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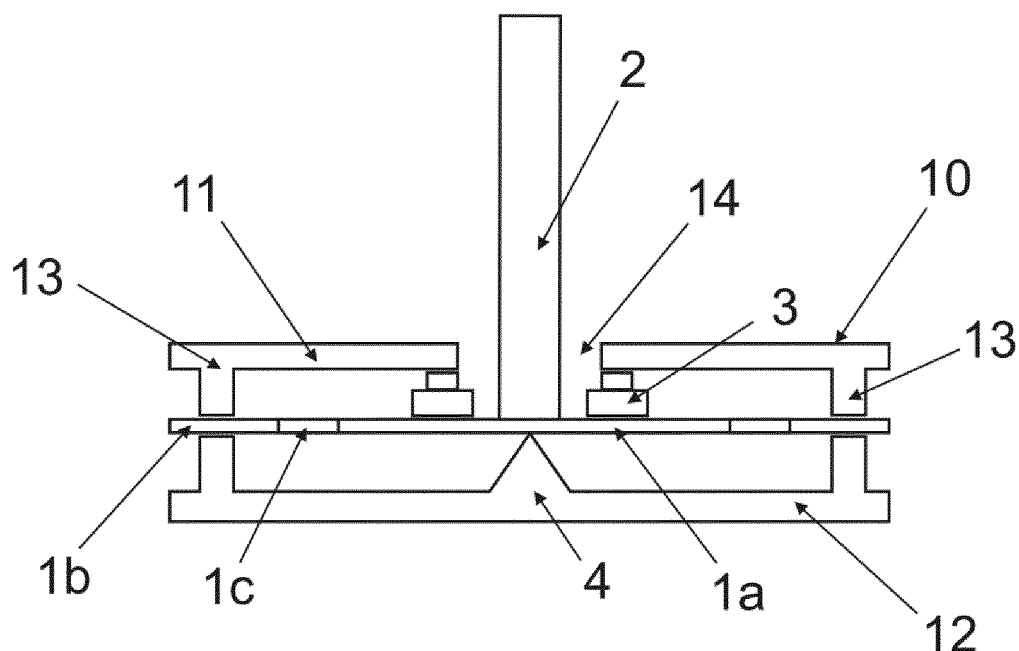
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(54) MULTIFUNCTIONAL CONTROL DEVICE

(57) According to the invention, a control device is provided comprising a rigid base (1 b), a tilting area (1 a) adapted to move relative to the rigid base (1 b) upon exertion of a force thereto, a hinge unit (1c) connecting

the tilting area (1a) to the rigid base (1b), an input unit (2) connected to the tilting area (1 a) to apply a force to the tilting area (1 a), and at least one sensor element (3) provided to detect a movement of the tilting area (1a).

Fig.2



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Description

FIELD OF INVENTION

[0001] The present invention relates generally to a control device.

BACKGROUND OF THE INVENTION

[0002] Multifunctional and direction control devices or actuators like joysticks can be used, e.g. to allow browsing and entering a selection in a menu list. They are used within electrical devices and mostly consist of a lever, which picks up the action executed by the user and feeds this movement or pressing action towards a sensor. The sensor acts like a switch and an transmission element like a rocker if further provided. Due to space and cost constraints, the application flexibility of those designs is limited. As long as friction within a hinge appears, the lifetime of the purely mechanical construction is also limited.

SUMMARY OF THE INVENTION

[0003] In accordance with one aspect of the present invention there is provided a control device comprising a rigid base, a tilting area adapted to move relative to the rigid base upon exertion of a force thereto, a hinge unit connecting the tilting area to the rigid base, an input unit connected to the tilting area to apply a force to the tilting area, and at least one sensor element provided to detect a movement of the tilting area.

[0004] The invention thus provides a tilting area and a fixed area, the rigid base, and a hinge unit in between. Accordingly, a force applied to the input unit creates a relative movement of the tilting area with respect to the rigid base or any elements associated with the rigid base. The hinge unit allows by its stiffness and/or flexibility, which can be adjusted by its shape and its material, a deflection of tilting area towards rigid base. The sensor element picks up the movement from the tilting area with respect to the rigid base and translates the primary effected physical values like travel resulting from the movement and/or pressure into an output signal.

[0005] The invention allows the formation of a simple and easy to manufacture and cost efficient control element. Also, a distinctive determination of multiple grades of a directed action is possible due to the simple application of a mechanical path of the tilting area.

[0006] The resulting movement can have x,y,z axis direction or any combination of those.

[0007] The input unit is preferably mounted or fixed to the tilting area.

[0008] Preferably, the rigid base extends in a first plane and the tilting area is provided to extend in parallel to or within the first plane in a situation where no force is exerted on the tilting area. Upon exertion of a force thereto the tilting area is adapted to be tilted with respect to the

first plane and then extends in a second plane not parallel to the first plane.

[0009] A suspension element may be provided to suspend the combination of the rigid base, the tilting area and the hinge unit.

[0010] Preferably, the tilting area, the rigid base and the hinge unit are integrally formed with each other and are formed of the same material. This allows the so formed integral unit to be the carrier for the input unit while at the same time providing an elastic suspension for a directional operation of the input unit. Only one single element is needed to provide these functions. This element can be easily and cost-effectively formed. Moreover, by its integrated provision, the hinge unit is provided frictionless. The resulting control device is highly reliable due to its frictionless suspension and its frictionless translation of force or deflection to sensors. Also, the device is rugged with respect to extreme climatic environments like dust, dirt, humidity or temperature due to a selection of specific materials and the frictionless suspension, and frictionless translation of force and/or deflection to the sensor element

[0011] Further, also sensors delivering electrical values may be used and may be formed contactless thereby further improving the reliability and ruggedness.

[0012] The tilting area, the rigid base and the hinge unit may be formed of steel, stainless steel, ceramics, PCB (printed circuit board) or plastic. This formation of the tilting area, the rigid base and the hinge unit as a single element out of one material, standard materials can be used and even three-dimensional printing can be used to form these integrated elements.

[0013] In another embodiment, the tilting area, and the rigid base are formed of the same material like for instance steel, ceramics or plastic and the hinge unit is formed of a different material like for instance rubber.

[0014] The hinge unit is preferably shaped such that a predetermined flexibility of the hinge unit is obtained. Thus, through the shape and/or material of the hinge unit, its flexibility can be defined. The hinge unit may be s-shaped, or meander like shaped or can have any other shape.

[0015] Preferably, the hinge unit provides a bias force to the tilting area. Thus, the hinge unit creates a counterforce once deflection or a force is applied to the input unit. Once an action disappears, the tension respectively the counterforce lets the tilting area return to its zero position as long as no locking state is provided by any auxiliary mechanical elements.

[0016] In one embodiment, the hinge unit is provided by the sensor elements itself adapted to be pressed or moved upon exertion of a force thereto. This allows an even simpler construction of the control device.

[0017] In one embodiment, the rigid base is formed of plastic and the tilting area is formed of steel, or vice versa.

[0018] The input unit may be a joystick.

[0019] The input unit may an encoder or a potentiometer or any other input element having at least one mode

of intrinsic operation. This allows the application of even more functions to the control device.

[0020] In one embodiment, a support element is further provided to support the tilting area. The tilting area moves relative to the support element. The support element may however also be part of the tilting area or attached thereto and may move together with the tilting area with respect to the rigid base or the suspension element. The support element or parts of it may however also be formed by the surrounding housing of the apparatus, where the control device is liked to be included into.

[0021] The sensor element may be an optical, magnetic, capacitive, inductive, resistive sensor element or a voltage and current transducer.

[0022] The sensor element translates an applied force by pressure/force or tension detection into an output signal.

[0023] The sensor element may be located on any of the tilting area, the rigid base, or the input unit sensing different movements.

[0024] In one embodiment, the sensor element forms part of the input unit.

[0025] Further, a restriction element may be provided to restrict movement of the tilting area in at least one of the possible directions of movement. According to the invention, the desired grades of freedom of the resulting movement can be restricted, which may be desirable for certain applications.

[0026] In another embodiment, an auxiliary element can be provided connectable to the tilted area to lock the control device in at least one direction.

[0027] In a further embodiment, a haptic feedback element can be provided connectable to the tilted area to provide a haptic feedback of movement of the tilting area.

[0028] The characteristics, features and advantages of this invention and the manner in which they are obtained as described above, will become more apparent and be more clearly understood in connection with the following description of exemplary embodiments, which are explained with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] In the drawings, same element numbers indicate same elements in each of the views:

Figure 1 is a schematic top view of a first embodiment of the invention;

Figure 2 is a schematic side view of the first embodiment shown in Figure 1;

Figure 3 is a schematic side view of the first embodiment in an actuated state;

Figure 4 is a schematic top view of second embodiment of the invention;

Figure 5 is a schematic top view of a third embodiment of the invention;

Figure 6 is a schematic side view of the third embodiment of the invention;

Figure 7 is a schematic top view of a fourth embodiment of the invention;

Figure 8 is a schematic side view of a fifth embodiment of the invention;

Figure 9 is a schematic side view of a sixth embodiment of the invention;

Figure 10 is a schematic side view of the sixth embodiment in an actuated state;

Figure 11 is a schematic side view of a seventh embodiment of the invention;

Figure 12 is a schematic side view of an eighth embodiment of the invention;

Figure 13 is a schematic side view of an ninth embodiment of the invention;

Figure 14 is a schematic side view of a tenth embodiment of the invention;

Figure 15 is a schematic side view of an eleventh embodiment of the invention;

Figure 16 is a schematic side view of a twelfth embodiment of the invention;

Figure 17 is a schematic side view of a thirteenth embodiment of the invention;

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0030] Throughout the following, a control device will be described. The control device is adapted to detect a movement of its input device along the x, y, z-axis or any combination of those. The control device translates a directed activity of a user to an input unit like turning a knob, stick etc. into an electrical value related to direction of activity.

[0031] Figure 1 is a schematic top view of a first embodiment of the invention. Figure 2 is a side view of the embodiment shown in Figure 1. The control device according to the invention comprises a rigid base 1b and a tilting area 1a which adapted to move relative to the rigid base 1b upon exertion of a force thereto. Rigid in this respect means that the base 1b is provided unmoveable with respect to the tilting area 1a. Further provided is a hinge unit 1c connecting the tilting area 1a to the rigid base 1b. The hinge unit 1c allows the deflection of the

tilting area 1 a with respect to the rigid base 1 b. The control device, the rigid base 1 b, the tilting area 1 a and the hinge unit 1 c are in the embodiment shown all of rectangular shape but can have different shapes as well, like e.g. circular.

[0032] Further provided is an input unit 2 connected to the tilting area 1a to apply a force to the tilting area 1 a, and at least one sensor element 3 provided to detect a movement of the tilting area 1 a. Around the input unit 2, the tilting area 1a is provided surrounded by the hinge unit 1c which again is surrounded by the rigid base 1 b.

[0033] A sensor element 3 is provided to detect the movement of the tilting area 1a. In the first embodiment, four sensor elements 3 are provided. Two sensor elements 3 are provided left and right of the input unit 2, i. e. along the positive and negative x-direction. Two further sensor elements 3 are provided on the upper and lower side of the input unit 2, i.e. along the positive and negative y-direction as shown in Figure 1. The invention, however, is not limited to the use of four sensor elements 3. According to the desired functionality of the control device, fewer or more sensor elements 3 may be provided. The sensor elements 3 are exemplarily and not restrictively provided below a top surface of a suspension element 10 of the control device and on top of the tilting area 1 a. Here, the sensor elements 3 are exemplarily adapted to measure a pressing force resulting from a movement of the tilting area 1 a. However, the sensor elements 3 are not restricted thereby and can have different functionality.

[0034] In the first embodiment of Figure 1 and 2, the rigid base 1 b and the tilting area 1 a extend in the same plane when no force is applied to the input unit 2. The support element 4 below the tilting area 1a is only an optional element. It supports the tilting area 1a. This provides stability and further also allows the provision of a counterforce against a pressing action in the z-direction of the input unit 2. The input unit 2 could be provided as a pressing knob or stick and the pressing of the knob or stick along the z-direction can thus be detected. Without the optional support element 4, this pressing action may not be detectable.

[0035] The control device may comprise a suspension element 10. The suspension element 10 may have a rectangular shape with a top surface 11, a bottom surface 12 and two side surfaces 13 and may be hollow. On its top surface 11, a hole 14 may be provided to allow the input unit 2 to extend therethrough. The suspension element 10 may also be described to have the shape of a rectangular letter "C" lying on its back. Here, the suspension element is shown as a separate element, but it or its parts can also be integrally formed by the surrounding housing where the control device is built into.

[0036] The tilting area 1a in Figures 1-3 extends in parallel to the top and the bottom surface of the suspension element 10 within the suspension element 10. On both its lateral ends, the hinge units 1c are coupled to the rigid base 1b. The rigid base 1b is rigidly connected to the suspension element 10. In the embodiment shown, the

rigid base 1b is fixed or pressed between side walls 14 of the suspension element 10. However, the rigid base 1 b may not be a separate element but may be an integral part of the suspension element 10 itself. In some embodiments described later, the rigid base 1 b could also be provided by the top surface 11 of the suspension element 10.

[0037] Figure 3 shows the control element of the first embodiment in an actuated state. A force or an action applied perpendicular, angled or parallel to the axis of the input unit 2 as indicated by the arrow creates a possible relative movement of the tilting area 1 a towards the rigid base 1 b. The hinge unit 1 c allows by its given stiffness or flexibility according to its shape and/or material a deflection, movement or tilt of the tilting area 1 a towards the rigid base 1b. The hinge unit 1c may be biased against the tilting area 1 a and creates a counterforce once deflection or force is applied to the Input unit 2. The resulting movement of the tilting area 1a can have an x,y, or z axis direction or any combination of those. The sensor element 3 picks up the movement or force of the tilting area 1a towards the rigid base 1b and translates the primary physical values like travel resulting from a movement and/or pressure into an output signal. Once the action disappears, the tension respectively the counterforce lets the tilting area 1a return to its zero position as long as no lock state is provided by auxiliary mechanical elements as described later.

[0038] In a preferred embodiment of the invention as shown in Figure 4, the tilting area 1a, the rigid base 1 b and the hinge unit 1 c are integrally formed of the same material thus constituting one single integrally formed element extending in a single plane. The single element may be formed from PCB (printed circuit board), plastics, steel, ceramics etc. However, other materials are also possible. This allows a simple and cost effective manufacturing of the control device according to the invention. Furthermore, the control element formed thereby is very robust and long-life. Advantageously, the stiffness or flexibility of the hinge unit 1 c can be defined by its geometry or shape of this section. The hinge unit 1 c may have a meander shape or may be s-shaped. In this embodiment, the control element could be formed by 3D printing.

[0039] Thus, the invention may use a single element, for instance a PCB element, where the input unit 2 is mounted onto the tilting area 1 a being movable towards the rigid base 1 c of the same PCB.

[0040] The hinge unit 1c between those areas - also consisting of the same PCB - creates by its shape an elastic suspension of the movable part of PCB. Both areas - movable and fixed ones - can accommodate any sensor element 3 to pick up the relative movement between movable and fixed parts of the PCB. The input unit 2, as will be later described, can also be part of an additional input element like e.g. a potentiometer being mounted onto tilting area 1a, thus allowing a combined interaction of control activities during operation. This interaction may be a pushing of the input unit 2 into one

direction (+x, +y or combination thereof) and turning the input unit 2 around its own axis. The input unit 2 can be any input element having at least one mode of intrinsic operation.

[0041] Throughout the invention, the tilting area 1a is can either be in the center or the outer area of the rigid base 1b. Thus, the input unit 2, a lever, knob, etc. can be rigidly assembled to the center area of the control device and then the surrounding outer area becomes fixed. It also can be assembled to the outer area then the center area of the control device becomes fixed.

[0042] Needed wires to any electrical sensor element 3 can also be fed from the sensor element 3 to an electronic circuitry using the hinge unit 1c without the need of additional cabling.

[0043] Figure 5 is a schematic top view of a third embodiment of the invention. Figure 6 is a schematic side view of the third embodiment of the invention. In Figure 5 and Figure 6, the tilting area 1a, the rigid base 1b and the hinge unit 1c are formed of different materials with respect to each other. In the top view shown in Figure 5, the tilting area 1a, a rigid base 1b and hinge unit 1c all have a rectangular shape. Around the input unit 2, the tilting area 1a is provided surrounded by the hinge unit 1c which again is surrounded by the rigid base 1b. In the side view of Figure 6 it is visible that the tilting area 1a and the rigid base 1b extend in the same plane while the hinge unit 1c is provided coupled to the lower surfaces of the rigid base 1b and the tilting area 1a. The rigid base 1b and the suspension element 10 may be made of plastic, the tilting area 1a may be formed by a steel plate, and the hinge unit 1c may be a rubber cushion. However, other materials are also possible. However, the hinge unit 1c can also be coupled to the upper surface of rigid base 1b and tilting area 1a or upper surface of rigid base 1a and lower surface of tilting area 1b and vice versa.

[0044] In the fourth embodiment of Figure 7, the tilting area 1a and the rigid base 1b are formed of same material while the hinge unit 1c is formed of a different material. The hinge unit 1c may comprise springs or rubber cushions etc. However, other materials/elements are also possible. In the embodiment shown in Figure 7, four springs are provided along the positive and the negative x-axis and the positive and the negative y-axis. Also, four sensor elements 3 are provided along the positive and the negative x-axis and the positive and the negative y-axis. However, the embodiment is not limited thereto.

[0045] In another embodiment a shown in Figure 8 the hinge unit 1c may be provided by the sensor element 3 itself. The tilting area 1a is supported on a support element 4. In a plane of the tilting area 1a, a gap is formed between the rigid base 1b and the tilting area 1a where in figure 1 the hinge unit 1c was provided. The tilting area 1a may be guided by vertical extensions 15 from the top surface 11 of the suspension element 10. In the embodiment shown, the elastic suspension and counterforce is provided by the sensor element 3 itself which

may be a spring based tact switch in coaction with the support element 4.

[0046] Figure 9 is a schematic side view of a sixth embodiment of the invention. Whereas in the previous embodiments, the tilting area 1a was provided around the input unit 2 and was surrounded itself by the rigid base, here, the rigid base 1b is located below the tilting area 1a, which still surrounds the input unit 2. The rigid base 1b is coupled to the bottom surface 12 of the suspension element 10. Here, the bottom surface 12 of the suspension element 10 may be provided with a support element 4 to support the rigid base 1b. The hinge unit 1c is placed exemplarily on the same plane as the rigid base 1b and couples the rigid base 1b to the tilting area 1a. In Figure 10, the same embodiment is shown in which a force is applied to the input unit 2 such that the tilting area 1a is tilted with respect to the rigid base 1b placed below the tilting area 1a and the sensor 3 is activated due to its motion towards the suspension element 10. In the provided embodiment, the sensor 3 is a pressing switch. However, any other sensor element can be provided.

[0047] Figure 11 is a schematic side view of a seventh embodiment of the invention. With respect to the first embodiment, only the input unit 2 is different. The input unit 2 itself can provide an additional grade of actuation. This may be provided by an encoder or a potentiometer or any input element having at least one mode of intrinsic operation. The input unit 2 may detect a downward pressing force onto its top surface, which could be used for a selection of an element in a menu. In order to provide a counterforce against the pressing force, a support element 4 is provided below the tilting area 1a. If the input unit 2 is a potentiometer, also a rotation of the input unit 2 around its axis can be detected. Thus, the control device is multifunctional. In this embodiment, a sensor element 3 forms thus also part of the input unit 2 itself.

[0048] Figure 12 is a schematic side view of an eighth embodiment of the invention. The input unit 2 in the embodiment shown can also pick up indirect actuation which may result from acceleration, vibration of a mechanical element 20 placed on top of the input unit 2. In this embodiment, the input unit 2 is not directly accessible by a user.

[0049] Figure 13 is a schematic side view of a ninth embodiment of the invention. In Figure 13, a restriction element 5 is provided in a direction path of movement of the input unit 2 or the tilting area 1a. Exemplarily, the restriction element 5 is provided adjacent to the input unit 2 and is provided in the example shown to extend in the horizontal direction. The restriction element 5 is located on the top surface 11 of the suspension element 10, but could also be formed below the top surface 11 of the suspension element 10. The restriction element 5 is provided to restrict possible deflections in one direction. This is done in the embodiment shown by narrowing the hole 14 formed on the top surface 11 of suspension element 10 into which the input unit 2 is inserted. This allows to provide a restriction in one direction which may be nec-

essary for a specific application of the inventive control device. The restriction element 5 could also be provided to restrict the movement of the tilting area 1 a. Here, the restriction element 5 may vertically extend from the top or bottom surface 11, 12 of the suspension element 10. The exemplarily provided restriction element 5 of figure 13 fully restricts the movement in the positive x-direction. Therefore, a corresponding sensor element 3 may be omitted as shown in figure 13.

[0050] Figure 14 is a schematic side view of a tenth embodiment of the invention. An auxiliary or locking element 6 is provided attached to the inner bottom surface 12 of the suspension element 10 and also on the bottom surface of the tilting area 1 a. The auxiliary element 6 in the embodiment shown may be formed of magnetic elements. Upon movement of the tilting area 1 a, the magnet 6a on the tilting area 1 a locks with the magnet 6b of the suspension element 10. This locking may be overcome by an increased force applied to the input unit 2. The locking effect allows an output of a constant output signal for a certain time as long as the lock is not interrupted.

[0051] Figure 15 is a schematic side view of an eleventh embodiment of the invention. A haptic feedback element 7 is provided to apply a haptic feedback for the selected activity direction. This could be a detent or a multi-step detent. The haptic feedback element 7 of figure 15 consists of two parts, an extension element 7a extending from the tilting area 1a and having a protrusion and an interlocking element 7b with a plurality of indentations provided to interlock with the protrusion of the extension element 7a. The interlocking effect depends on the tilt of the tilting area 1 a and the protrusion may move from one indentation to the other along the path of movement of the tilting area 1 a providing a haptic feedback of detents.

[0052] Figure 16 is a schematic side view of a twelfth embodiment of the invention. In Figure 16, the restriction element 8 is provided to allow a certain movement in one direction, but to provide a restriction in that direction beyond the allowable movement. This may provide a protection or limitation of an impact for the tilting area 1a and/or the sensor element 3 in case of applying an extensive force or deflection to the input unit 2. In contrast to figure 13, the restriction element 8 does not fully restrict the movement in one direction. Therefore, a corresponding sensor element 3 is still provided.

[0053] Figure 17 is a schematic side view of a thirteenth embodiment of the invention. An auxiliary element 9 can provide an active acknowledgement of an executed action like optical or mechanical indicators/actuators from the control device where the actuation information is fed to a separate element.

[0054] In the embodiments shown, the sensor element 3 may be provided to translate an applied action or force by a proximity detection, i.e. contactless. This may be based on an optical, magnetic, capacitive, inductive, resistive detection or by voltage and current transducers. The sensor element 3 may alternatively translate an ap-

plied action by a pressure or force detection. Here, a spring activated switch could be used. Further, the sensor element 3 may translate and applied action by a tension detection in form of a strain gauge.

[0055] The sensor element 3 may also provide partial or full functionality of a hinge unit 1 c as shown in Figure 8. This may be implemented by a counterforce of pressed switch, which removes the full or partial need for an additional hinge unit 1 c.

[0056] Throughout the invention, sensor elements 3 can be located on at least one of the following elements: the tilting area 1 a, the rigid base 1 b, the hinge unit 1 c or the input unit 2 picking up any tension, travel or shift among the respective adjacent elements.

[0057] The invention has a number of benefits compared to prior art.

[0058] The inventive control device has high reliability resulting from a frictionless suspension and/or a frictionless translation of force / deflection to the sensor elements by a usage of contactless sensor elements.

[0059] The control device provides extreme climatic ruggedness against dust, dirt, humidity, temperature by a possible selection of corresponding materials, a frictionless suspension, a frictionless translation of force / deflection to sensor elements and the usage of contactless sensor element.

[0060] Further, a distinctive detection of multiple grades of directed action by the application of a mechanical path of the tilting area is feasible.

[0061] A flexible application of multiple grades of directed action by a combination of parts of a singular function like potentiometers, switches to an element having multi-action either separate or as a combination is provided by the inventive control device.

[0062] Further, the invention is cost efficient by a usage of standard materials and components like encoders, switches and a few additional manufacturing processes.

[0063] It should be understood that the embodiments shown may also be combined if not excluded otherwise.

[0064] While this invention has been described in connection with what is presently considered to be practical exemplary embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the scope of the appended claims.

LIST OF REFERENCE SIGNS

[0065]

1a	tilting area
1b	rigid base
1c	hinge unit
2	input unit
3	sensor element
4	support element
5,8	restriction element

- 6,9 auxiliary element
- 7 haptic feedback element
- 7a extension element
- 7b interlocking element
- 10 suspension element
- 11 top surface of suspension element
- 12 bottom surface of suspension element
- 13 side surface of suspension element
- 14 hole in suspension element
- 15 vertical extensions of suspension element
- 20 mechanical element

Claims

1. A control device comprising

a rigid base (1 b),
 a tilting area (1a) adapted to move relative to the rigid base (1b) upon exertion of a force thereto,
 a hinge unit (1c) connecting the tilting area (1a) to the rigid base (1b),
 an input unit (2) connected to the tilting area (1a) to apply a force to the tilting area (1 a), and
 at least one sensor element (3) provided to detect a movement of the tilting area (1 a).

- 2. Control device according to claim 1, wherein the rigid base (1 b) extends in a first plane and the tilting area (1 a) is provided to extend in parallel to or within the first plane in a situation where no force is exerted on the tilting area (1 a), and upon exertion of a force thereto adapted to be tilted with respect to the first plane and to extend in a second plane not parallel to the first plane.
- 3. Control device according to claim 1 or 2, wherein a suspension element (10) is provided to suspend the combination of the rigid base (1 b), the tilting area (1 a) and the hinge unit (1c).
- 4. Control device according to any one of the previous claims, wherein the tilting area (1 a), the rigid base (1 b) and the hinge unit (1 c) are integrally formed with each other.
- 5. Control device according to any one of the previous claims, wherein the tilting area (1a), the rigid base (1 b) and the hinge unit (1c) are formed of the same material, preferably of steel, stainless steel, ceramics, PCB or plastic.
- 6. Control device according to any one of the previous claims, wherein the tilting area (1a), and the rigid base (1 b) are formed of the same material and the

hinge unit (1 c) is formed of a different material.

- 7. Control device according to any one of the previous claims, wherein the hinge unit (1 c) is shaped such that a predetermined flexibility of the hinge unit (1 c) is obtained.
- 8. Control device according to claim 7, wherein the hinge unit (1c) is s-shaped, or has a meander like shape.
- 9. Control device according to any one of the previous claims, wherein the hinge unit (1 c) provides a bias force to the tilting area (1 a).
- 10. Control device according to any one of the previous claims, wherein the hinge unit (1 c) is provided by the sensor elements (2) adapted to be pressed or moved upon exertion of a force thereto.
- 11. Control device according to any one of the previous claims, wherein the input unit (2) is:
 - adapted to move in at least two directions, and/or
 - is an encoder, a joystick, a potentiometer or any other input element having at least one mode of intrinsic operation.
- 12. Control device according to any one of the previous claims, wherein a support element (4) is further provided to support the tilting area (1 a).
- 13. Control device according to any one of the previous claims, wherein the sensor element (3) is a contactless proximity sensor or translates an applied force by pressure/force or tension detection into an output signal.
- 14. Control device according to any one of the previous claims, wherein the sensor elements (3) are located on any one of the following elements: the tilting area (1 a), the rigid base (1 b), or the input unit (2).
- 15. Control device according to any one of the previous claims, wherein the sensor elements (3) form part of the input unit (2).
- 16. Control device according to any one of the previous claims, wherein a restriction element (5) is provided to restrict movement of the tilting area (1 a) in at least one of the possible directions of movement.
- 17. Control device according to any one of the previous claims, wherein an auxiliary element (6) is provided connectable to the tilted area to lock the control device in at least one direction.

18. Control device according to any one of the previous claims, wherein a haptic feedback element (7) is provided connectable to the tilted area to provide a haptic feedback of movement of the tilting area (1 a).

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Fig.1

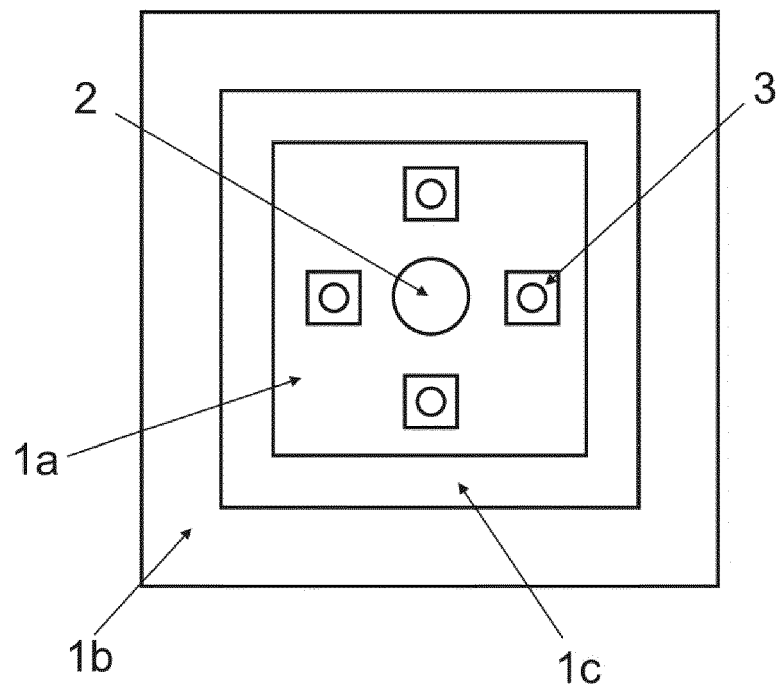


Fig.2

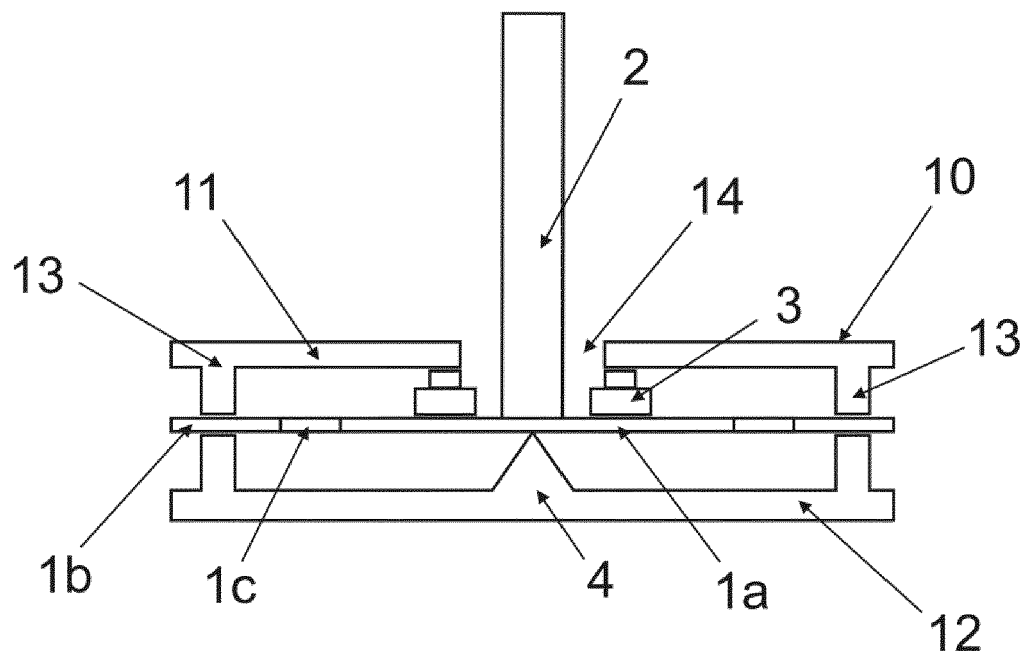


Fig.3

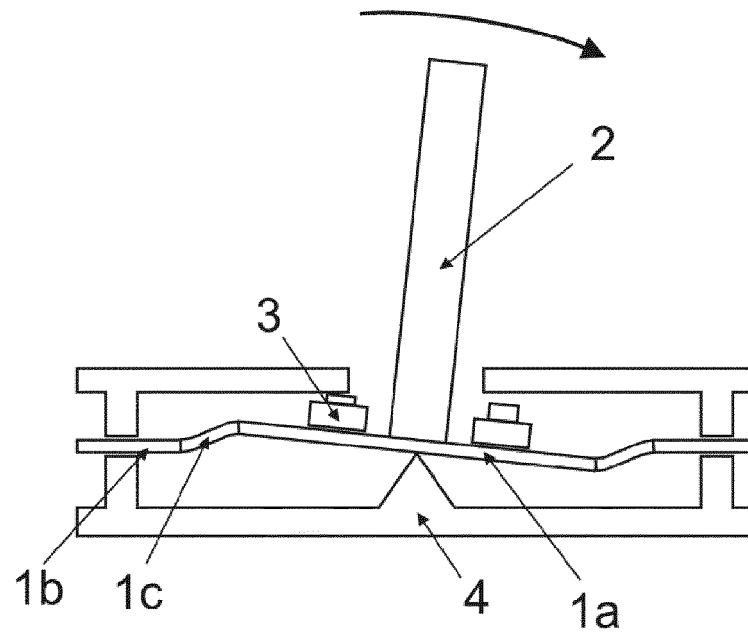


Fig.4

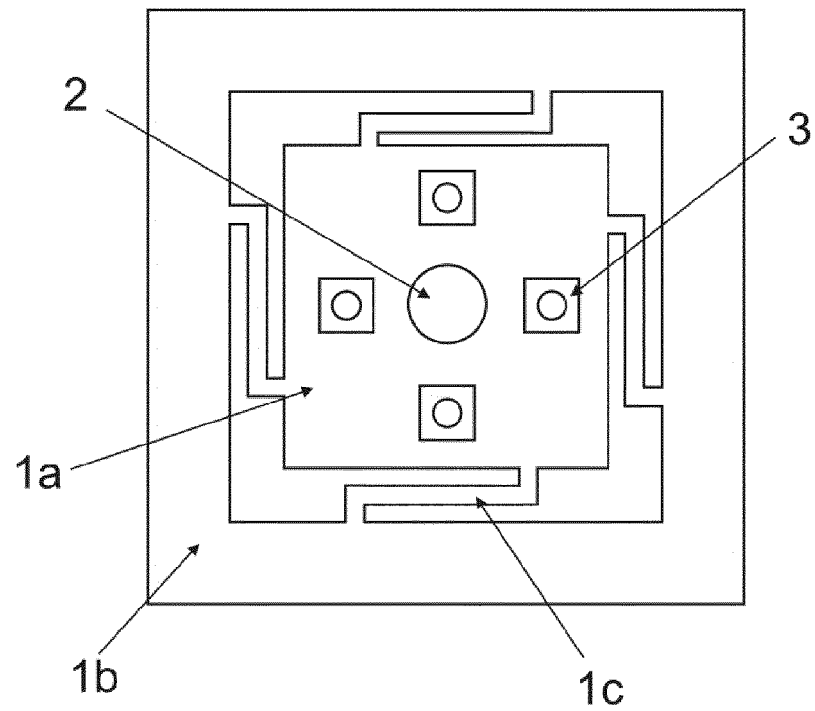


Fig.5

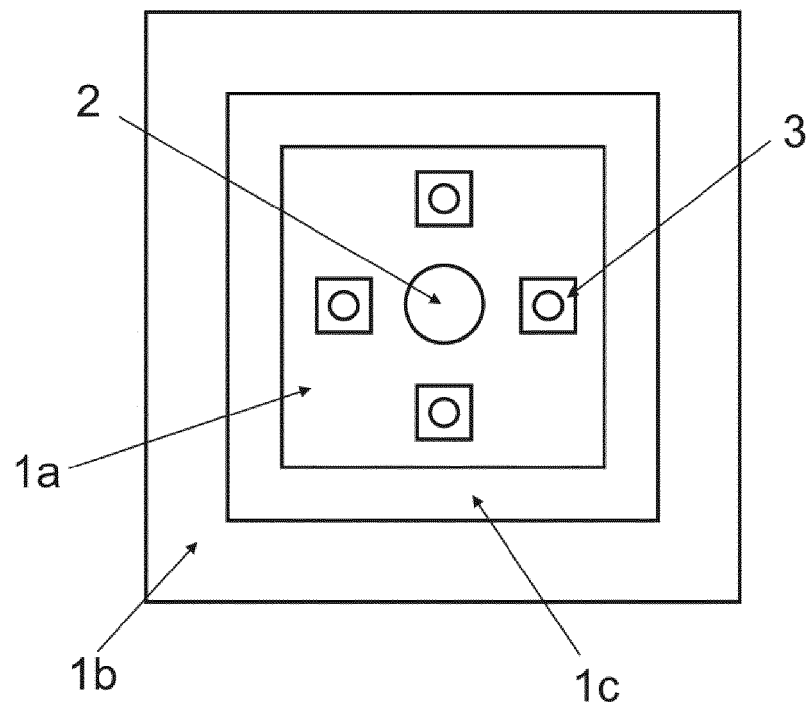


Fig.6

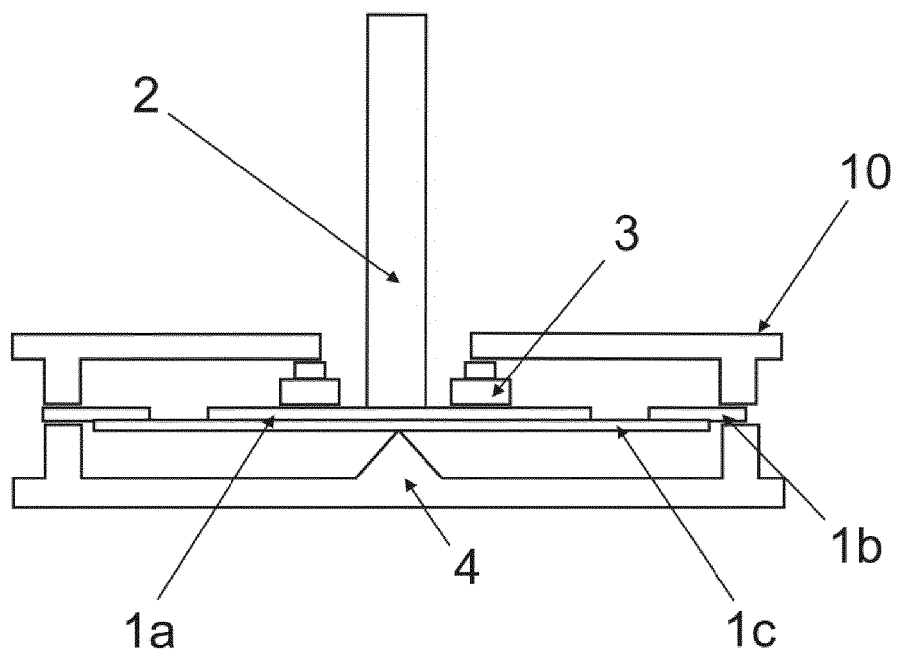


Fig.7

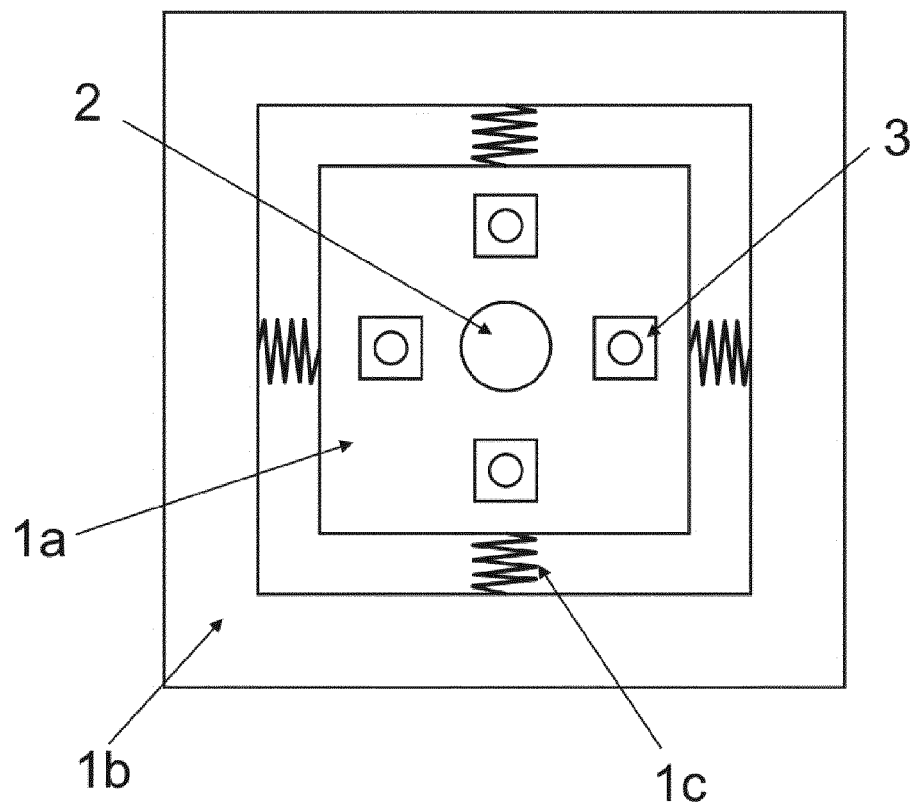


Fig.8

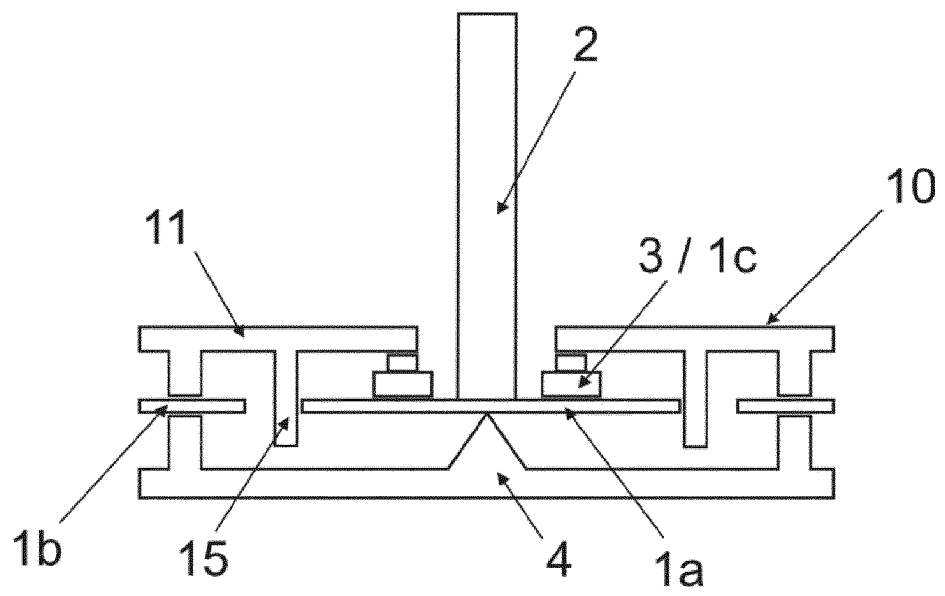


Fig.9

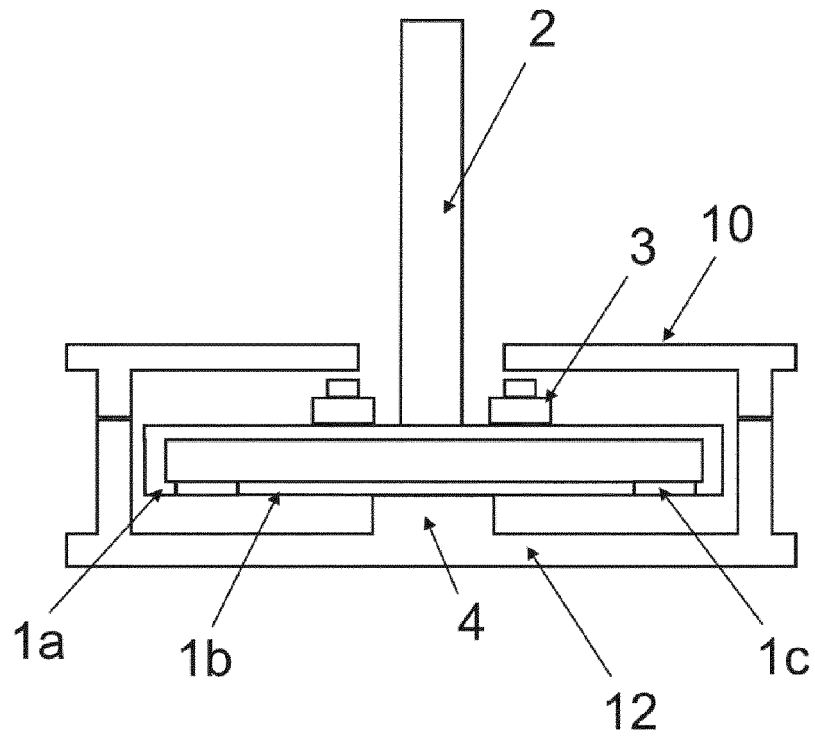


Fig.10

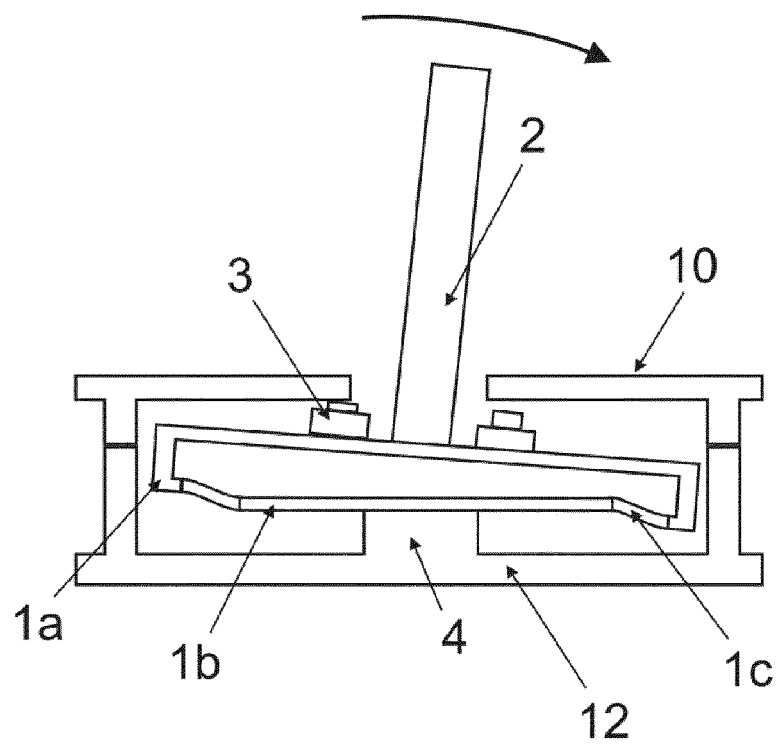


Fig.11

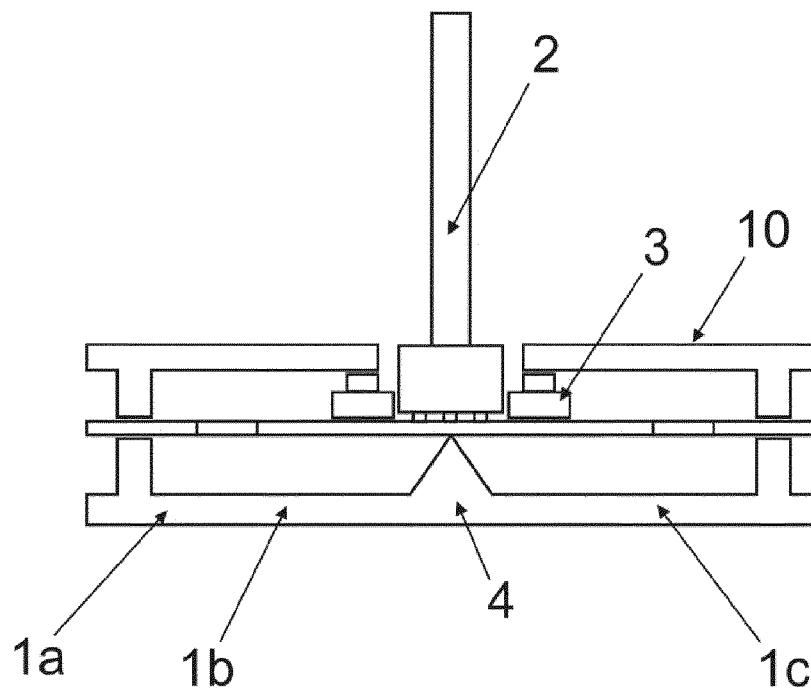


Fig.12

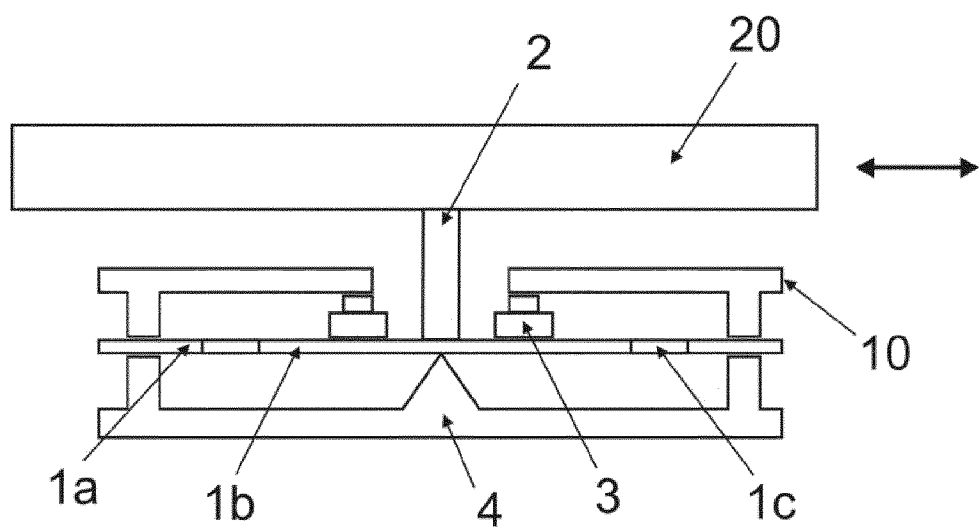


Fig.13

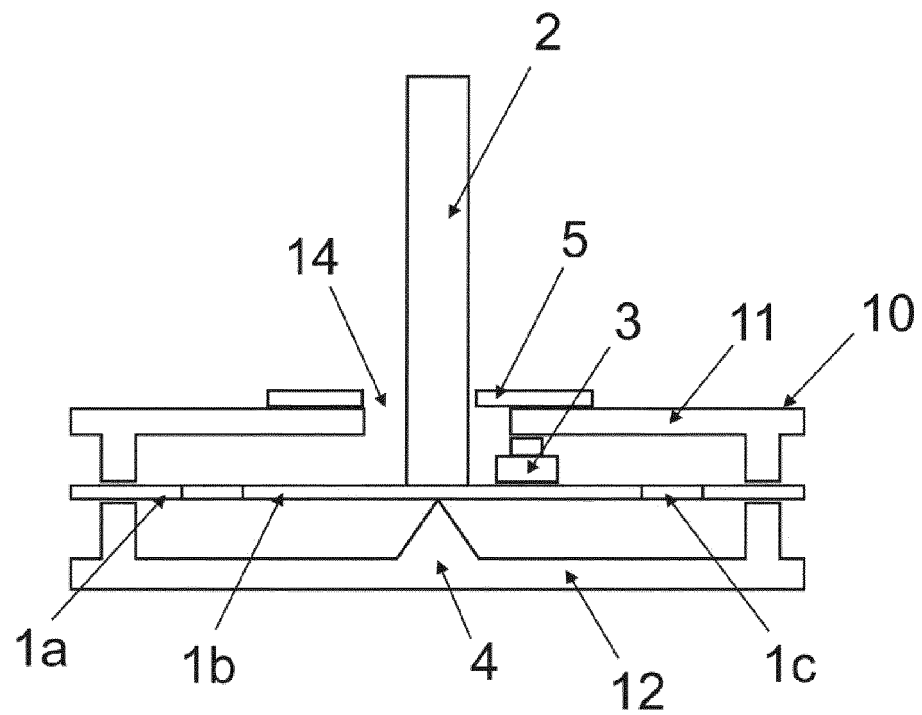


Fig.14

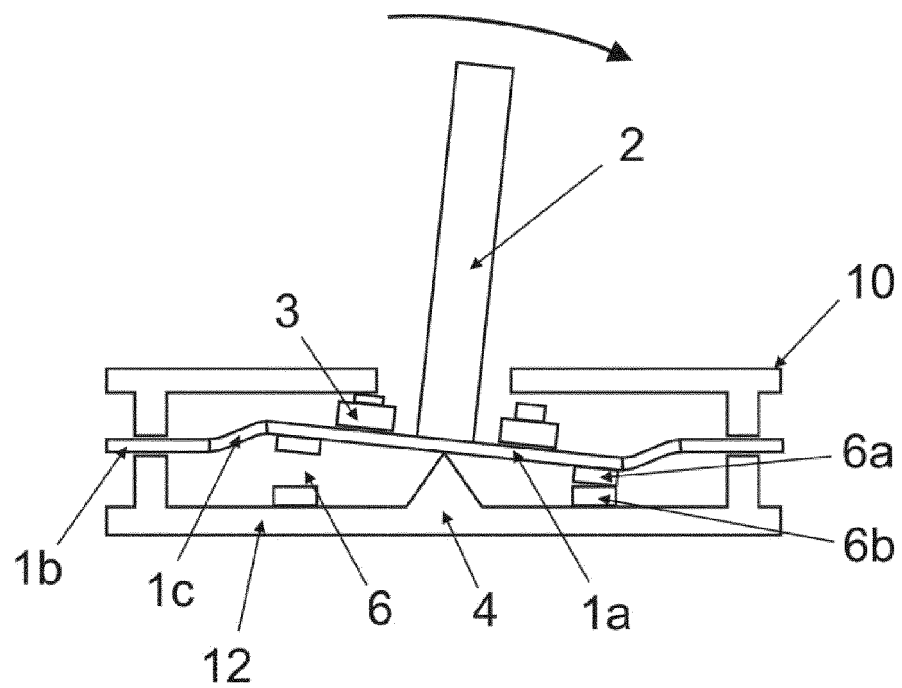


Fig.15

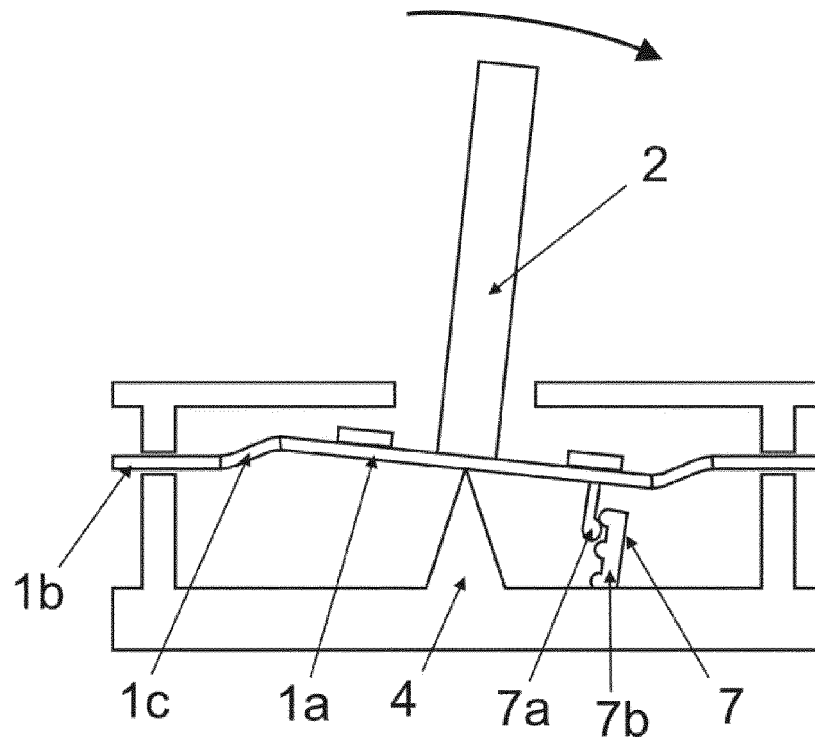


Fig.16

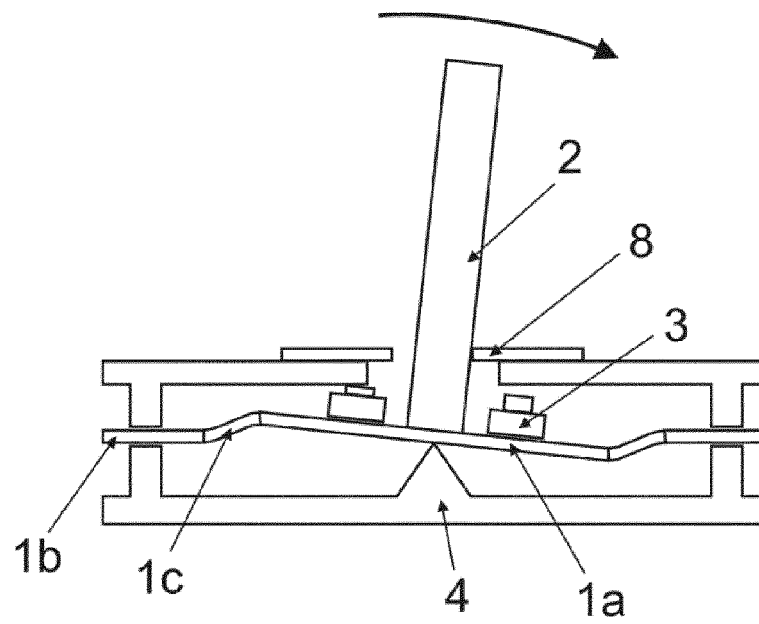
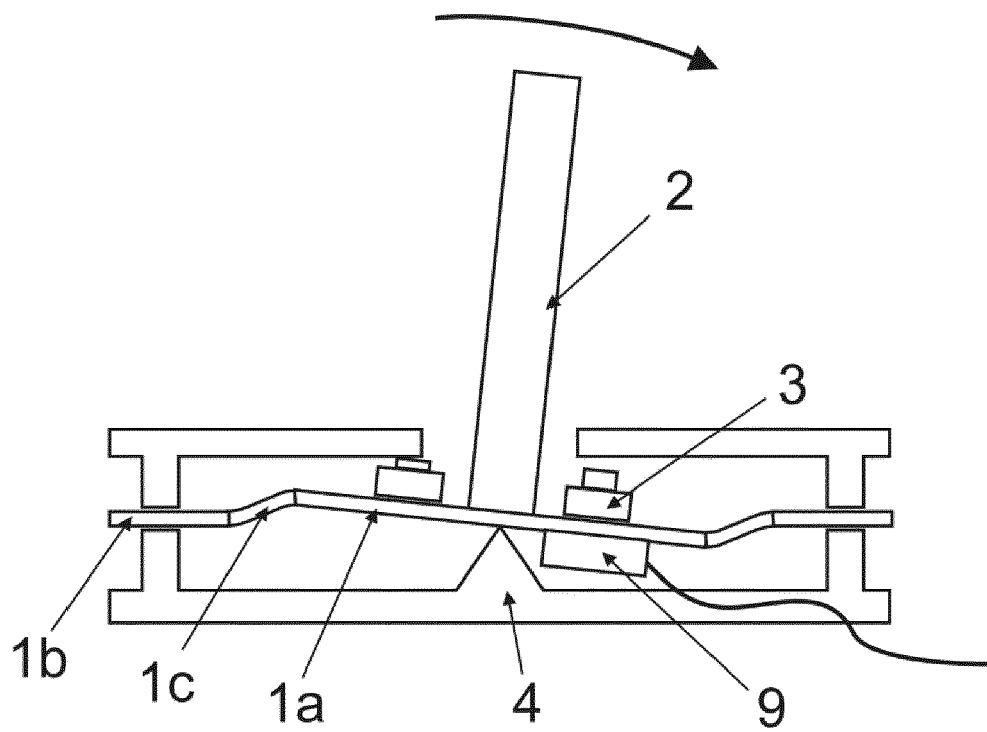


Fig.17





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