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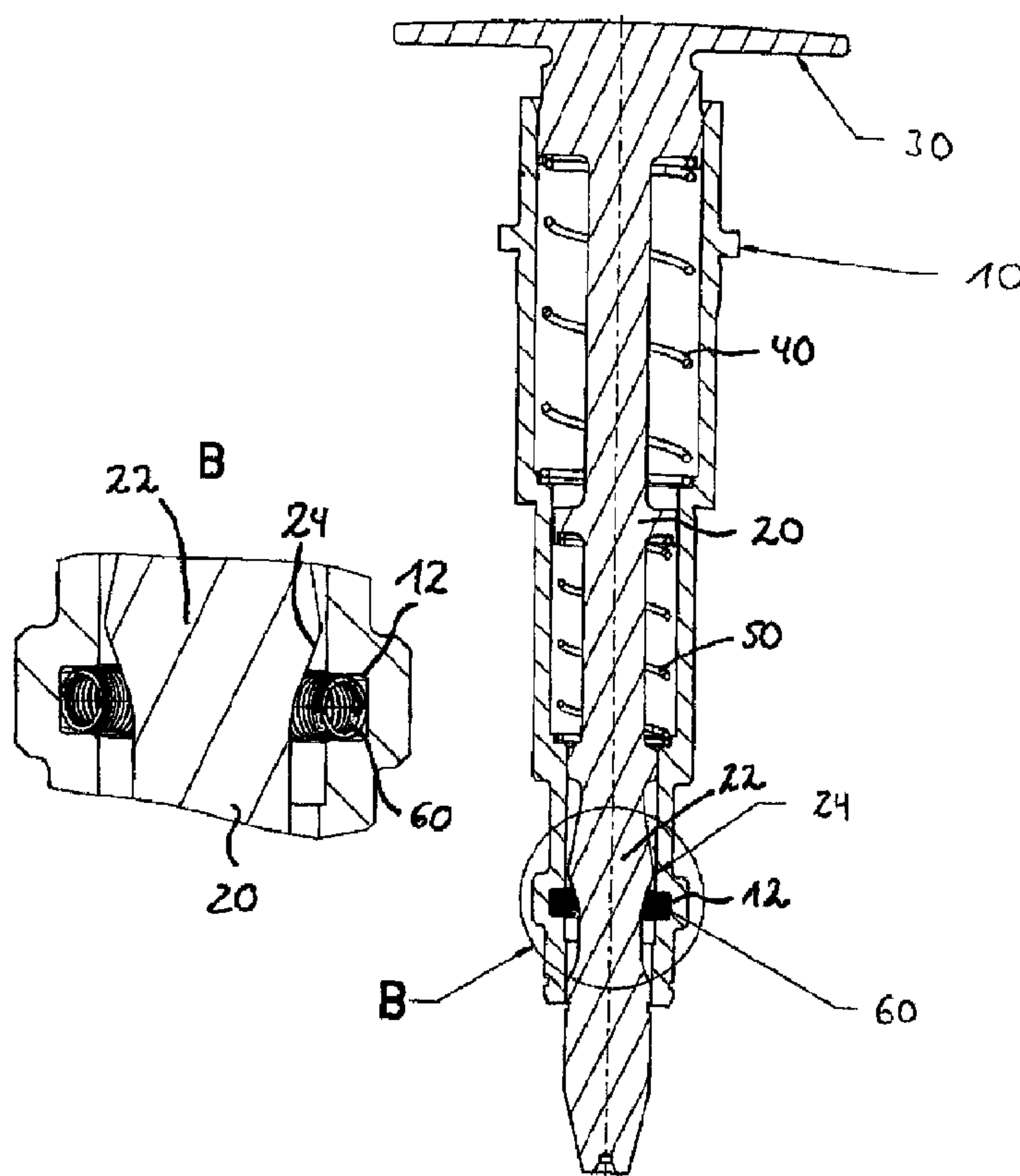
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(54) Title: ACTUATION ELEMENT



(57) Abrégé/Abstract:

The present invention relates to an actuation element in the form of a pushbutton, wherein the pushbutton includes at least one housing and at least one shaft movable in translation in the housing, wherein the housing or the shaft has at least one deformable element, and wherein the shaft or the housing has at least one activation surface, with the deformable element and the activation surface cooperating with one another such that the deformable element exerts a counter-force on the shaft on the movement of the shaft relative to the housing, said force being directed against the direction of movement of the shaft.



Abstract

The present invention relates to an actuation element in the form of a pushbutton, wherein the pushbutton includes at least one housing and at least one shaft movable in translation in the housing, wherein the housing or the shaft has at least one deformable element, and wherein the shaft or the housing has at least one activation surface, with the deformable element and the activation surface cooperating with one another such that the deformable element exerts a counter-force on the shaft on the movement of the shaft relative to the housing, said force being directed against the direction of movement of the shaft.

Actuation element

The present invention relates to an actuation element in the form of a pushbutton,
5 wherein the pushbutton includes at least one housing and at least one shaft
movable in translation in the housing.

It is known from the prior art to use pushbuttons which are connected to a snap-in
mechanism or are formed by it. In this respect, this snap-in mechanism is
10 configured in the form of a dome and gives the user haptic feedback with respect to
the actuation of the pushbutton. An advantage of this known actuation element is
that it is signaled to the user by the named haptic feedback that the actuation has
been carried out successfully; however, a disadvantage is the restricted
translational movement or movability of the pushbutton as well as the fact that an
15 adaptation or change of the force with which the feedback is generated is not
possible in already known dome-shaped actuation elements based on a snap-in
mechanism.

It is therefore the underlying object of the invention to further develop an actuation
20 element of the initially named kind such that the translational movement of the
pushbutton can be configured as larger than in already known pushbuttons and
such that there is furthermore the possibility that the force with which the feedback
to the user takes place can be adjusted.

25 This object is achieved by an actuation element having the features of claim 1.
Provision is accordingly made that the housing and/or the shaft has at least one
deformable element and that the shaft and/or the housing has at least one
activation surface, wherein the deformable element and the activation surface
cooperate such that the deformable element exerts a counter-force on the shaft on
30 the movement of the shaft relative to the housing, said force being directed against
the direction of movement of the shaft.

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It is conceivable that the deformable element is elastically deformable. A preferred embodiment comprises the deformable element being formed by at least one spring or including at least one spring.

- 5 The named deformable element can extend over the full periphery or also only partially peripherally about the named shaft.

Provision can furthermore be made that the activation surface is formed by a section of the shaft which has an enlarged diameter with respect to the adjacent
10 regions of the shaft and/or is formed by one or more projections which project outwardly from the shaft. If the activation surface moves into the region of the deformable element, a counter-force perceivable for the user is exerted by the deformable element on the pushbutton. This counter-force is recognized as a tactile feedback so that the user is ultimately informed that the actuation was successfully
15 carried out by a switch or microswitch, for example.

Provision is made in a further embodiment that the activation surface and the deformable element are configured such that the activation surface can be moved past the deformable element. It is thus conceivable, for example, that the activation
20 surface and the deformable element are designed so that the activation surface is moved toward the deformable element, which is only possible while applying a specific force, and so that the activation element and the deformable element are designed such that the activation surface can be moved beyond, i.e. past, the deformable element.

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It is conceivable in this respect that the shaft is designed such that, in the position in which the activation surface is moved past the deformable element, it is fixed in this position in at least one direction of movement by the deformable element. It is conceivable to fix the actuated pushbutton in the actuated position.

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Provision is made in a further embodiment of the invention that the activation surface is formed by one or more projections and/or by a thickened shaft section

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and that the shaft has a smaller diameter in the direction of movement of the shaft before and after the projections or the named shaft section than in the region of the projections or of the thickened section. Provision can alternatively or additionally be made that the total thickened shaft section and/or the projections is/are designed
5 with mirror-symmetry relative to the plane of the thickening or of the projections which extends perpendicular to the shaft, i.e. it/they are the same or substantially the same with respect to the geometrical embodiment in the direction of movement of the shaft before and after the thickened shaft section or the projection(s).

10 The present invention further relates to a system including at least one actuation element in accordance with one of the claims 1 to 8 as well as to a switch, preferably a microswitch, wherein the switch and the actuation element are arranged relative to one another such that the switch can be switched by the actuation element.

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The present invention further relates to an aircraft having at least one actuation element in accordance with one of the claims 1 to 8 and/or having at least one system in accordance with claim 9. It is conceivable to arrange the named actuation element and/or the named system in the cockpit of an aircraft, for example.

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Further advantages and particulars of the invention will be explained in detail with reference to an embodiment shown in the drawing. There are shown:

Figure 1: a longitudinal sectional representation through the actuation element in
25 accordance with the invention before its actuation and the detail B in an enlarged view; and

Figure 2: a longitudinal sectional representation through the actuation element in
30 accordance with Figure 1 after its actuation and an enlarged view of detail A.

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The stationary, that is not movable, housing of the actuation element in accordance with the present invention is designated in each case by the reference numeral 10 in Figures 1 and 2. The shaft 20 which has the actual actuation surface 30 for the user of the actuation element in its upper end region runs movable in translation in
5 the housing 10.

As can further be seen from Figures 1 and 2, the shaft 20 is preloaded with respect to the housing 10 by means of the springs 40, 50 so that the shaft 20 is preloaded upwardly, relative to the housing 10, that is into the non-actuated position in
10 accordance with Figure 1 or a force is exerted in this direction.

As can further be seen from Figures 1 and 2, the shaft 20 has a thickened section 22 in its lower end region or in the lower end section of the housing 10. This section 22 of the shaft 20 has a larger diameter than the sections of the shaft 20 which lie in
15 front of and behind the thickened section 22. An activation surface of the shaft 22 is designated by reference numeral 24 and is formed by or includes in the embodiment shown here the region of largest diameter of the thickened section 22 of the shaft 20 and/or forms or includes the section of the shaft in which the dimension of the shaft increases or decreases in the direction of thickness or width.

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The reference numeral 60 designates a spring or a spring band which is not displaceable in the longitudinal direction of the housing 10 and in the direction of movement of the shaft 20, but is rather received in a groove 12 of the housing as can in particular be seen from the detailed representations B and A of Figures 1 and
25 2.

As can be seen from these detailed representations, this spring band 60 is formed by a helical spring 60 running around the shaft 20.

30 As can further be seen from Figures 1 and 2, the lower end region of the shaft 20 of the actuation element projects out of the housing 10. A microswitch or the like can

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e.g. be arranged in this lower end region and is actuated when the pushbutton or the actuation element is actuated.

Figure 1 shows the state of the actuation element in accordance with the invention before its triggering or actuation by a user. As can be seen from this Figure, the activation surface 24 in this case is not in contact with the spring band 60, but is rather arranged in front of it in the direction of actuation of the shaft 20. If now a downward force is exerted on the actuation surface 30 and thus also on the shaft 20 in accordance with Fig. 1, that is if a user wants to actuate the pushbutton in accordance with the invention, the shaft 20 is moved downwardly against the force of the springs 40, 50, which has the result that the activation surface 24 comes into contact with the spring band 60. This has the result that the user, for example, the pilot, is given a haptic or tactile feedback which signals that the shaft 20 was moved by a specific distance downwardly or relative to the housing. The spring band 60 is elastically deformed by this downward movement due to the thickened section 22 of the shaft 20 and at this moment exerts a counter-force on the hand of the user. This counter-force is perceived as tactile feedback so that the user knows that the pushbutton was actuated.

If the pushbutton is fully depressed, as can be seen from Figure 2, the activation surface 24 moves past the elastically deformable spring band 60 and ultimately lies beneath the spring band 60, that is after it in the direction of movement, as can be seen from the detailed representation A. This means that during the movement of the shaft 20 in accordance with Figures 1 and 2 from the top to the bottom, the activation surface 24 initially lies in front of the elastically deformable spring band 60, then at the level of the elastic, deformable spring band 60 and finally lies after the elastically deformable spring band 60.

In the position shown in Figure 2, the pushbutton is held in the position shown by the spring band 60 and a specific minimum force is required to move the shaft 20 or the activation surface 24 in accordance with Figure 2 upwardly past the spring band 60.

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The moment at which the activation force 24 moves into the region of the elastically deformable spring band 60 and/or lies in its region and/or was already moved beyond the elastic spring band 60 on the activation of the pushbutton, as can be
5 seen from Figure 2, can give a haptic feedback or a tactile feedback to the user which signals to the user that the pushbutton has been properly actuated.

Unlike the snap-in domes known from the prior art, the present invention allows a substantially unlimited translational movability of the shaft 20 or of the pushbutton.
10 A further advantage is that the force which is exerted by the deformed spring or by the deformed spring band 60 can be varied by the dimensions of the activation surface 24 and/or of the spring or of the spring band 60. This force is increased by reducing the diameter of the activation surface 24.

15 It is possible by the variation of the position of the thickened section 22 or activation surface 24 to vary the position or the moment for a specific tactile feedback to the user. An aspect is thus conceivable in which the thickened section and/or projections or the activation surface is/are not fixedly arranged at the shaft 20, as is the case in the embodiment, but can rather be fixed at different positions relative to
20 the shaft 20.

Finally, it is pointed out that the spring 60 or the movable element can also be arranged at the shaft and the activation surface or the thickened section or the like can be arranged at the housing. The above statements apply to such an
25 embodiment accordingly.

WE CLAIM:

1. An actuation element in the form of a pushbutton, wherein the pushbutton includes at least one housing and at least one shaft movable in translation in the housing, characterized in that the housing or the shaft has at least one deformable element; and in that the shaft or the housing has at least one activation surface, with the deformable element and the activation surface cooperating with one another such that the deformable element exerts a counter-force on the shaft on the movement of the shaft relative to the housing, said force being directed against the direction of movement of the shaft.
2. An actuation element in accordance with claim 1, characterized in that the deformable element is formed such that it is elastically deformable.
3. An actuation element in accordance with claim 1 or claim 2, characterized in that the deformable element is formed by a spring.
4. An actuation element in accordance with one of the preceding claims, characterized in that the deformable element extends over the full periphery or partially peripherally about the named shaft.
5. An actuation element in accordance with one of the preceding claims, characterized in that the activation surface is formed by a section of the shaft which has an enlarged diameter with respect to adjacent regions of the shaft or is formed by one or more projections which project outwardly from the shaft.
6. An actuation element in accordance with one of the preceding claims, characterized in that the activation surface and the deformable element are configured such that the activation surface can be moved past the deformable element.

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7. An actuation element in accordance with claim 6, characterized in that the shaft is formed so that, in the position in which the activation surface is moved past the deformable element, the shaft is fixed in this position by the deformable element.
8. An actuation element in accordance with one of the preceding claims, characterized in that the activation surface is formed by one or more projections and/or by a thickened shaft section; and in that the shaft has a smaller diameter in the direction of movement of the shaft before and after the projections or the named shaft section than in the region of the projections or of the thickened section and/or is configured with mirror symmetry relative to the plane of the thickened section or of the projections.
9. A system including at least one actuation element in accordance with one of the claims 1 to 8 as well as at least one switch, preferably a microswitch, wherein the switch and the actuation element are arranged relative to one another such that the switch can be switched by the actuation element.
10. An aircraft having at least one actuation element in accordance with one of the claims 1 to 8 and/or having at least one system in accordance with claim 9.

