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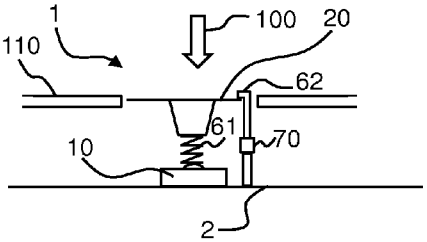
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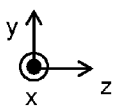


Fig. 1

(57) Abstract: The invention relates to the use of a push button device, described below, according to one of the subsequent claims for actuating a functionality in a motor vehicle, and also to a push button device of a functionality of a motor vehicle, wherein the push button device has: - a mechanical and/or electric function controller which has a first control state and a second control state; - a push button element with a manually actuable push button surface, wherein the push button element can be pressed from a disengaged state into a pressed state by way of a pressure force, wherein the function controller has the first control state when the push button element is in the disengaged state, and the function controller has the second control state when the push button element is in the pressed state, wherein the push button device has: - a first spring which acts upon the push button element with a first force in the direction of the disengaged state, - a retaining device which defines the position of the disengaged state of the push button element, wherein the push button device has an adjuster by means of which the position of the disengaged state of the push button element is adjustable.

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PUSH BUTTON DEVICE WITH ADJUSTMENT FUNCTION FOR APPLICATION IN A VEHICLE

The invention relates to a push button device which is actuated by way of a pressing movement of a user. The invention also relates to the specific use of the device as a function actuator of a motor vehicle; for example as a door actuator, in particular door opener, for a vehicle door.

DE 20 2009 009 861 U1 presents an already known door opener for attachment to the outer side of a vehicle door and having an actuation switch.

DE 10 2006 024 292 A1 presents an already known handle for the electric actuation of a lock on a flap or on a door in a vehicle by means of an electric switch.

The inventors have found the prior art to be disadvantageous insofar as the extent to which the push button device protrudes or is recessed with respect to a surrounding surface is dependent on component and assembly tolerances.

It is an object of the present invention to improve the disadvantages of the prior art. Said object is achieved by means of the independent claims. Advantageous refinements are defined in the subclaims.

The object is achieved in particular through the use of a push button device, described below, for actuating a functionality in a motor vehicle, preferably as a door actuator, in particular door opening control part and/or door locking control part, of a motor vehicle side door, in particular as a door exterior actuator, installed into the door exterior surface, or as a door interior actuator, installed into the door interior lining, of a motor vehicle side door. The invention is likewise realized by means of a module of a motor vehicle, for example a motor vehicle side door, having a push button device of said type as a door actuator, or a motor vehicle having a motor vehicle side door of said type.

In particular, the object is furthermore achieved by means of a push button device of a functionality of a motor vehicle, wherein the push button device has:

- a mechanical and/or electric function controller which has a first control state and a second control state;
- a push button element with a manually actuable (or manually actuated) push button surface (that is to say it is the intention for said surface to be pressed for example by hand), wherein the push button element is pressable from a disengaged state into a pressed state by means of a pressing force, preferably along a movement direction of the push button element, wherein preferably, the push button element is moved further in an engaging direction with respect to a surface, immediately surrounding the push button device, of the motor vehicle when in the pressed state than when in the disengaged state,
wherein the function controller has the first control state when the push button element is in the disengaged state, and the function controller has the second control state when the push button element is in the pressed state,
- a first spring which acts upon the push button element with a first force in the direction of the disengaged state,
- a retaining device which defines the position of the disengaged state of the push button element,
- an adjuster by means of which the position of the disengaged state of the push button element is adjustable.

By means of the retaining device, the position of the disengaged state can be predetermined and adapted to different installation situations. For example, it is possible for a flush termination of the push button device with the surrounding vehicle door surface to be defined; here, component tolerances however lead to sometimes undesired results. By means of the adjuster, even after installation or during the course of installation, a fine adjustment of the rest position of the push button element (position of the disengaged state), for example an alignment with the surrounding surface of the vehicle, can be performed. The position of the disengaged state of the push button element, or rest position, is particularly preferably to be understood to mean the position of the push button element in the direction of the pressure force to be applied, that is to say, for example, the distance between the push button element and the function controller or the extent to which the push button element is recessed, or protrudes, with respect to the immediately surrounding surface of the motor vehicle.

The first spring is preferably a compression spring, for example leaf spring or leaf spring pack, which is arranged in force-transmitting fashion between push button element and function controller, which first spring may in this case be coupled for example to one or more of the provided pivot arms. By means of a leaf spring or a leaf spring pack, a structural space-saving realization of a compression spring is realized which is conducive to the small installation depth of the push button device (for example for installation into the vehicle door).

The first spring preferably acts on a movable part of a function controller which is in the form of a switch, for example on the push button head of a microswitch.

The retaining device preferably forms a stop (for example a static or adjustable projection), particularly preferably a deflecting stop, for example by way of a second spring, as discussed below.

The push button device is preferably a device by means of which a user (for example driver or front passenger) can operate a particular function of the vehicle by pressing the push button element. In this case, after being pressed, it is not imperatively necessary for the push button element to return into the disengaged position of its own accord; rather, a push-push mechanism (similar functional principle to a ballpoint pen) is for example also possible. The push button device may preferably be installed in the interior compartment of the vehicle, or may be installed in the vehicle so as to be accessible from the outside. The push button device preferably has a holder which connects, for example, a first rotary joint and the function controller. The push button device preferably has a preferably shell-shaped support in which the push button device is pre-installed.

A functionality in a motor vehicle may be understood to mean, for example, the following: the opening and/or closing of the vehicle (doors, tailgate, luggage compartment cover), the opening and/or closing of a flap (for example glove compartment, fuel tank cap, charging cap), folding-over/adjustment of seat surfaces, functions controllable by control element in the dashboard/cockpit/interior compartment lining (for example air-conditioning system, entertainment, turn signals/windshield washer system, electric window lifter).

A mechanical and/or electrical function controller is preferably to be understood to mean a device which records or detects a movement of the push button element and controls, for example activates or deactivates, the functionality in response thereto. The function controller may for example be purely mechanical, for example a Bowden cable or a control linkage and/or gear mechanism, may be purely electrical, for example a sensor arrangement with Hall sensor, or may be electromechanical, for example a microswitch. The function controller preferably controls an electrical and/or mechanical actuator. Said function controller is preferably positionally fixed with respect to the vehicle or with respect to the holder of the push button device.

The first control state and the second control state of the function controller are preferably to be understood to mean two different states which, for example, directly or indirectly influence the state of the functionality (for example ON/OFF, CLOSED/OPEN).

An immediately surrounding surface of the vehicle may be in particular be a door interior lining, seat lining, dashboard or (interior or exterior) sheet-metal regions of the vehicle which are visible or which lie within the reach of the user. The immediately surrounding surface of the vehicle is, for example, the exterior metal sheet of the vehicle door.

The push button element serves for the actuation of the functionality by the user. The push button surface preferably faces toward the user. Preferably, the push button element has an attached panel and the push button surface is the surface of the panel. The user should press the push button surface in order to actuate the push button device. The required pressure force is preferably in the range from 1 N to 1000 N, particularly preferably from 10 N to 100 N, very particularly preferably in the range from 20 N to 40 N. The panel preferably covers openings of the push button element for the adjustment of the disengaged position and/or for the adjustment of the depressed position, preferably by means of a tool, preferably hand-operated tool (for example screwdriver), of the push button element relative to the holder or support. The push button surface preferably adjoins the surface of the vehicle (for example door surface) in approximately flush fashion. The push button element is preferably displaceable in substantially or approximately linear or translational fashion between the disengaged and pressed states. The push button element is preferably movable

relative to the holder and/or relative to the function controller and/or relative to the vehicle door. The difference between the depressed and disengaged positions is preferably, in particular in the case of a door opener, less than 5 mm, particularly preferably less than 2 mm, and is very particularly preferably 1.5 mm.

In a further exemplary embodiment of the present invention, the push button device is a door opener and/or the function controller is an electric switch.

This gives rise to highly advantageous usage, firstly as a push button for opening the door, secondly for the electrical actuation of a functionality, for example the opening of the door.

The door opener is preferably an electric door opener for the actuation of an actuator of a vehicle door closure and/or of an actuator of a vehicle door opening and/or closing mechanism for installation into the vehicle door. The door opener is preferably a module which can be installed into a vehicle door. The door opener preferably does not have a handle, such that it is only possible for a pushing movement to be exerted on the door opener by the user. A vehicle door closure is preferably to be understood to mean the lock of the vehicle door, which has for example a latch mechanism and a locking mechanism. A vehicle door opening and/or closing mechanism is preferably to be understood to mean a mechanism by means of which the vehicle door is automatically pivoted open and/or closed and/or slid open and/or closed.

The vehicle door is for example a driver's door or front passenger's door or a tailgate.

The switch is preferably a switch for generating an electrical signal, wherein the first control state is a first switching state and the second control state is a second switching state. The switch is preferably a push button switch, preferably microswitch. A switch may also be understood to mean a sensor arrangement, for example with a Hall sensor or piezo element, which distinguishes between at least two different mechanical states and outputs a signal in a manner dependent thereon.

In a further exemplary embodiment of the present invention, the first spring is a catch spring, for example a leaf spring with snap action effect.

A catch spring has the advantage of an audible click or perceptible snapping action when the spring overshoots a particular compressed state, which can be used as

audible and/or tactile feedback for the user of the door handle. The catch spring is preferably of dome-shaped or conical form.

In a further exemplary embodiment of the present invention, the push button device has a second spring as part of the retaining device, which second spring acts upon the push button element with a second force in the direction of the pressed state.

In this way, the second spring forms a stop which deflects in the disengagement direction. Thus, during the disengagement movement of the push button element, there is not a sudden stoppage of movement but rather a smooth braking action until spring equilibrium is achieved between the first and second springs. Furthermore, rattling noises which arise for example owing to an abutment are eliminated. The second spring is preferably a tension spring. It is preferably (in each case indirectly or directly) coupled in force-transmitting fashion at one side to the push button element, and at the other side to a part which is positionally fixed (with respect to the vehicle and/or holder) of the push button device; here, said second spring may for example be coupled to one or more provided pivot arms. The statement that the spring is part of the retaining device is also to be understood to encompass the situation in which the second spring is the only part of the retaining device, that is to say the retaining device is formed by the second spring.

The first spring preferably has a spring constant which is very high (for example greater by one, preferably two, particularly preferably three orders of magnitude) in relation to the spring constant of the second spring. In this way, the travel required for pressing in the push button element for the actuation of the function controller is approximately constant, such that even in the case of a push button element which has been adjusted by way of the adjuster, the push button feel is approximately the same. The change in the push button element then corresponds, for example, to the distance by which the screw of the adjuster is screwed in or out.

In a further exemplary embodiment of the present invention, the second spring is a wire bow spring which extends transversely, preferably substantially perpendicular, to the direction of movement of the push button element.

In this way, a particularly structural space-saving realization of a tension spring is realized which is conducive to the small installation depth of the push button device in

the vehicle. The wire bow spring is preferably held by at least one positionally fixed hook preferably in the central region of the wire bow spring. It is preferable for the ends of the wire bow spring to act on two pivot arms connected to the push button element, or on the push button element.

In a further exemplary embodiment of the present invention, by means of the adjuster, the magnitude of the first force and/or the magnitude of the second force can be adjusted, and thus the position of the disengaged state of the push button element can be adjusted.

In this way, even after installation, a fine adjustment of a rest position, which is spring-loaded from both sides, can be performed in a simple manner. It is preferably possible for the preload of one or both springs to be varied by way of an adjustment element, for example a (grub) screw. Here, at least one of the coupling points of a spring is preferably changed with regard to its relative position with respect to the push button element and/or with respect to the function controller.

In a further exemplary embodiment of the present invention, the adjuster has a screw which is acted on by one of the springs, wherein a preload of said spring can be adjusted by means of the screw.

This yields a simple adjustment facility with few components, which can be operated by way of a simple tool.

In a further exemplary embodiment of the present invention, the push button element has an opening for the operation of the adjuster preferably by means of a tool, in particular hand-operated tool (for example screwdriver). The opening preferably permits operation of the adjuster proceeding from the side of the push button surface (that is to say proceeding from the front side).

This yields simple accessibility for adjustment purposes.

In a further exemplary embodiment of the present invention, the push button device has at least one adjustable stop which defines a position of a maximally pressed state of the push button element.

In this way, adjustable overload protection is provided, such that the user cannot damage the function controller by pushing the push button element in with too great a force.

In a further exemplary embodiment of the present invention, the stop is a screw which is arranged at least partially below or within the push button element, wherein the push button element has an opening for the rotation of the screw, preferably by means of a tool, in particular hand-operated tool (for example screwdriver). The opening preferably permits operation of the adjuster proceeding from the side of the push button surface (that is to say proceeding from the front side).

In this way, a simple and space-saving means for adjustment is realized which requires no structural space to the side of the push button element and which can furthermore be concealed from the user, for example by way of a covering panel for the opening. The screw is preferably arranged, out of the view of an operator, below or within the push button element.

In a further exemplary embodiment of the present invention, the push button device has a coupler mechanism which consists of one or more rotary joints which interact with one or more pivot arms, wherein the push button element is guided in relation to the function controller by means of the coupler mechanism.

In this way, the precise setting of the rest position of the push button element by means of the adjuster is made easier. It is preferable for at least two axes of rotation of the rotary joints to be parallel and spaced apart from one another and positioned in series by way of a pivot arm. It is particularly preferable for two such rotary joint pairs, coupled by way of in each case one pivot arm, to be provided. Said pivot arms preferably pivot in the same direction of rotation when the push button element is pressed. It is particularly preferable for the pivot arms to be coupled to one another by way of a further coupling arm and two further rotary joints.

In a further exemplary embodiment of the present invention, the push button device has a sealing element which surrounds the push button element at least in regions and bears against said push button element and which has a bead which, in the installed state of the push button device, bears against the reverse side of the immediately surrounding surface of the vehicle.

In this way, flexible sealing of the structural space in which the push button device is installed, for example of the vehicle door cavity, is realized, which can follow the movement of the push button element by virtue of the bead rolling on the reverse side and which realizes a sealing action both in the pressed state and in the disengaged state. The bead thus adapts to the movement, in particular to a movement component of the structural element perpendicular to the surrounding surface, and permits a consistent sealing action. The push button element preferably has at least two positions, a first position and a second position, wherein the push button element is moved further in an engaging direction relative to the surface in the second position than in the first position, wherein, by means of a deformation of the bead from the first position in relation to the second position, a sealing action is realized in both positions.

The sealing element may preferably be used in other applications which relate not imperatively to a push button device but more generally to a seal of a gap between two components, which form the gap between them, of a vehicle below a surface, wherein the components move relative to one another (for example a tank cap and the surrounding vehicle surface). An advantageous synergistic effect between an adjuster and the seal element is that, with the adjustability of the rest position of the push button element, the size of the contact surface of the bead against the reverse side of the surface is also adjustable, whereby the sealing action is also adjustable. Furthermore, the influence which is exerted by the elastic sealing element on the spring equilibrium and which thus moves the push button element into an undesired rest position can be compensated.

What preferably suffices is a sealing action with respect to fouling (dust protection), particularly preferably spray water, wherein a spray water sealing action exists in particular at the top side of the sealing element in the installed state and preferably at the side surfaces. The sealing element preferably completely surrounds the push button element.

The bead is preferably formed by a convex bulge of the sealing element in the direction of the surface against which said bead is to bear, wherein the bead is particularly preferably of hollow form or concave on the other side, such that said bead is easily deformable and can thus particularly advantageously roll on the reverse side. The contour of the convex side preferably runs substantially parallel to the contour of

the concave side, that is to say, in the extreme case, the bead is formed by a bulge with constant material thickness. The bead preferably lies with the convex side against the reverse side, or is set up in this way. It is preferable for that end of the bead which is averted from the push button element, that is to say an outer edge of the sealing element or the end which does not adjoin that region of the sealing element which bears against the push button element, to be at least regionally fixed relative to the reverse side of the surface of the vehicle, for example by virtue of the sealing element, at its outer edge, being regionally, or across the reverse side of the surrounding surface, pushed into one or more grooves. The grooves are for example part of a housing which bears the structural element, or said grooves are arranged directly on the reverse side. The structural element is preferably held by a shell-shaped support which is fixed relative to the reverse side of the surface of the vehicle, and that end of the bead which is averted from the structural element is at least regionally fixed to the support. In this way, the sealing element furthermore simultaneously serves as a seal between the support and the vehicle space surrounding the support.

The sealing element preferably defines an inner opening with an inner edge which bears against the push button element. The push button element preferably has an at least partially encircling shoulder on which the inner edge lies and is thus positioned in two directions. The bead of the sealing element preferably runs further outward.

In a further exemplary embodiment of the present invention, the bead has drainage depressions.

In this way, water which collects in the gap between the push button element and the immediately surrounding surface can run off or evaporate, whereas dirt continues to be effectively kept away. This furthermore promotes a self-cleaning effect, as dried dirt can be more easily blown out by the relative wind. It is preferable for the drainage depressions to be provided in particular on that side of the sealing element which is situated at the bottom in the installed state, such that water can simply flow off, but dirt is kept away.

In a further exemplary embodiment of the present invention, the push button element has an attachable panel, and the sealing element bears against the push button

element and/or the panel in a gap between the panel and a surface of the push button element.

In this way, it is firstly possible for openings in the push button element (for example for adjustment) to be covered by the panel, wherein sealing (spray water and/or dirt) between the push button element and panel is realized by way of the sealing element, and secondly, the panel holds the sealing element in position at its inner edge.

The panel is for example a panel, preferably chromium panel, whereby an appealing appearance can be attained without the push button element, which is cumbersome to produce owing to its attachment points to, for example, rotary joints and/or springs and/or other guide means, having to undergo expensive surface treatment. Said panel preferably has a surface which covers that side of the push button element which faces toward the user, at least to the extent that the user would see the push button device. The panel preferably has lateral projections which also laterally partially cover the push button element. The panel can preferably be mounted on the push button element by means of a snap-action fastener or by means of a mount-and-slide fastener (for example a linear bayonet fastener) with preferably L-shaped guide grooves.

Here, the gap may also be larger than the thickness of the sealing element at that location (for the desired sealing action, this is nevertheless sufficient), though the gap is advantageously of the same size as, or slightly smaller than, the thickness of the sealing element at that location, such that no residual gap remains.

In a further exemplary embodiment of the present invention, the sealing element has a region of high Shore hardness for abutment against the push button element, and/or the panel has a region of low Shore hardness for forming the bead.

In this way, it is firstly possible for the sealing element to be of more stable design in the region of the push button element and/or the panel, such that there, the assembly process is simpler and/or the mounting of the panel is easier, for example because the sealing element does not undesirably fold there. Furthermore, a relatively hard region permits better positioning in grooves. Secondly, the region in which the push button element rolls on the vehicle door inner surface (as the reverse side of the immediately surrounding surface) can be designed to be soft, such that the rolling takes place in an

advantageous fashion. The sealing element is preferably produced in the form of a two-component or multi-component injection molded part. Here, the region of high Shore hardness is preferably composed of a first component, and the region of low Shore hardness is preferably composed of a second component.

In a further exemplary embodiment of the present invention, the push button element has, on one side, a groove into which an inner edge of the sealing element is placed.

In this way, a fixing of the sealing element to the push button element is realized which is easy to assemble. In the case of a push button device which is a door opener, the lateral groove is preferably provided on that side of the push button element which, in the installed state of the door opener, is situated close to and parallel to the door side edge.

The invention will now be discussed in more detail by way of an example on the basis of drawings. In the drawings:

figure 1 shows a push button device according to the invention,

figures 2a-b show a push button device according to the invention based on figure 1, wherein the retaining device has a spring, and furthermore, an optional sealing element is shown,

figures 3a-c show a push button device according to the invention based on figure 1 and, in part, figures 2a and b, wherein the first spring is a catch spring,

figures 4a-d show a realization of the invention based on the preceding figures, with a multiplicity of advantageous further features.

Figure 1 shows a push button device 1 according to the invention of a functionality of a motor vehicle. Said push button device has a mechanical and/or electric function controller 10 which has a first control state and a second control state. Said push button device has a push button element 20 with a manually actuable push button surface, wherein the push button element 20 can be pressed from a disengaged state into a pressed state by way of a pressure force 100. The function controller 10 has the first control state when the push button element 20 is in the disengaged state, and the function controller 10 has the second control state when the push button element 20 is

in the pressed state. The push button device 1 furthermore has a first spring 61, which acts on the push button element 20 with a first force in the direction of the disengaged state, and a retaining device 62, which defines the position of the disengaged state of the push button element 20. Furthermore, the push button device 1 has an adjuster 70 by means of which the position of the disengaged state of the push button element 20 is adjustable. The retaining device 62 is in this case shown by way of example as a hook-like element, the length of which can be adjusted by way of the adjuster 70.

In this way, the position of the push button element 20 in the disengaged state, in particular the projecting length of the push button element 20 in relation to a surface 110, immediately surrounding the push button device 1, of the vehicle can be adjusted.

Figures 2a-b show a push button device 1 according to the invention based on figure 1, wherein the push button device 1 has a second spring 62.1 as part of the retaining device 62, and furthermore, an optional sealing element 90 is shown. Figure 2a shows the disengaged state of the push button element 20, and figure 2b shows the engaged state. The second spring 62.1 acts on the push button element 20 with a second force in the direction of the pressed state. The adjustment device 70 has a screw 71 which is acted on by the second spring 62.1, wherein, by means of the screw 71, a preload of the second spring 62.1 can be adjusted, resulting in a changed position of the push button element in the disengaged state owing to the changed spring equilibrium. Owing to the spring equilibrium, it is thus possible by way of the adjuster 70 for the magnitude of the first force and the magnitude of the second force to be adjusted, and thus for the position of the disengaged state of the push button element 20 to be adjusted. The push button element 20 has an opening 23 for the operation of the adjuster 70. The optional sealing element 90 surrounds the push button element 20 and bears against the latter. Said sealing element has a bead 91 which, in the installed state of the push button device 1, bears against the reverse side of the immediately surrounding surface 110 of the vehicle. In figure 2a, the bead 91 bears against the reverse side over a large area, and in figure 2b, which shows the pressed-in state of the push button element 20, the bead 91 bears against the reverse side over a smaller area.

In this way, a rest position of the push button element is realized which is defined by force equilibrium and which is furthermore adjustable by way of the adjuster, in this case by way of a screw. Furthermore, a seal is provided; a sealing action is attained in any state, pressed or disengaged. The adjuster is advantageous in particular with the use of a sealing element because, in this way, it is firstly possible for the sealing action to be adjusted, and secondly, the influence which is exerted by the elastic sealing element on the spring equilibrium and which thus moves the push button element into an undesired rest position can be compensated.

Figures 3a-c show a push button device 1 according to the invention based on figure 1 and, in part, figures 2a and b, wherein the first spring 61 is a catch spring. In this variant, the screw 71 is acted on by the first spring 61. Figure 3a shows the push button element 20 in a rest position, and figure 3b shows the push element 20 in the pressed position, wherein here, the catch spring has snapped over. Figure 3c shows the rest position of the push button element 20 after the screw 71 has been screwed further into the push button element 20 (dashed rotary arrow). The push button element 20 has moved further upward as a result of the rotation of the screw 71. Tactile and/or haptic feedback is made possible by way of the catch spring. Furthermore, a catch spring normally has a high spring constant up to the snap-over point, such that the pressing travel up to the snap-over point remains approximately constant even after an adjustment by way of the adjuster. Here, an exemplary optional mounting of the push button element is shown for holding the push button element on a translatory path – other mounting options may also be used (such as for example a coupler mechanism).

Figures 4a-d show a realization of the invention based on the preceding figures, with a multiplicity of advantageous further features. Figures 4a and b show two longitudinal sections at different Z positions. Figure 4c shows a perspective view, wherein the push button element 20 has been removed for the purposes of the illustration, and figure 4d shows a perspective cross-sectional illustration. The push button device 1 is a door opener, and the function controller 10 is an electric switch.

The push button device 1 has a coupler mechanism, wherein the push button element 20 is guided relative to the function controller 10 by way of the coupler mechanism. The push button device 1 has a first rotary joint 31 with a rotary joint axis, and has a

first pivot arm 51. The push button device 1 furthermore has a second rotary joint 32 with a rotary joint axis, wherein the rotary joint axes of the first and second rotary joints 31, 32 are spaced apart from one another and the push button element 20 and the function controller 10 are connected to one another by way of the first rotary joint 31, the first pivot arm 51 and the second rotary joint 32. The first and the second rotary joint 31, 32 are connected in series by way of the first pivot arm 51. Here, furthermore, a holder 2 is shown as part of the push button device 1, which holder connects the first rotary joint 31 and the function controller 10, wherein there may also be a direct connection between function controller 1 and push button element 20 without holder 2. The push button device 1 has a second pivot arm 52 and also a third rotary joint 33 and a fourth rotary joint 34 with in each case one rotary joint axis, wherein the rotary joint axes of the third and fourth rotary joints 33, 34 are arranged parallel to the provided rotary joint axes, wherein the push button element 20 and the function controller 10 are furthermore connected to one another by way of the third rotary joint 33 and the fourth rotary joint 34, and the third rotary joint 33 and the fourth rotary joint 34 are connected in series by way of the second pivot arm 52. Here, the push button element 20 forms a coupling, corresponding to a four-bar linkage, between the first and third rotary joints 31, 33, such that these rotate approximately synchronously. The first pivot arm 51 and the second pivot arm 52 are designed to be pivoted in an identical direction of rotation as a result of a movement of the push button element 20. If a user pushes on the push button element 20 with a force 100 far to the outside, as shown, the other end of the push button element 20 is also pulled downward by way of the rotary joint arrangement, as the freedom of movement of the push button element 20 on the other side is restricted by the rotary joint 34, the rotary joint 33 and the pivot arm 52.

Furthermore, the push button device 1 preferably has a coupling arm 53 and a fifth rotary joint 35 and a sixth rotary joint 36 with in each case one axis of rotation, wherein the axes of rotation of the fifth and sixth rotary joints 35, 36 are arranged parallel to the provided rotary joint axes, and wherein the first pivot arm 51 is connected by way of the fifth rotary joint 35 to the coupling arm 53, and the second pivot arm 52 is connected by way of the sixth rotary joint 36 to the coupling arm 53. In this way, the synchronization between the rotary joints 31, 33 is further improved, which is highly effective in particular in the angle range which is of interest for the translational

movement of the push button element 20 (the two pivot arms 51, 52 approximately parallel and on one axis). If a user pushes on the push button element 20 with a force 100 far to the outside, as shown, the other end of the push button element 20 is also pulled downward by way of the rotary joint arrangement. By way of the rotary joint 32 and the pivot arm 51, the pivot arm 51 is pivoted about the rotary joint 31. Here, with the pivot arm 51, the rotary joint 35 is also pivoted, such that the coupling arm 53 exerts a pressure force on the rotary joint 36. Said pressure force pivots the pivot arm 52 about the rotary joint 33 and effects a pulling action on the push button element 20 via the rotary joint 34.

The push button surface has a long side 21 and a short side 22, and the provided rotary joint axes are arranged perpendicular to the long side 21.

The second spring 62.1 is a wire bow spring which extends transversely, and substantially perpendicularly, with respect to the direction of movement of the push button element 20. The push button device 1 has at least two adjustable stops 80, 80' which define a position of a maximally pressed state of the push button element 20. The stops 80, 80' are screws 81, 81' which are arranged at least partially below or within the push button element 20. The push button element 20 has an attachable panel 25 and the sealing element 90 bears against the push button element 20 and the panel 25 in a gap between the panel 25 and a surface of the push button element 20. The sealing element 90 has a region of high Shore hardness 92 for abutment against the push button element 20, and the panel 25 has a region of low Shore hardness 93 for forming the bead 90. The bead 90 is shown in a relaxed position such as would be assumed if the surface 110 were not present. The push button element 20 has, on one side, a groove 26 into which an inner edge of the sealing element 90 is placed. The push button device 1 has a holder 2, which connects the first rotary joint 31 and the function controller 10, and a shell-shaped support 3, into which the push button device 1 is pre-installed. The push button element 20 is thus held by way of the holder 2 and the support 3, wherein the support 3 is fixed relative to the reverse side of the surface 110 of the vehicle. That end of the bead 91 which is averted from the push button element 200 is at least regionally fixed to the support 3, whereby the sealing element 90 furthermore also seals off the interior of the support 3 with respect to the vehicle space below the surface 110.

With this invention, simple adjustability of a push button element relative to a surface surrounding it is realized, whereby production or assembly tolerances can be compensated. In a particular embodiment with two springs, wherein the spring which forces the push button element into the rest position has a high spring constant in relation to the spring which acts on the push button element in the direction of the pressed state, the travel of the push button element from the rest position to the pressed state remains approximately the same even if an adjustment of the rest position is performed. The invention preferably encompasses a mechanical coupling of the push button element by means of an adjustment screw and two springs which, preloaded oppositely to one another, are in spring equilibrium. One spring holds the push button element in the rest position such that the push button element cannot fall out (and is furthermore situated in a defined position), and the other spring pushes the push button element back into the rest position from the pressed state. An optional catch spring makes it possible to realize pleasant switch feel by way of haptic and/or acoustic feedback.

List of reference numerals

1	Push button device, for example electric door opener
2	Holder
3	Support
10	Function controller, for example switch
20	Push button element
21	Long side of the push button element
22	Short side of the push button element
23	Opening for screw 71
25	Panel
26	Groove
31	First rotary joint
32	Second rotary joint
33	Third rotary joint
34	Fourth rotary joint
35	Fifth rotary joint
36	Sixth rotary joint
51	First pivot arm
52	Second pivot arm
53	Coupling arm
61	First spring
62	Retaining device
62.1	Second spring
70	Adjuster
71	Screw
80	Stop
81	Screw
90	Sealing element
91	Bead
92	Region of high Shore hardness
93	Region of low Shore hardness
100	Pressing force
110	Surface, immediately surrounding the push button device, of the vehicle

Patent claims

1. Use of a push button device (1) according to one of the subsequent claims for actuating a functionality in a motor vehicle.

2. Push button device (1) of a functionality of a motor vehicle, wherein the push button device (1) has:
- a mechanical and/or electric function controller (10) which has a first control state and a second control state;
- a push button element (20) with a manually actuable push button surface, wherein the push button element (20) is pressable from a disengaged state into a pressed state by means of a compressive force (100),
wherein the function controller (10) has the first control state when the push button element (20) is in the disengaged state, and the function controller (10) has the second control state when the push button element (20) is in the pressed state,
- a first spring (61) which acts upon the push button element (20) with a first force in the direction of the disengaged state,
- a retaining device (62) which defines the position of the disengaged state of the push button element (20),
characterized in that
the push button device (1) has an adjuster (70) by means of which the position of the disengaged state of the push button element (20) is adjustable.

3. Push button device (1) according to Claim 2, wherein the push button device (1) is a door opener, and/or the function controller (10) is an electric switch.

4. Push button device (1) according to Claim 2 or 3, wherein the first spring (61) is a snap spring.

5. Push button device (1) according to one of Claims 2 to 4, wherein the push button device (1) has a second spring (62.1) as part of the retaining device (62), which

spring acts upon the push button element (20) with a second force in the direction of the pressed state.

6. Push button device (1) according to Claim 5, wherein the second spring (62.1) is a wire bow spring extending transversely with respect to the direction of movement of the push button element (20).

7. Push button device (1) according to Claim 5 or 6, wherein by means of the adjuster (70) the magnitude of the first force and/or the magnitude of the second force is adjustable and therefore the position of the disengaged state of the push button element (20) is adjustable.

8. Push button device (1) according to Claim 7, wherein the adjuster (70) has a screw (71) which is acted upon by one of the springs (61, 62.1), wherein a pretensioning of said spring (61, 62.1) is adjustable by means of the screw (71).

9. Push button device (1) according to one of Claims 2 to 8, wherein the push button element (20) has an opening (23) for the operation of the adjuster (70).

10. Push button device (1) according to one of Claims 2 to 9, wherein the push button device (1) has at least one adjustable stop (80) which defines a position of a maximally pressed state of the push button element (20).

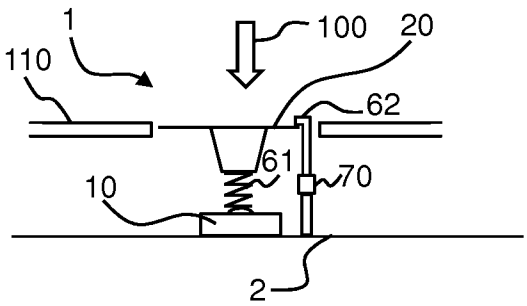
11. Push button device (1) according to Claim 10, wherein the stop (80) is a screw (81) which is at least partially arranged under or within the push button element (20), wherein the push button element (20) has an opening for rotating the screw (81).

12. Push button device (1) according to one of Claims 2 to 11, wherein the push button device (1) has a coupler mechanism which consists of one or more rotary joints (31, 32, 33, 34, 35, 36) which interact with one or more pivot arms (51, 52), wherein the push button element (20) is guided in relation to the function controller (10) by means of the coupler mechanism.

13. Push button device (1) according to one of Claims 2 to 12, wherein the push button device (1) has a sealing element (90) which surrounds the push button element (20) at least in regions and bears thereagainst and which has a bead (91) which, in the installed state of the push button device (1), bears against the reverse side of the immediately surrounding surface (110) of the vehicle.

14. Push button device (1) according to Claim 13, wherein the push button element (20) has an attachable panel (25) and the sealing element (90) bears against the push button element (20) and/or the panel (25) in a gap between the panel (25) and a surface of the push button element (20).

15. Push button device (1) according to either of Claims 13 and 14, wherein the sealing element (90) has a region of high Shore hardness (92) for bearing against the push button element (20) and/or the panel (25) and a region of low Shore hardness (93) for forming the bead (90).



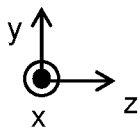
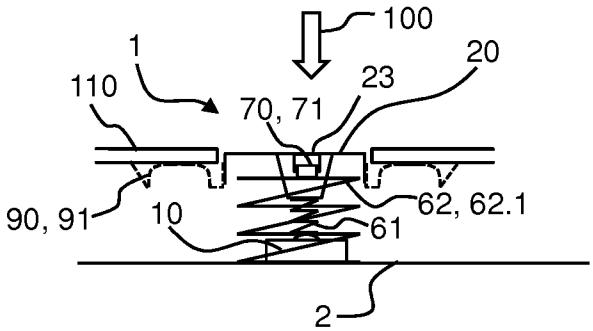


Fig. 1



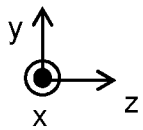
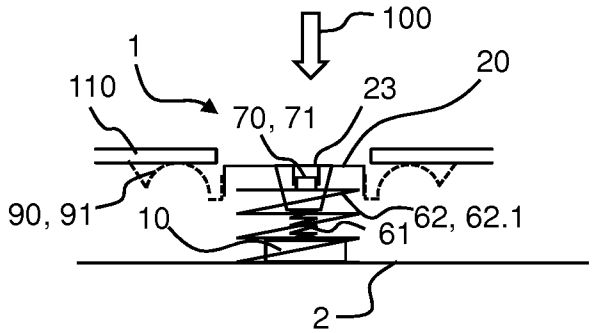


Fig. 2a



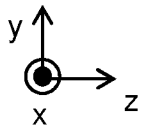


Fig. 2b

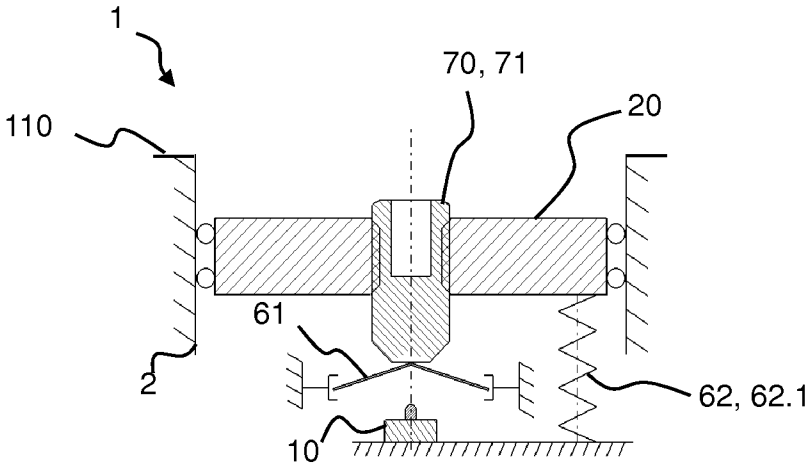


Fig. 3a

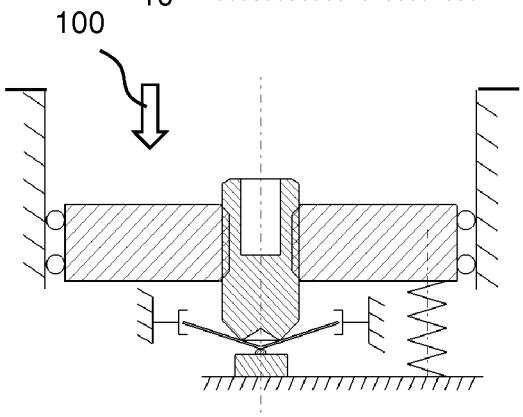


Fig. 3b

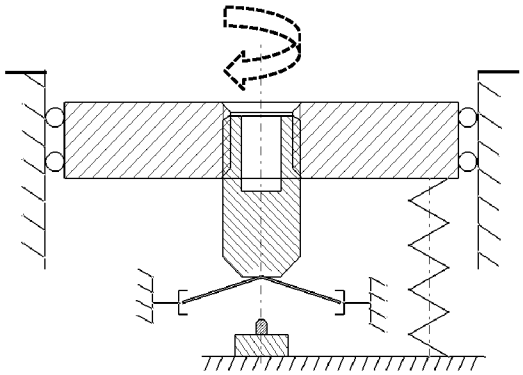
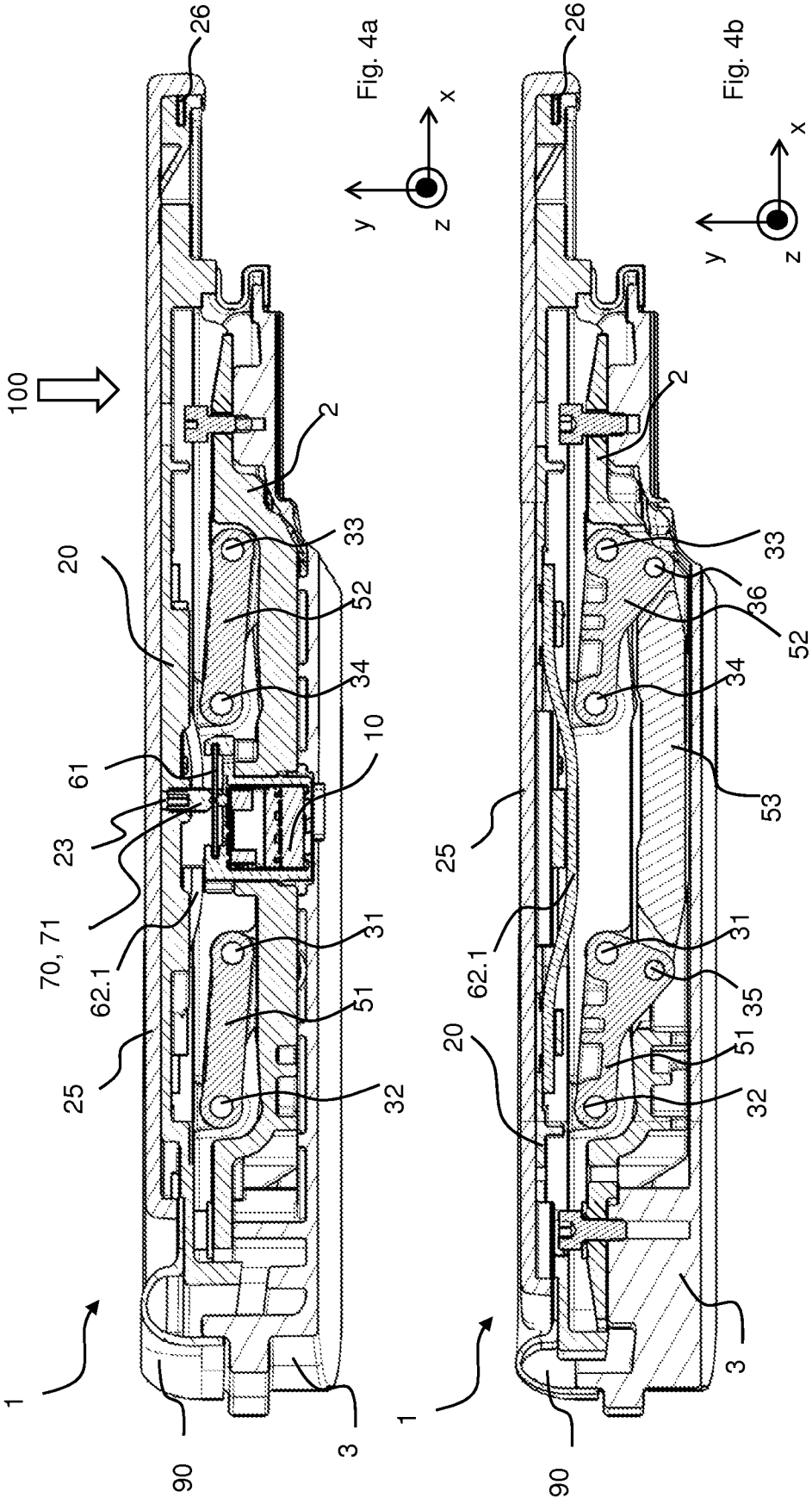


Fig. 3c


Fig. 4a
Fig. 4b
x
y
z
100
1
2
3
10
20
23
25
26
31
32
33
34
35
36
51
52
53
61
62.1
70, 71
90

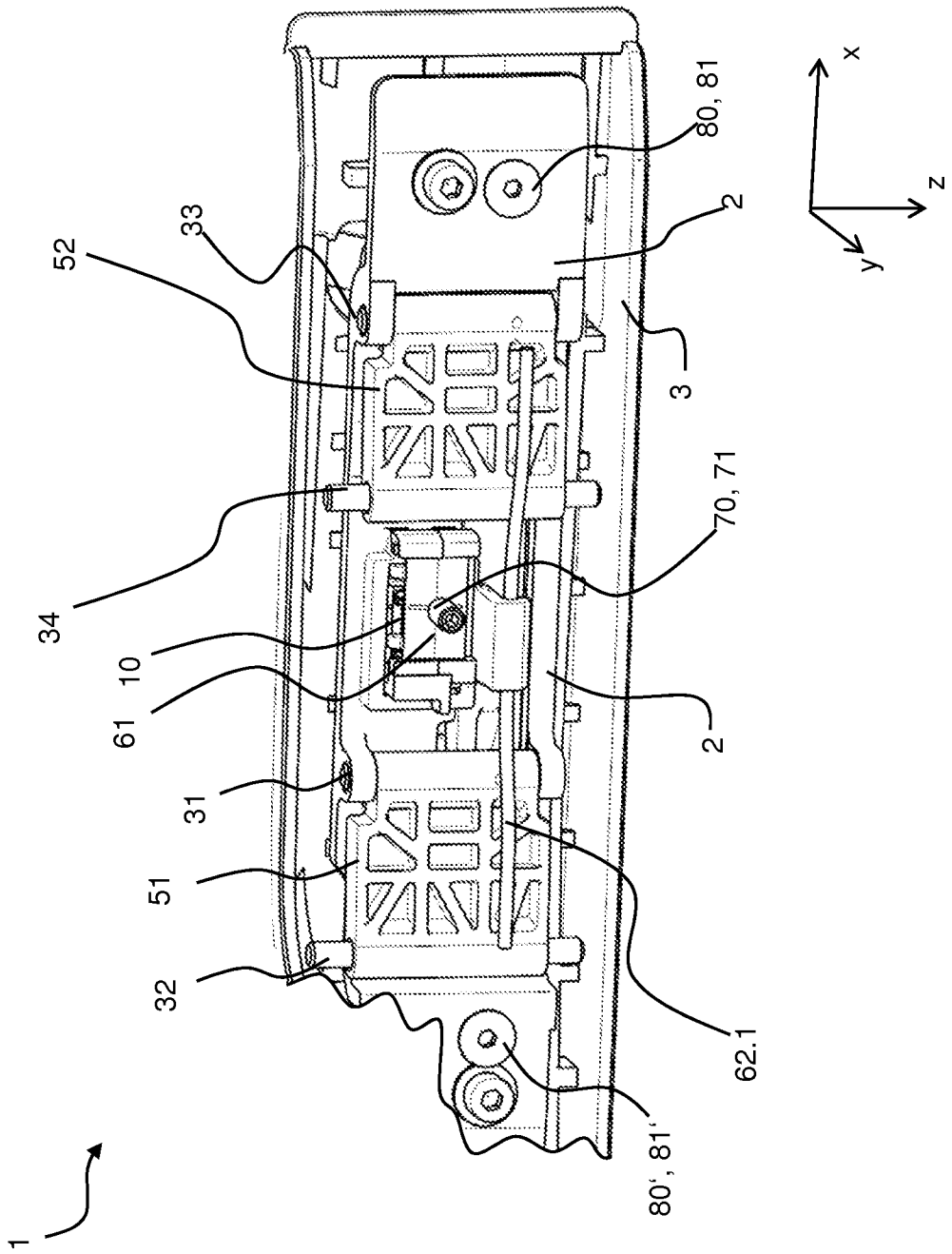


Fig. 4c

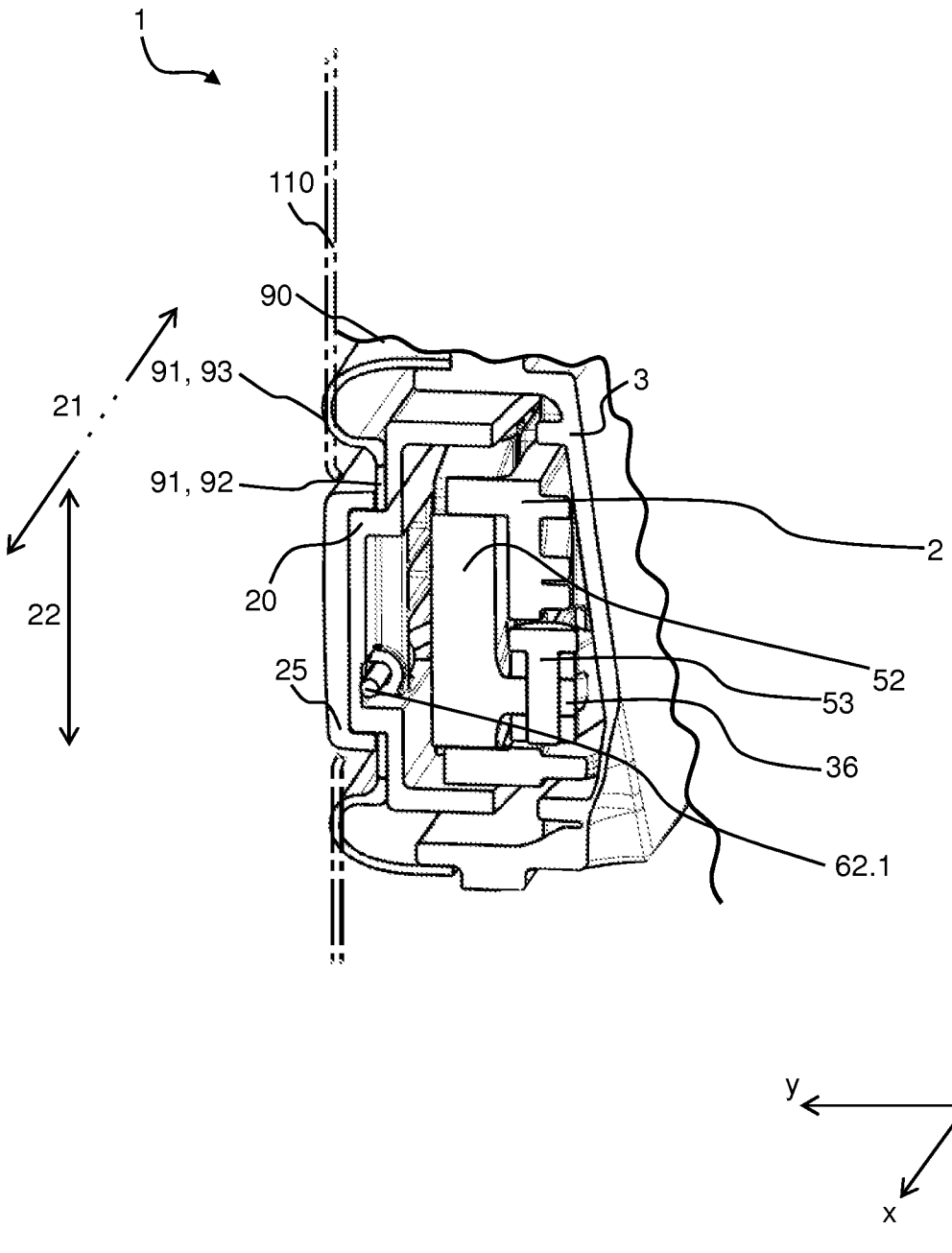


Fig. 4d

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/057549

A. CLASSIFICATION OF SUBJECT MATTER
INV. E05B81/76 E05B85/10 E05B1/00 G05G1/02
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E05B H01H G05G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 January 2016	03/02/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Antonov, Ventseslav

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/057549

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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International application No
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