection between armature 9 and return spring 7. In order to enable an even more gentle rolling-off action and thus quieter switching, oblique edges 90 are additionally rounded towards contact spring 5 or towards the return spring.

[0053] The switching noise of a switching unit could be reduced with an arrangement with a return spring 7 by 3 dB (A) in comparison with a switching unit with a straight edge. In order to measure noise, the switching arrangement was plugged in a low-reflection, closed container with noise-absorbent walls and a reflecting base in an automotive plug base which was placed on a surface which is resiliently suspended. The switching unit was energised with 13.5 V and switched on again without a coil suppression. The switching noise was measured with a microphone at a 1 m distance from the switching unit within the container and evaluated via the A filter.

[0054] An embodiment is represented in Fig. 10, in which return spring 7 is arranged on contact spring 5. Return spring 7 is configured in an L-shape and joined approximately centrally to contact spring 5. A first limb of the return spring extends perpendicularly away from contact spring 5 and forms a transition via a 90° curve into a second limb which extends parallel with contact spring 5. Together with contact spring 5, a U- or C-shaped configuration is produced. As a result of the joining of return spring 7 to contact spring 5, vibrations of contact spring 5, which can arise during opening, are effectively damped and the switching noise further reduced as a result.

[0055] A further embodiment is represented in Fig. 11 in which return spring 7 is also arranged on contact spring 5. Joining is carried out here at the end of contact spring 5. In particular, joining is in the vicinity of contact opening 4 which serves to receive a contact element. Damping is particularly effective as a result. As in the case of the embodiment of Fig. 10, a first limb extends perpendicularly away from contact spring 5 and forms a transition via a curve into a second limb which extends parallel with contact spring 5. Overall, return spring 7 and contact spring 5 are together therefore once again C-shaped or U-shaped. In contrast to the embodiment of Fig. 10, however, the free end of return spring 7 projects inwards, that is to say, towards the rest of spring element 10. The length of the spring is increased as a result of the L-shaped configuration, as a result of which the damping properties and spring properties are changed. In particular, such a return spring 7 is more flexible than a short return spring 7.

[0056] A further embodiment is represented in Fig. 12. As already shown in Figures 10 and 11, return spring 7 is again joined via contact spring 5. Joining is carried out here once again at the end of contact spring 5 and in particular in the vicinity of receptacle opening 4 for a contact element. Return spring 7 has a first limb which extends perpendicularly away from contact spring 5 so that an L-shaped configuration is produced overall. Such embodiments can be easier to produce than the embodiments shown in Figures 10 and 11.

[0057] A further embodiment is represented in Fig. 13. Return spring 7 extends here in an S-shape or meandering manner in order to achieve a long spring length. The joining of return spring 7 is carried out again at the end of contact spring 5. A first limb again extends perpendicularly away from contact spring 5 and forms a transition via a curve into a second limb which in turn forms a transition via a curve into a third limb. It then forms a transition via a further curve into a fourth limb which extends parallel with contact spring 5.

[0058] A comparison between an embodiment in which return spring 7 is not arranged on contact spring 5 (left, a) and an embodiment in which return spring 7 is arranged on contact spring 5 (right, b) is represented in Fig. 14. A further reduction in the switching noise by 3.3 dB is achieved by the joining of return spring 7 via contact spring 5.

Reference numerals

[0059]

1	Arrangement
2	Coil body
3	Switching unit
4	Receptacle opening
5	Contact spring
6	Restoring element
7	Return spring

8 Fastening location
9 Armature
10 Spring element
20 Coil core
25 Yoke
27 Supporting surface
35 Distal end
36 Proximal end
37 Extension direction
50 Contact force
51 Width
52 Limb
60 Restoring force
65 Spring coil
70 Counterforce
71 Width
72 Limb
74 Step
75 Starting section
76 Curve
77 Straight section
78 End section
79 Middle section
80 Rivet
81 Rivet
100 First switching position
200 Second switching position
300 Resilient characteristic curve
301 Resilient characteristic curve prior art
400 Characteristic curve Magnet drive system
401 Characteristic curve Magnet drive system prior art
501 Resilient force

B Width direction
E Plane
E1 Energy
E2 Energy prior art
E3 Excess energy
E4 Excess energy prior art

Claims

1. An arrangement (1) for an electric switching device device, in particular a relay, with at least one switching unit (3) which is movable from a first switching position (100) into a second switching position (200), having a restoring element (6) which, at least in the second switching position (200), exerts a restoring force (60) directed towards the first switching position (100) and acting on the switching unit (3), and having a return spring (7) which exerts a counterforce (70) acting on the switching unit (3), wherein counterforce (70) and restoring force (60) cancel each other out in the first switching position (100), and wherein the fastening location (8) of the return spring (7) is movable with the switching unit (3).

2. The arrangement (1) according to Claim 1, wherein the return spring (7) is fastened to the switching unit (3).

3. The arrangement (1) according to Claim 1 or 2, wherein the switching unit (3) comprises an armature (9) and/or a contact spring.

4. The arrangement (1) according to any one of Claims 1 to 3, wherein the return spring (7) projects on the same side as the contact spring (5).

5. The arrangement (1) according to any one of Claims 1 to 4, wherein the contact spring (5) and/or the return spring (7) and/or the restoring element (6) are part of a spring element (10).

6. The arrangement (1) according to any one of Claims 1 to 5, wherein the contact spring (5) and return spring (7) have parallel limbs (52 or 72).

7. The arrangement (1) according to any one of Claims 1 to 6, wherein the return spring (7) has a smaller spring constant than the contact spring (5).

8. The arrangement (1) according to any one of Claims 1 to 7, wherein the arrangement (1) in the first switching position (100) is stop-free.

9. The arrangement (1) according to any one of Claims 1 to 8, wherein the return spring (7) is pretensioned.

10. The arrangement (1) according to any one of Claims 1 to 9, wherein the return spring (7) is arranged on the contact spring (5).

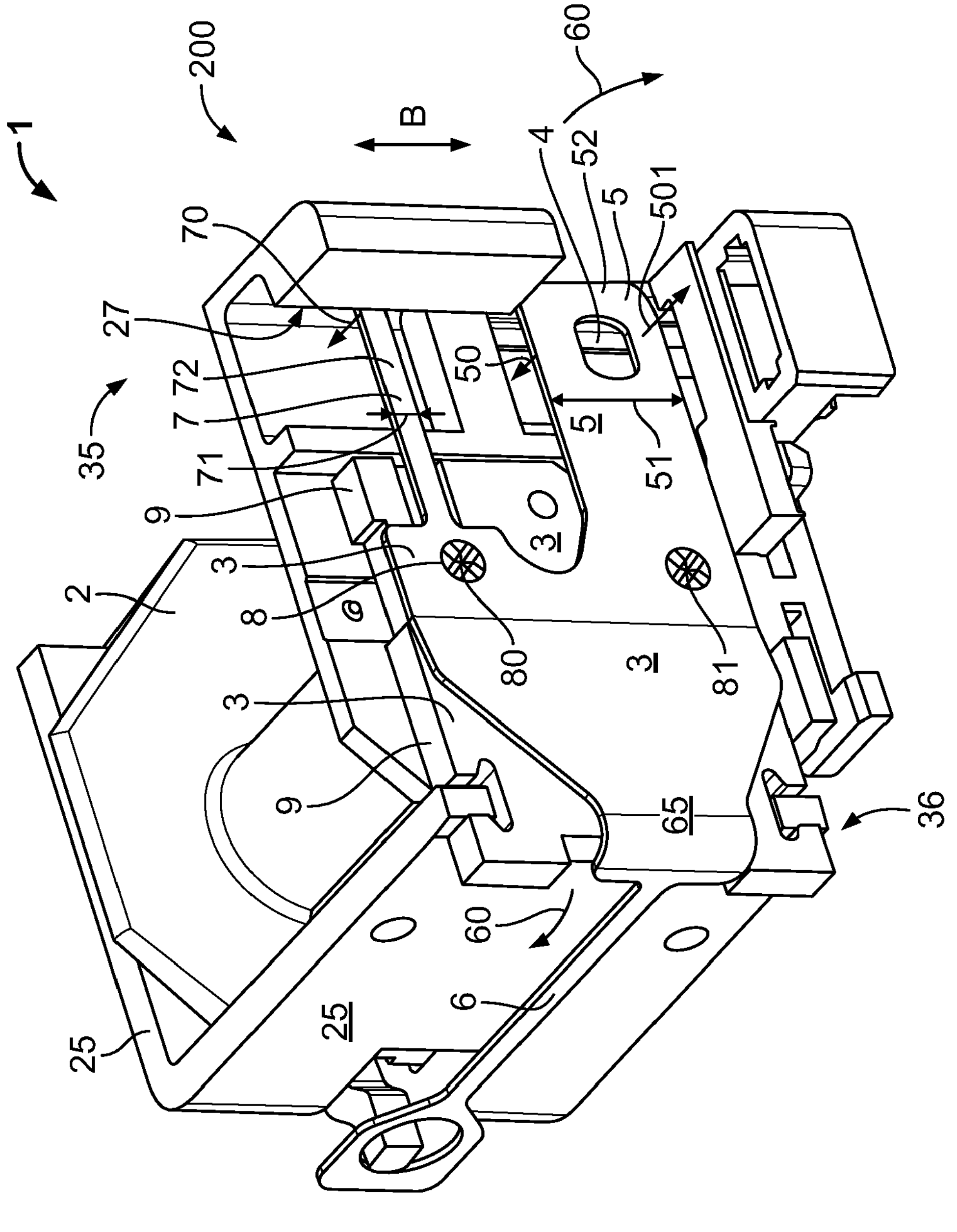
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Fig. 1

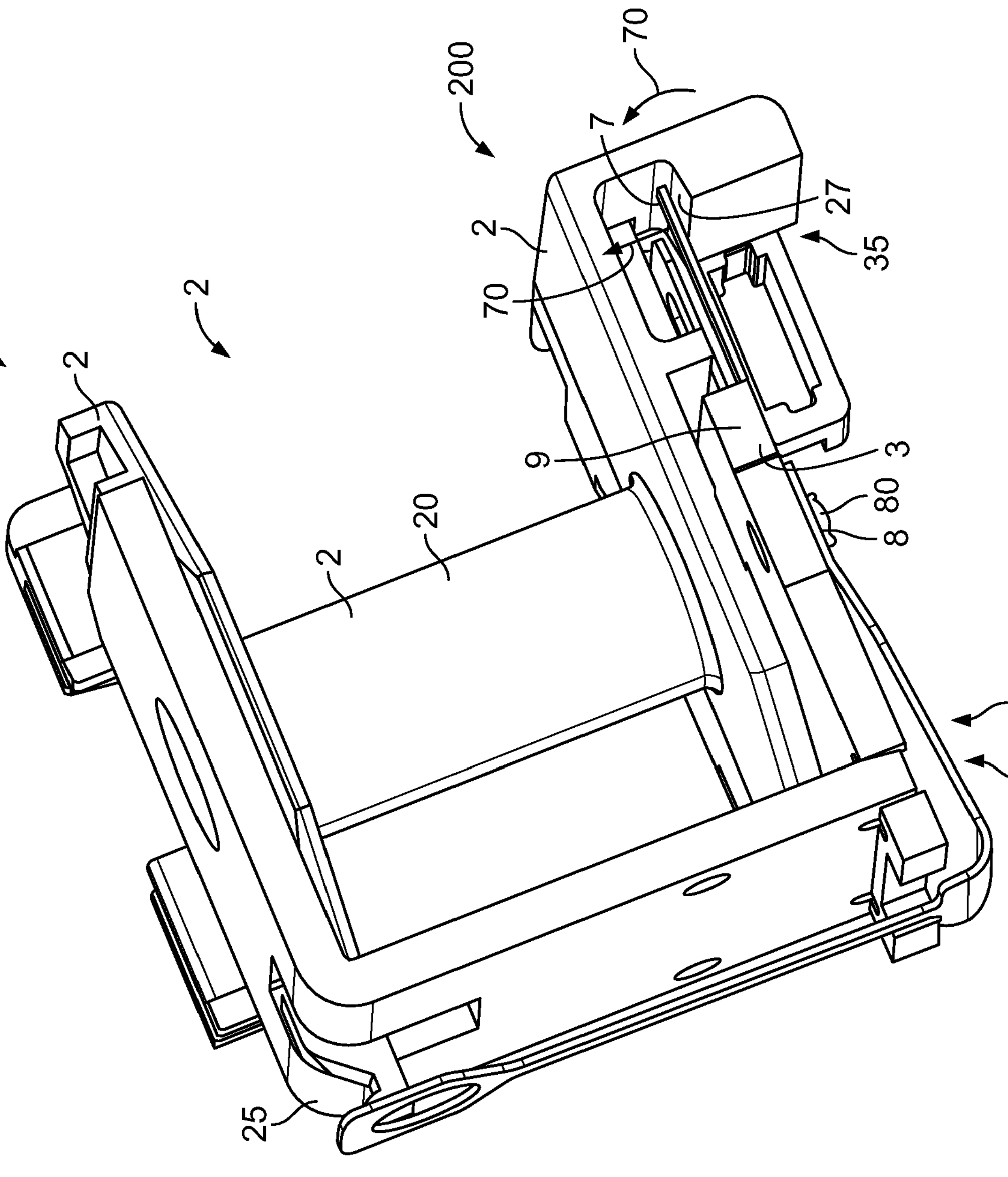

Fig. 2

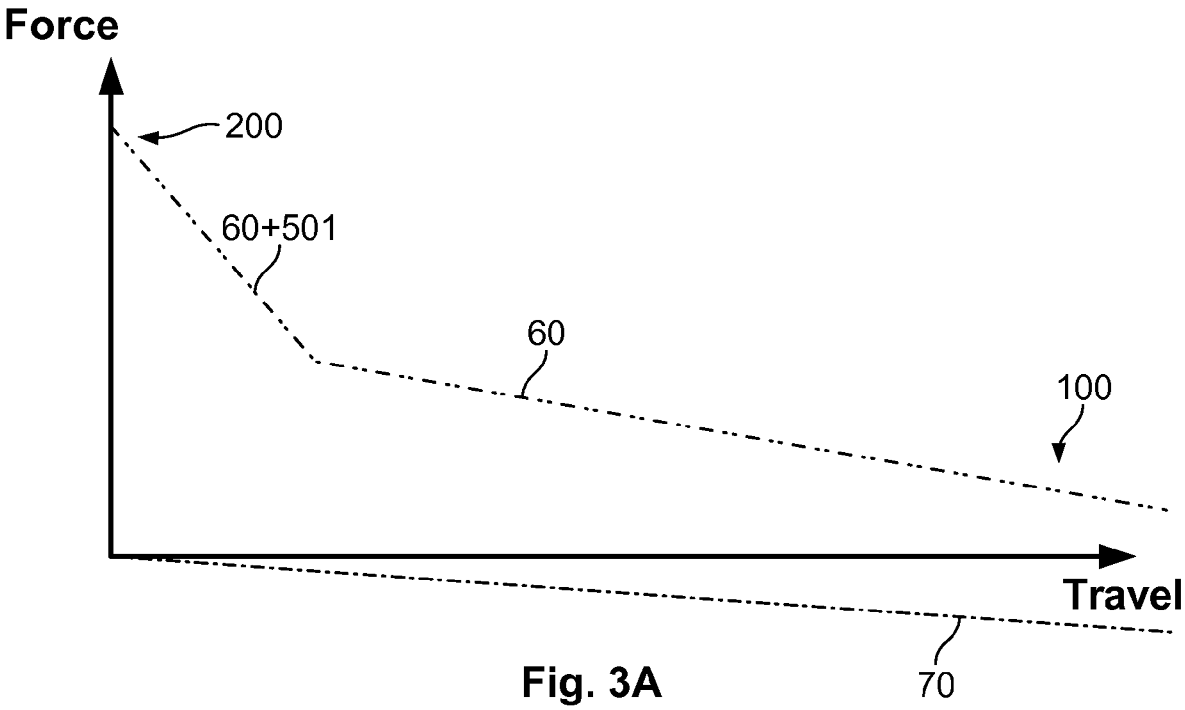

Fig. 3A

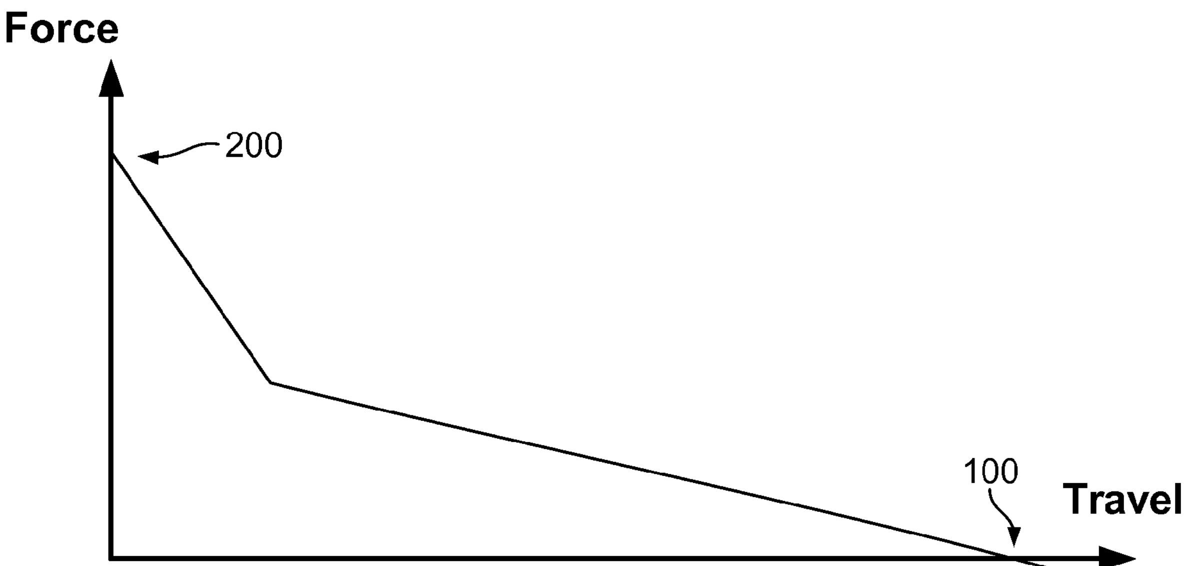

Fig. 3B

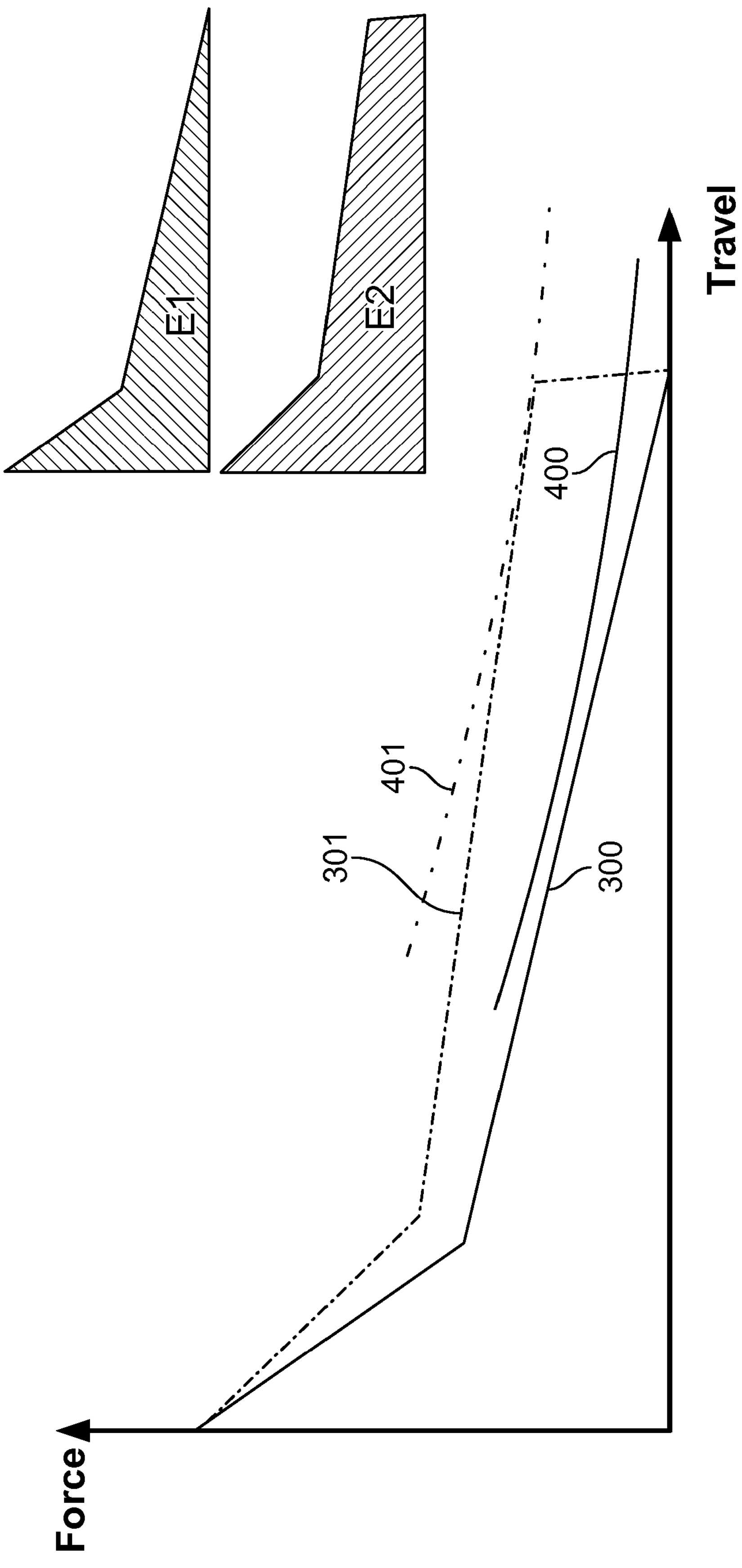

Fig. 3C

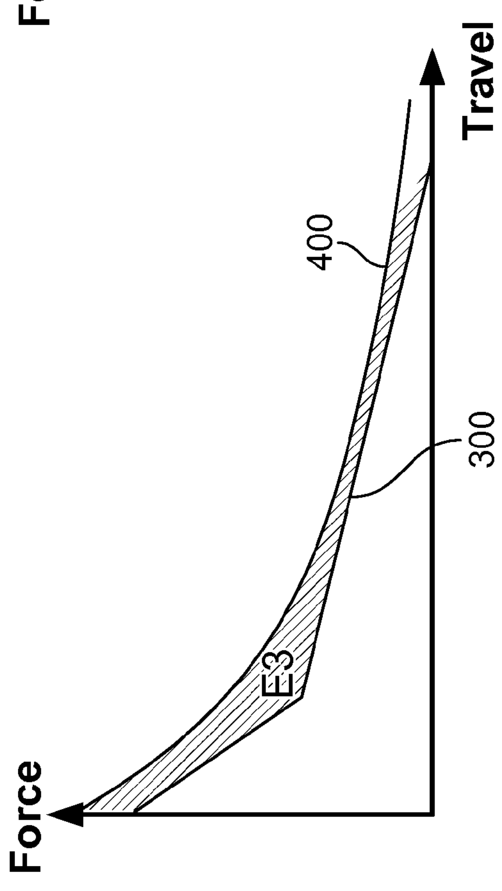

Fig. 3D

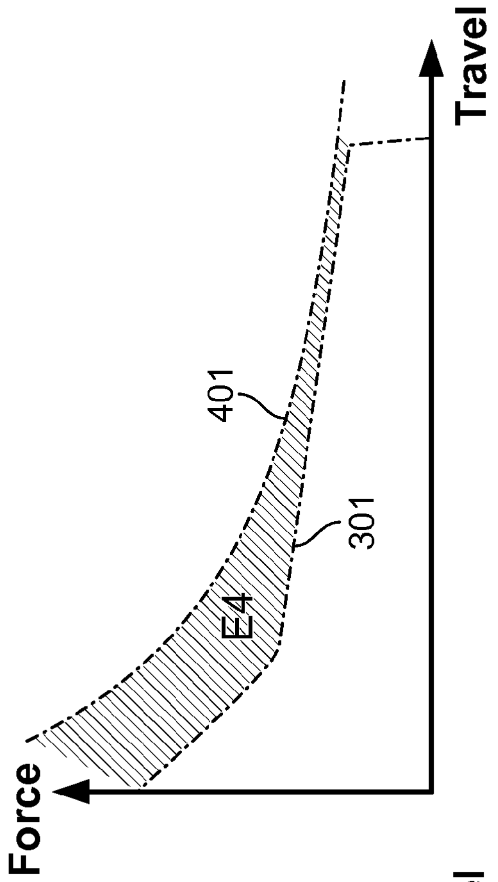

Fig. 3E

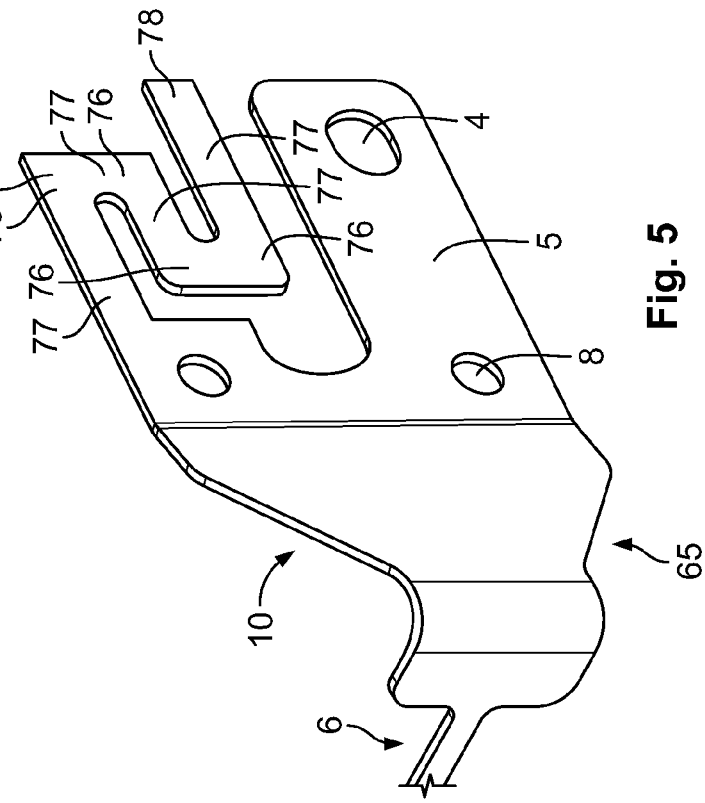
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Fig. 5

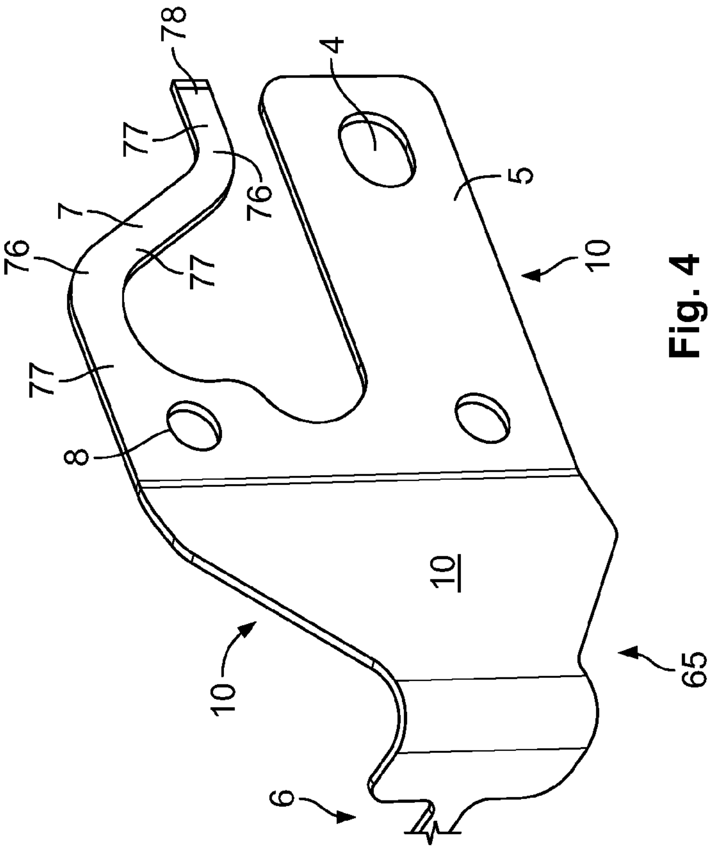
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Fig. 4

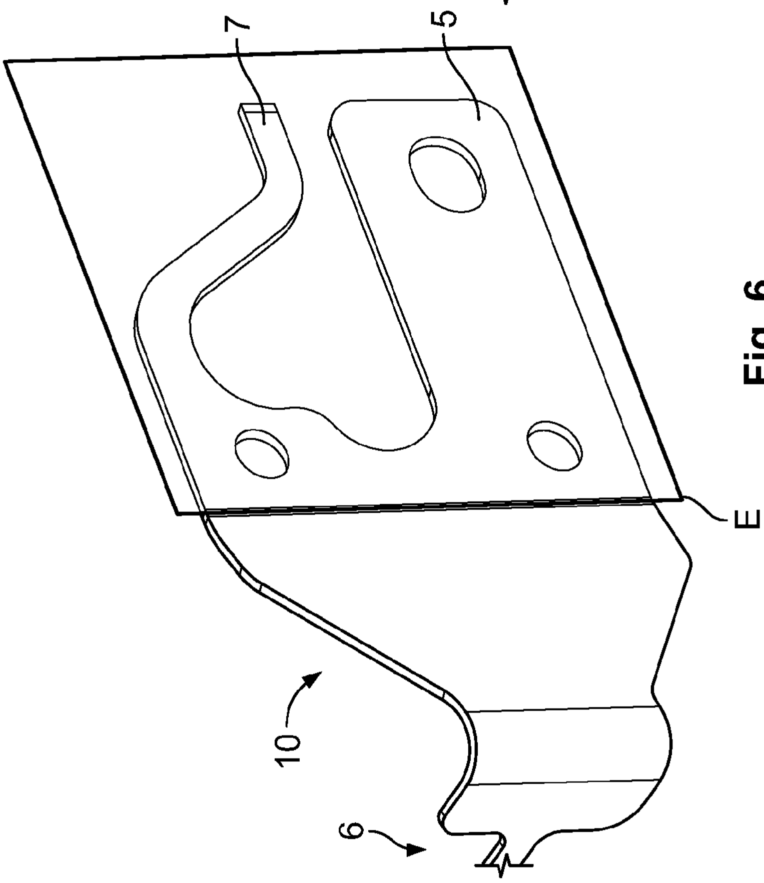

Fig. 6

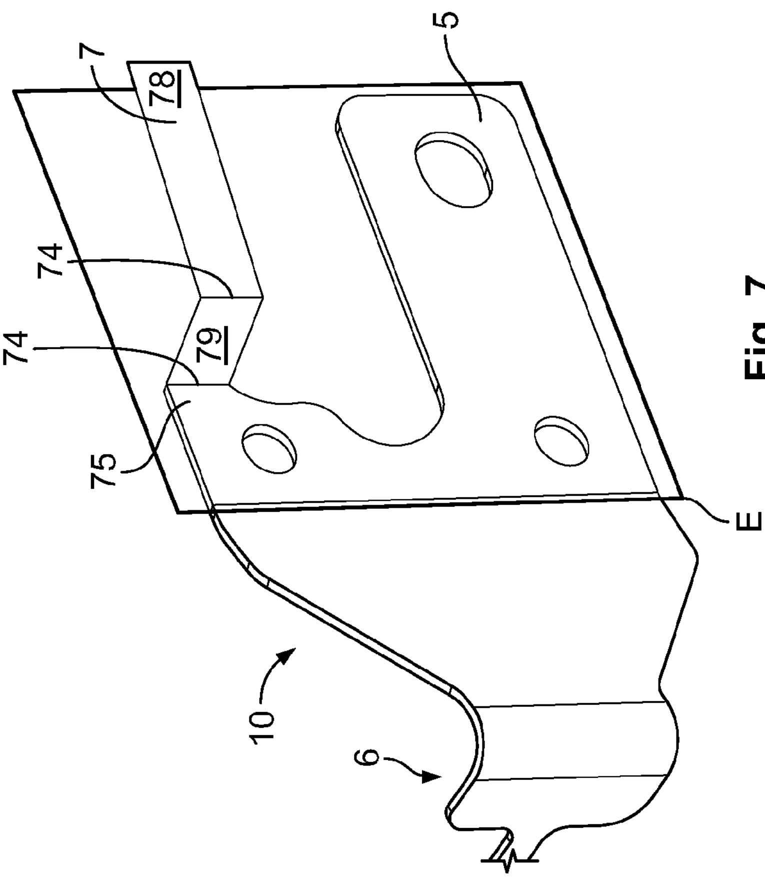

Fig. 7

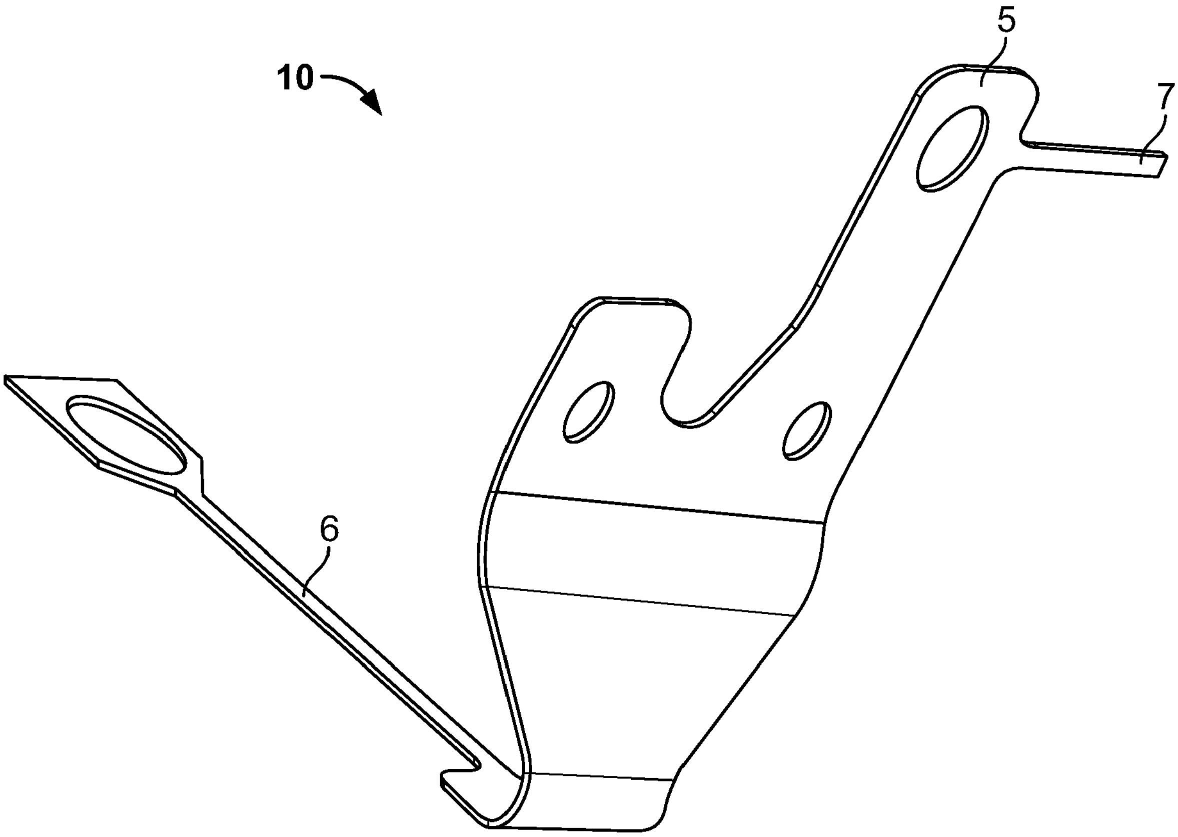

Fig. 8

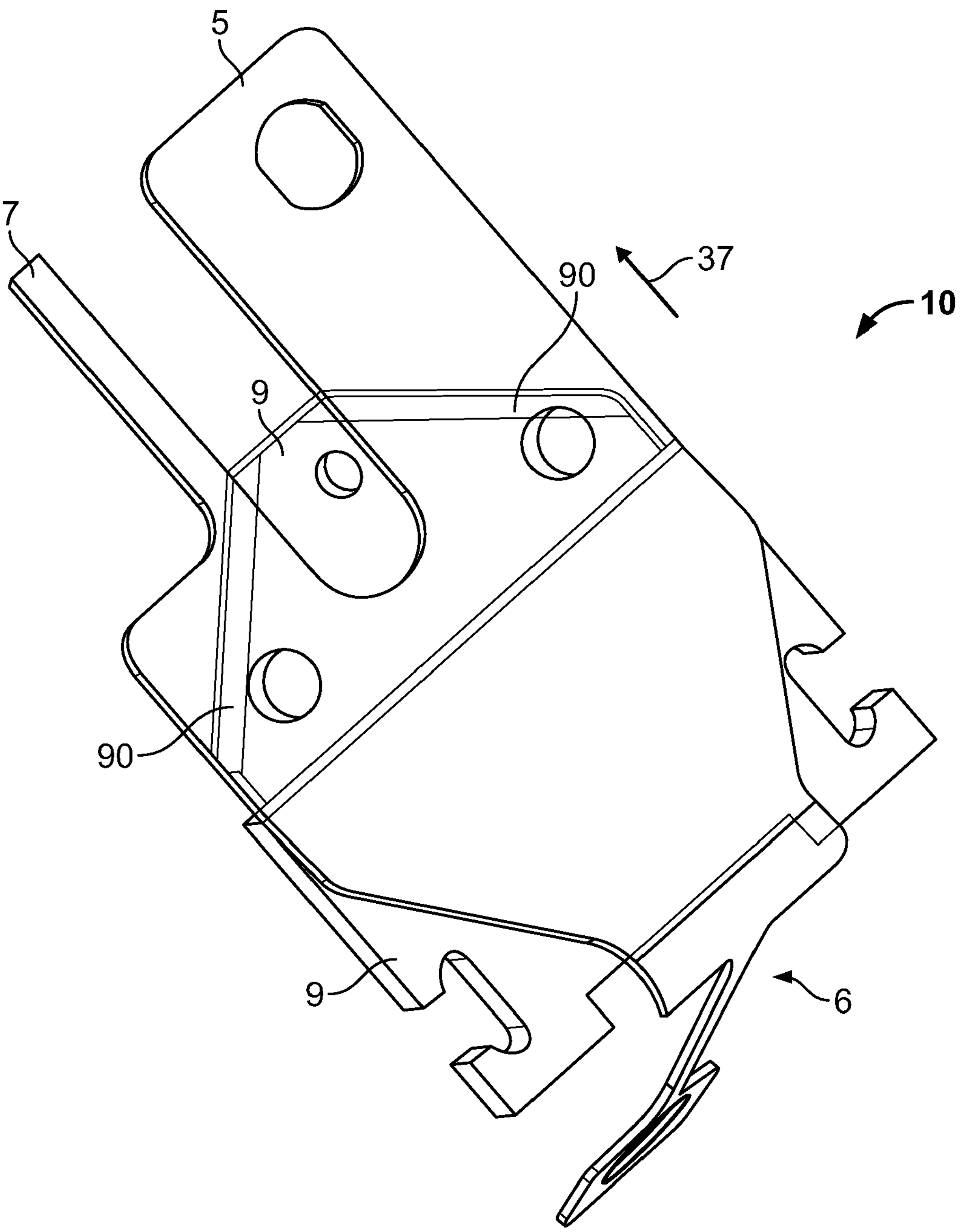

Fig. 9

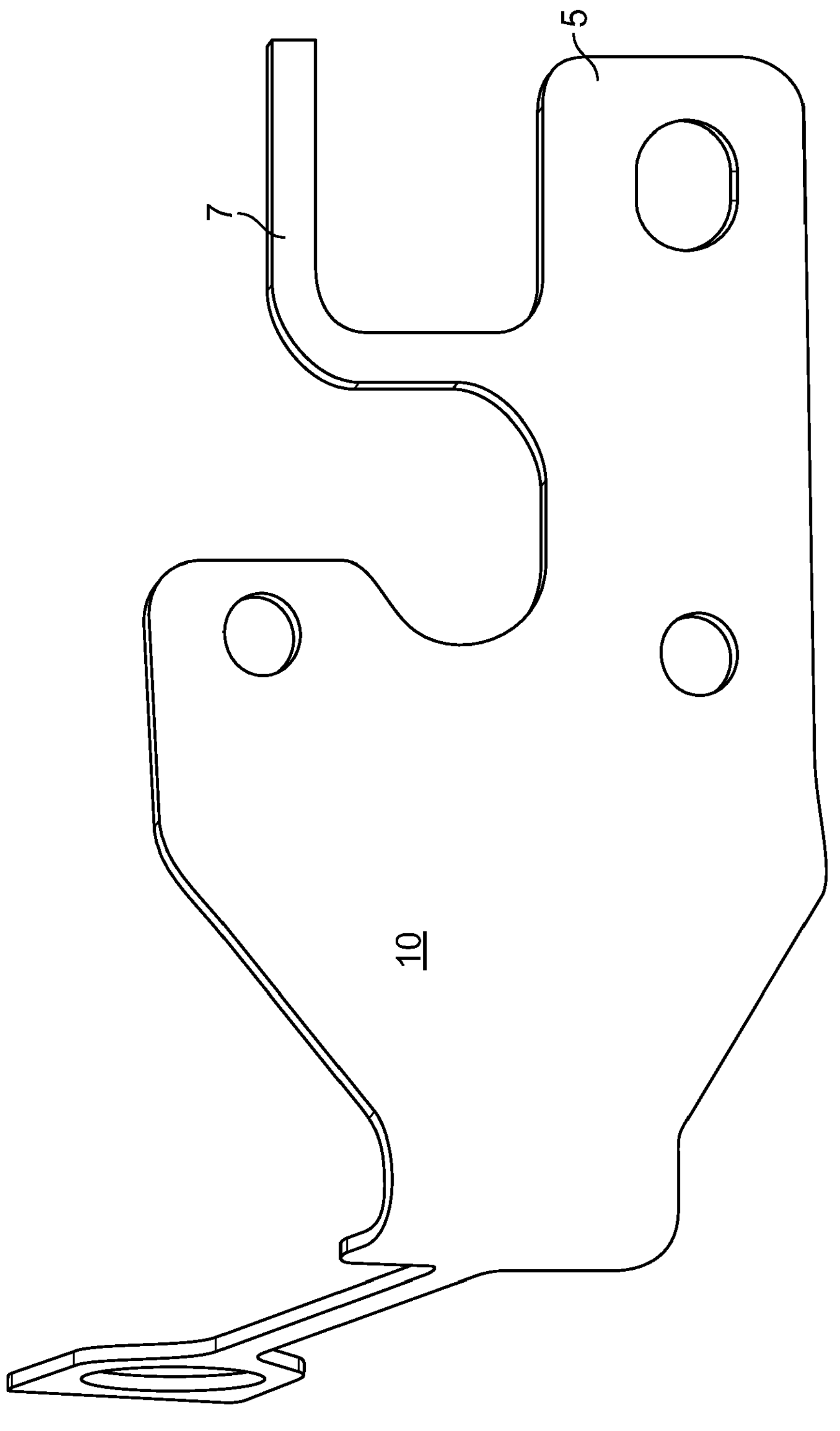

Fig. 10

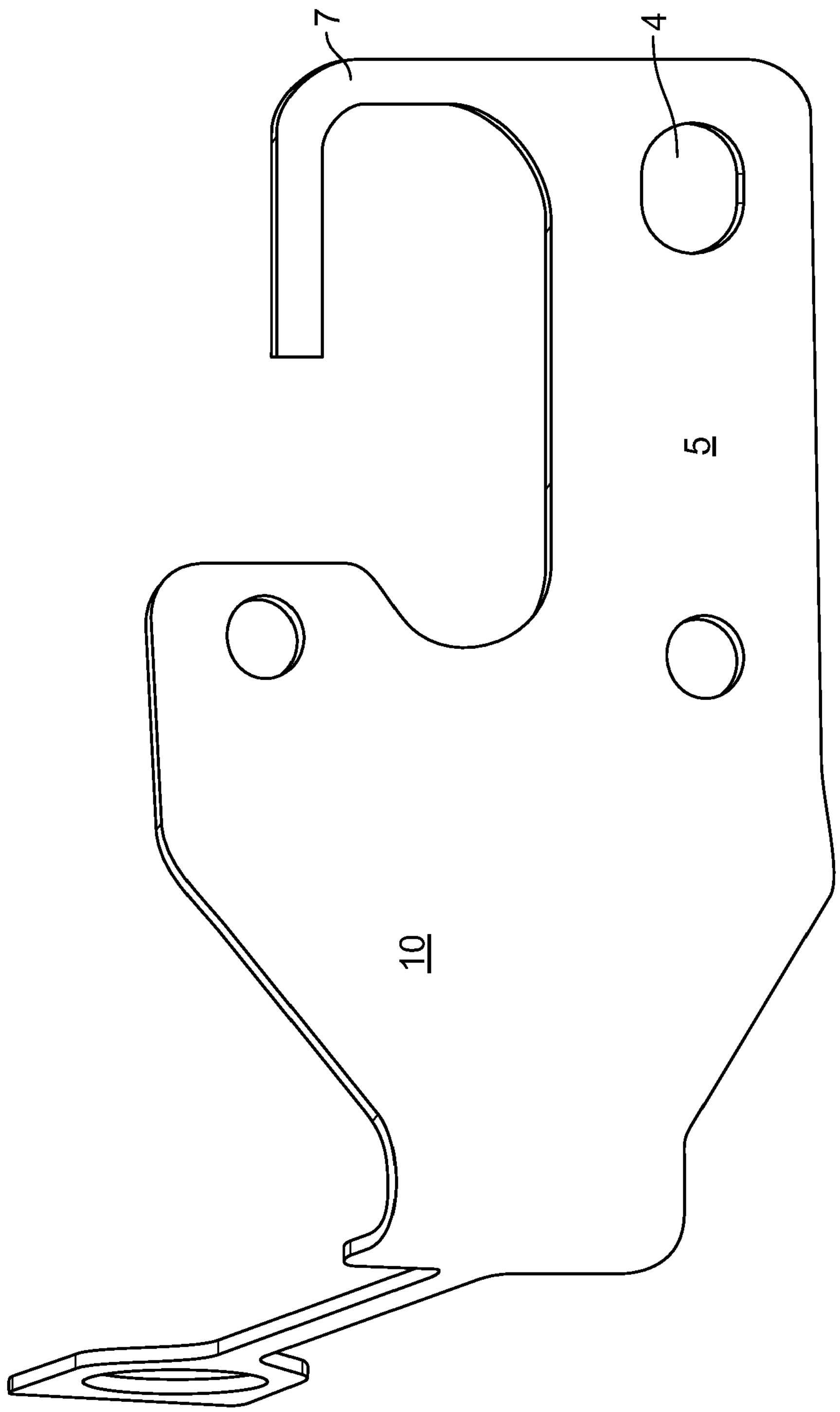

Fig. 11

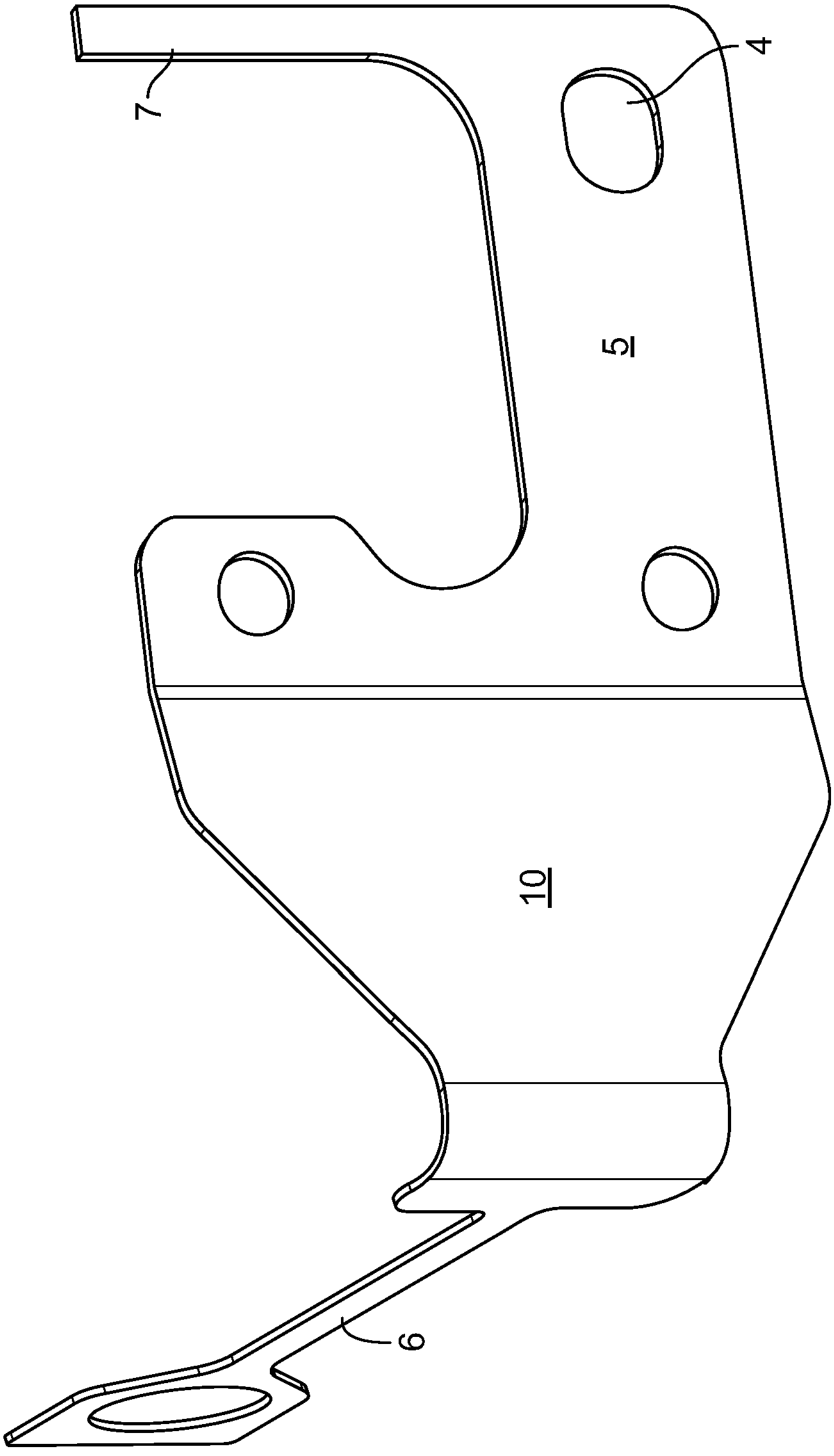

FIG. 12

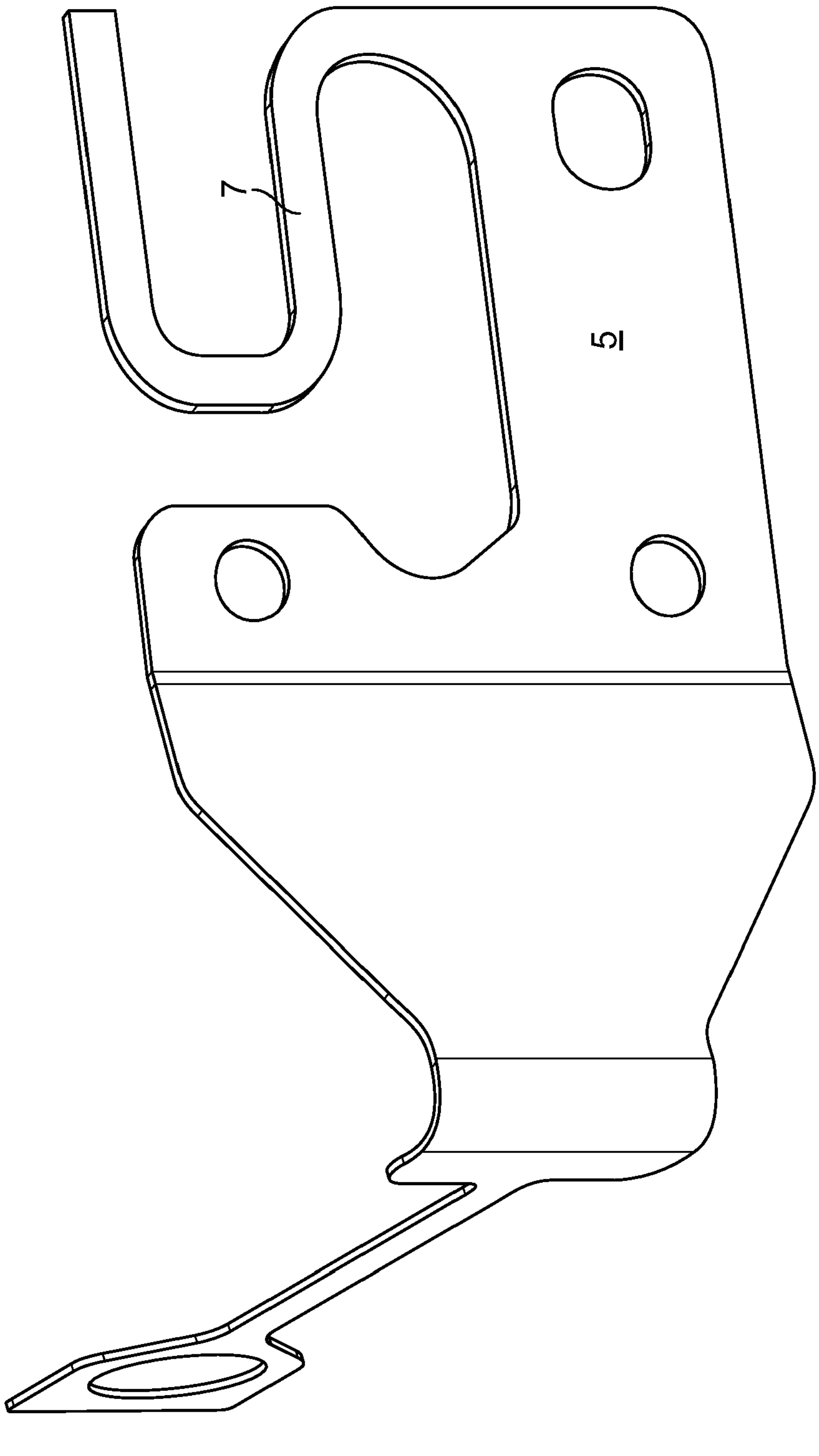

Fig. 13

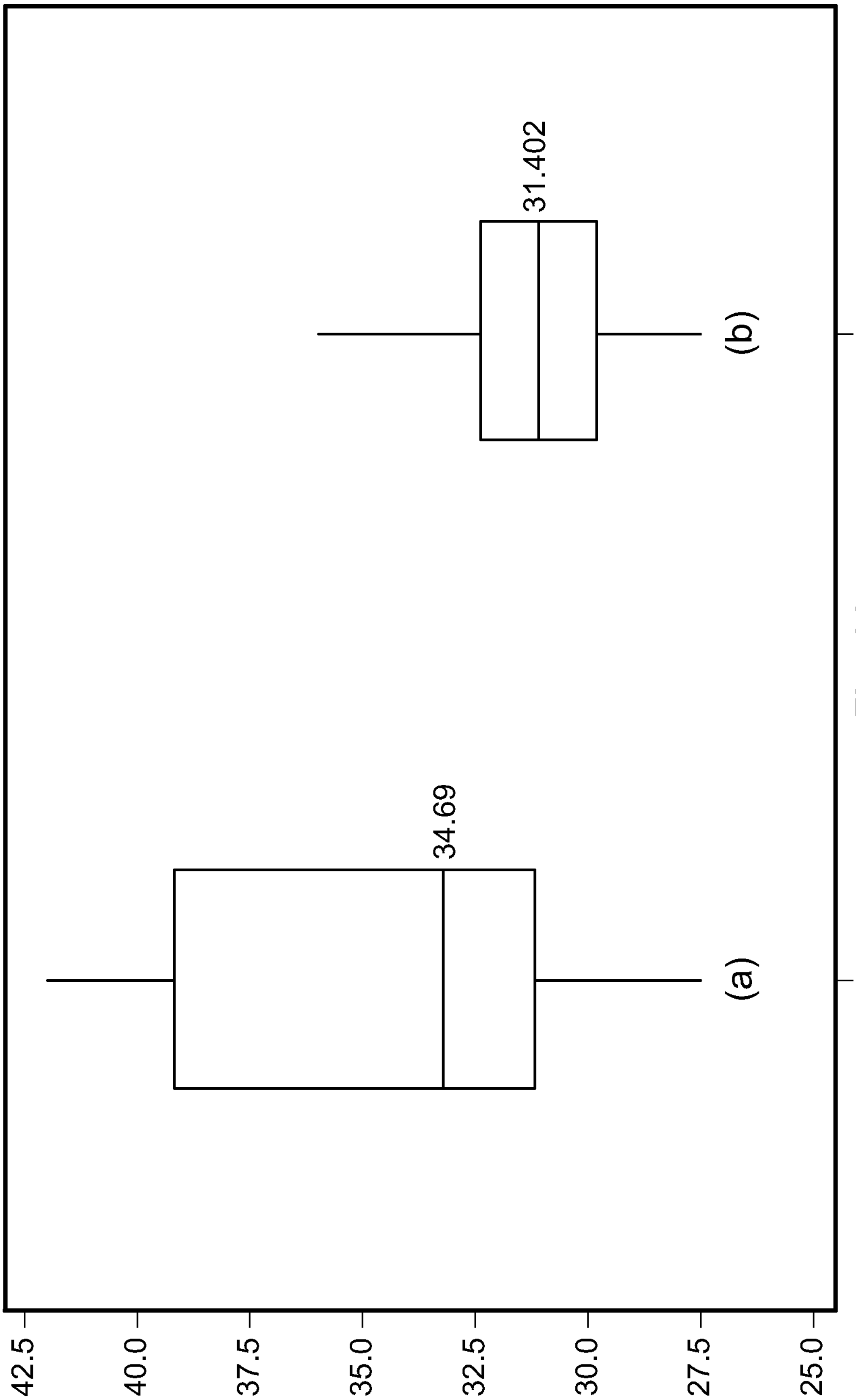

Fig. 14

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EUROPEAN SEARCH REPORT

Application Number
EP 16 15 2815

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP S60 80644 U (TAIKODENKI) 4 June 1985 (1985-06-04) * the whole document *	1-10	INV. H01H50/28 H01H50/30 H01H50/60
X	US 2 471 181 A (WILSON JOHN M) 24 May 1949 (1949-05-24) * column 2, line 6 - column 4, line 14; figures 1-3 *	1-4,6, 8-10	
A	JP S61 54131 A (MATSUSHITA ELECTRIC WORKS LTD) 18 March 1986 (1986-03-18) * figures *	1	
A	JP H06 44881 A (FUJITSU LTD) 18 February 1994 (1994-02-18) * figures *	1	

TECHNICAL FIELDS SEARCHED (IPC)
H01H

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	17 June 2016	Ramírez Fueyo, M

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17-06-2016

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82