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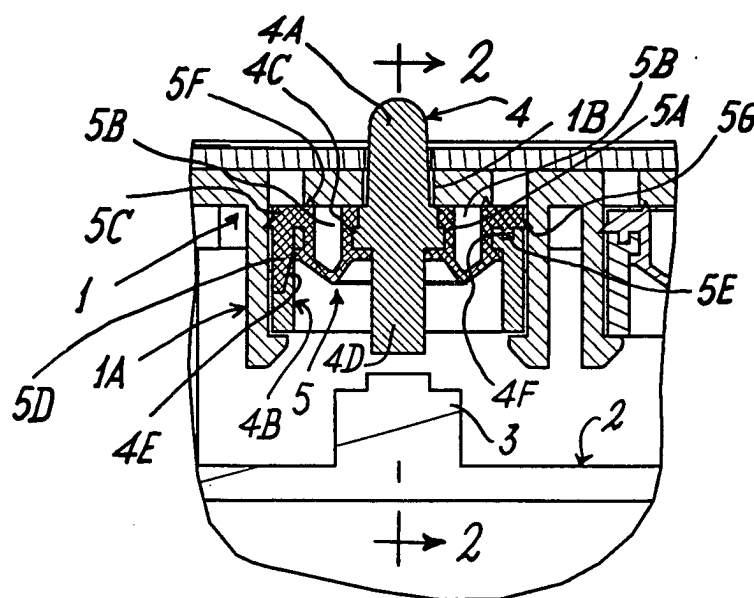
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(54) **Pushbutton structure for electronic, electrical and/or mechanical applications**

(57) A pushbutton structure for electrical, electronic and/or mechanical applications, to be mounted in a panel or the like (1), the structure comprising at least one pushbutton component (4; 104; 204a, b) co-injection moulded or co-moulded with an elastically deformable

component (5; 205), which is hence connected in a liquid-tight manner to said pushbutton structure and which presents parts (5F, G; 205F, G) which seal against the panel or the like (1) when the structure is mounted (Figure 1).



**FIG. 1**

## Description

**[0001]** The present invention relates to a pushbutton structure for electronic, electrical and/or mechanical applications.

**[0002]** There are certain known applications in which the pushbutton, generally of moulded plastic, must not allow water to infiltrate beyond a panel in which it is mounted and behind which electrical, electronic and mechanical means may be present, the operation of which can be prejudiced by such infiltration.

**[0003]** Various solutions have been devised to solve the infiltration problem; in one of the most widespread, rubbery material is used to mould a one-piece structure representing both the pushbutton and a more or less complicated apron part which acts as a gasket when the one-piece structure has been mounted in the panel or dashboard.

**[0004]** The described solution has however the drawback of difficult acceptability if the pushbutton has also to have an aesthetic function. This is the case with pushbuttons for household electrical appliances such as refrigerators, washing machines, conventional or microwave ovens etc. in which functionality (in the strict sense of this term) must be associated with appearance, i.e. with the aesthetics of the product in which the pushbuttons are important components.

**[0005]** The main object of the invention is to provide a pushbutton structure which associates unexceptionable functionality, especially in terms of its sealing, with a pleasant appearance.

**[0006]** Another object of the present invention is to provide a simple, reliable and compact pushbutton structure.

**[0007]** These and further objects which will be apparent from the detailed description given hereinafter are attained by a pushbutton structure in accordance with the teachings of the accompanying claims.

**[0008]** The invention will be more apparent from the ensuing detailed description of preferred embodiments thereof given by way of non-limiting example and illustrated in the accompanying drawings, in which:

Figure 1 is a schematic cross-section through a pushbutton structure of the invention mounted in a panel covering a compartment in which electronic circuitry is present comprising a switch, for example an electronic switch, to be controlled by the pushbutton;

Figure 2 is a section on the line II-II of Figure 1;

Figure 3 is a longitudinal section through a variant of the pushbutton structure of Figure 1;

Figures 4, 4A, 4B show respectively a plan view, a section on the line A-A of Figure 4 and a section on the line E-E of Figure 4A, of a double pushbutton embodiment of the invention.

**[0009]** With reference to Figures 1 and 2, the refer-

ence numeral 1 indicates overall a conventional front panel behind which a conventional electro-electronic circuit 2, for example a printed circuit is situated, comprising a schematically represented switch, for example an electronic switch 3, which is to be operated by a pushbutton structure, indicated overall by 4.

**[0010]** The panel 1 presents an outer component, for example decorative, and an inner component provided with a seat 1A for snap-engaging the pushbutton structure 4, the operated part 4A of which emerges from holes 1B of the front panel 1.

**[0011]** The pushbutton structure 4 is co-injection moulded or co-moulded from plastic material definable as rigid (for example ABS) or from rubbery material (for example thermoplastic rubber for injection moulding, particularly SEBS rubber obtained by polymerizing styrene and ethylene-butylene blocks), with the result that the structure is in one piece. In particular, the rigid plastic component (indicated by parallel line hatching) comprises an apron 4B connected by a bridge 14 (Figure 1) to the operated part 4A comprising a base flange 4C and an axial finger 4D facing the switch 3 on which it is intended to act. Rigid with the two connected plastic parts 4A and 4B comprising the pushbutton structure (as a result of co-injection moulding or co-moulding all the components of the structure) there is an elastic rubber component 5 (for example of the aforesaid SEBS) indicated by cross hatching and performing the triple function of supporting the component 4A, 4B, of acting as a return spring, and of acting as a seal to hence prevent access of water to the circuit 2.

**[0012]** In detail, the elastic component comprises an inner groove 5A into which there extends the flange 4C of the part 4A. On three consecutive sides the elastic component 5 comprises a groove 5B which is open upwards, i.e. towards the front panel 1. External to the groove 5B the elastic component 5 comprises a surrounding flange 5C provided with appendices 5D and 5E for engagement with or in corresponding seats or passages 4E and 4F of the part 4B (as already stated this is joined to the part 4A by the bridge 14). The flange 5C presents, respectively facing upwards and outwards, annular seal rims 5F and 5G, preferably of triangular section, which are intended to cooperate - for sealing purposes - with the seat 1A and with the front panel 1.

**[0013]** When the part 4A is pressed to operate the switch 3, the elastic component flexes to then return, on abandoning the part 4A, into the position of Figure 1 without the seal being lost during these movements.

**[0014]** At least part of the rubbery material of the component 5 is preferably chosen transparent or translucent for a reason which will be explained hereinafter. The rigid plastic component, i.e. the component 4, has its operating finger off-centre (see Figure 2) and oppositely presents a passage 10, which is occupied by transparent rubbery material and is aligned with a light source 11 (for example an LED) carried by the circuit 2.

**[0015]** To prevent light dispersion, the component 4

presents, aligned with the light source 11 and with the passage 10, a light guide 12 in the form of a cylindrical or frusto-conical appendix facing and surrounding said source.

**[0016]** The movement of the component 4 (during its operation and return) is substantially a rocking movement (arrow Z) about the bridge 14 and the fourth side 13 (that without the groove 5B) of the elastic component 5.

**[0017]** The example of Figure 3 is a simple variant of the embodiment of Figures 1 and 2. In Figure 3 parts equal or corresponding to those of Figures 1 and 2 are indicated by the same reference numerals plus 100. The difference lies in the fact that the passage 10 occupied by the co-injected transparent or translucent rubbery component is not provided. The rigid plastic part 104 (which corresponds to that of Figures 1 and 2) is in fact solid, signifying that in this pushbutton structure, visibility of the state of the static switch 3 of the relative circuit is not required.

**[0018]** Figures 4, 4A and 4B show another embodiment of the invention, providing a double pushbutton structure in the sense that the user can act on two members, each of which determines the passage of state of a different switch (static or non-static). In these figures, parts equal or corresponding to those of Figure 1 are indicated by the same reference numerals plus 200.

**[0019]** In this embodiment the rubbery component (again shown by cross hatching) indicated here by 205 is joined (by the effect of co-injection moulding or co-moulding) to two separate pushbutton components 204a and 204b both provided with an off-centre operating finger 204d (similar to the embodiments of Figures 2 and 3). Each of them can be operated independently of the other.

**[0020]** In this embodiment, again similar to the embodiments of the preceding figures, there are two grooves 205G on three consecutive sides of the rubbery component, in each pushbutton component 204a and 204b.

**[0021]** Between the pushbutton components 204a and 204b there extends for a short distance an appendix 20 of the rubbery component 205 (to prevent water infiltration into this region), the two pushbutton components 204a, 204b being joined in this region to the apron 204b (in a manner similar to that indicated by 14 in Figure 2). This region is indicated by K in Figure 4B. In a certain sense this region, by virtue of its narrowness and a certain intrinsic elasticity of the plastic material (ABS), can be considered a hinging region (as is the region 14 of Figure 2).

**[0022]** Although the illustrated embodiments have been described in relation to the operation of an electronic switch, it is apparent that this is not to be taken as a limitation on the field of application of the invention, it being evident that the movement of the pushbutton components (4, 104, 204a, 204b) can be transferred or transmitted to other members, including mechanical, to

activate or deactivate operational interventions of appliances, machines and devices.

## 5 Claims

1. A pushbutton structure for electrical, electronic and/or mechanical applications, to be mounted in a panel or the like, **characterised by** comprising at least one pushbutton component (4; 104; 204a, b) co-injection moulded or co-moulded with an elastically deformable component (5; 205), which is hence connected in a liquid-tight manner to said pushbutton structure and which presents parts (5F, G; 205F, G) which seal against the panel or the like (1) when the structure is mounted.
2. A pushbutton structure as claimed in claim 1, wherein the pushbutton component (4; 104; 204a, b) comprises a surrounding side wall (4B, 204B) for its mounting in the pushbutton or the like (1).
3. A pushbutton structure as claimed in claim 1 or in claims 1 and 2, wherein two pushbutton components (204a, 204b) and a common elastically deformable component are provided.
4. A pushbutton structure as claimed in one or more of the preceding claims, wherein the pushbutton component (4; 104; 204a, b) is of relatively rigid material, preferably ABS, whereas the material of the elastically deformable component (5; 105; 205) is natural or synthetic rubber, preferably a thermoplastic rubber obtained by polymerizing blocks of styrene and ethylene-butylene.
5. A pushbutton structure as claimed in claim 1 or in claims 1 and one or more of the other preceding claims, wherein the sealing parts (5F, G; 205F, G) of the elastically deformable component (5; 105; 205) comprise at least one peripheral lip (5G; 205G) and at least one lip (5F; 205F) provided to cooperate with the mounting panel (1).
6. A pushbutton structure as claimed in one or more of the preceding claims, wherein the material of the elastically deformable component (5; 105; 205) is at least partly transparent or translucent and extends through the pushbutton component (4; 104; 204a, b).
7. A pushbutton structure as claimed in one or more of the preceding claims, wherein the pushbutton component presents an operating finger (4D; 104D; 204D) integral therewith.
8. A pushbutton structure as claimed in claim 7, wherein the operating finger (4D; 104D) is posi-

tioned off-centre within the pushbutton component.

9. A pushbutton structure as claimed in one or more of the preceding claims, wherein the pushbutton component (4; 104; 204a, b) is hinge-connected (14; K) to the surrounding side wall (4B; 204B). 5
10. A pushbutton structure as claimed in one or more of the preceding claims, wherein the elastically deformable component (5; 105; 205) presents along part of its contour a groove (5G; 205G). 10
11. A pushbutton structure as claimed in claim 3, wherein the two pushbutton components (204a, 204b) present adjacent faces spaced-apart, into said space there extending, and forming a seal, an appendix (20) of the elastically deformable component (205). 15

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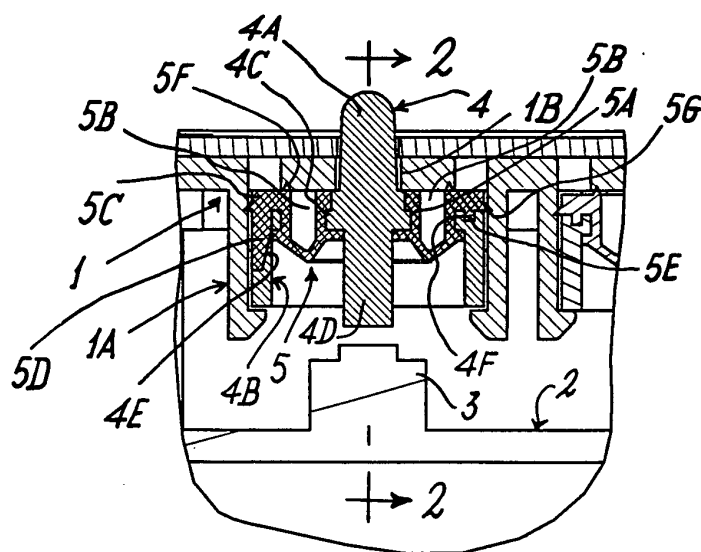
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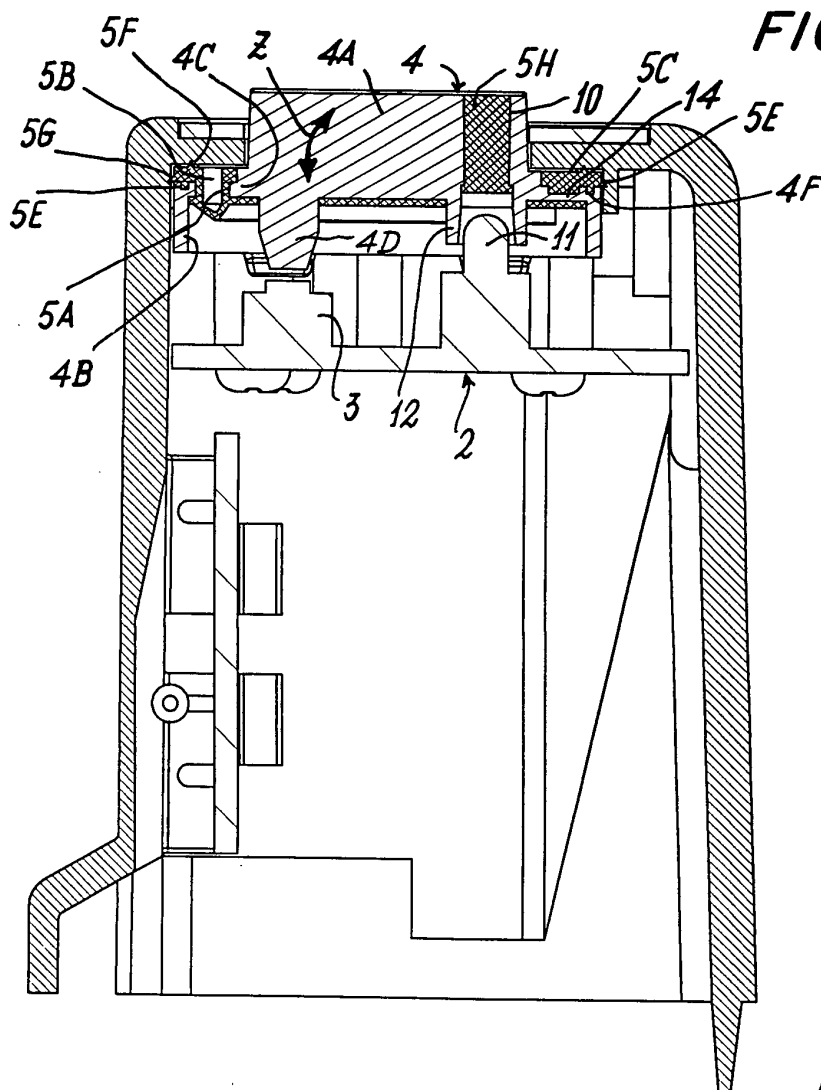
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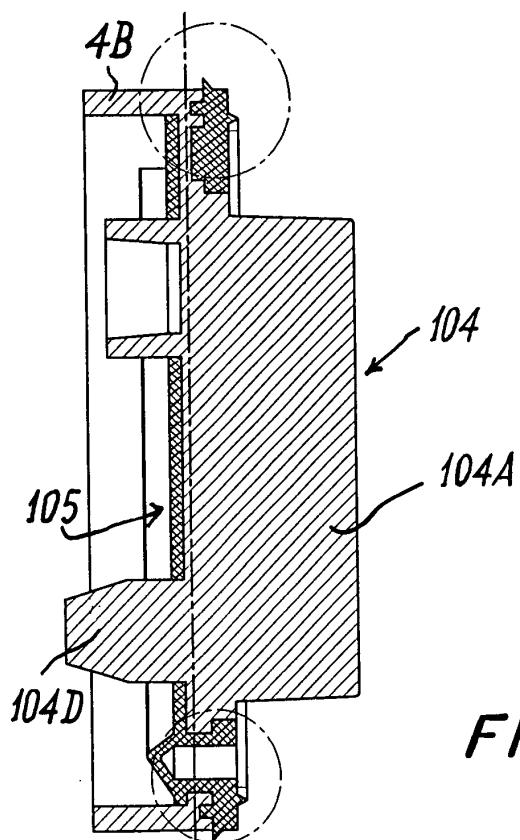
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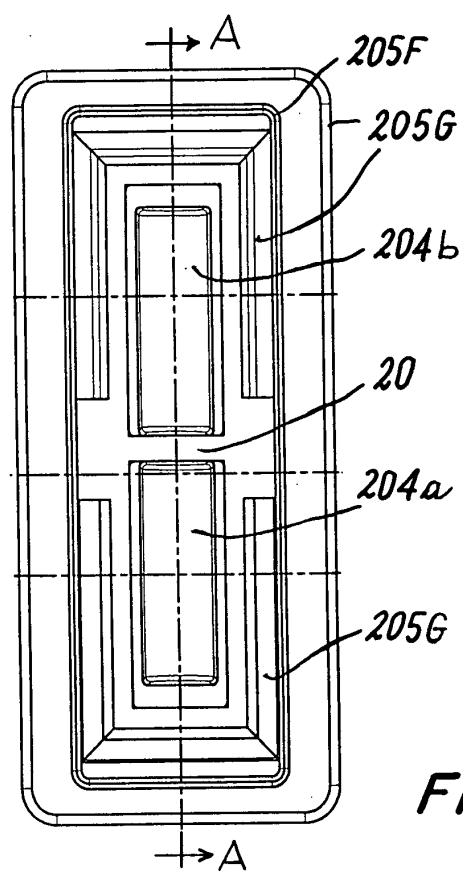
**FIG. 1**



**FIG. 2**



**FIG. 3**



**FIG. 4**

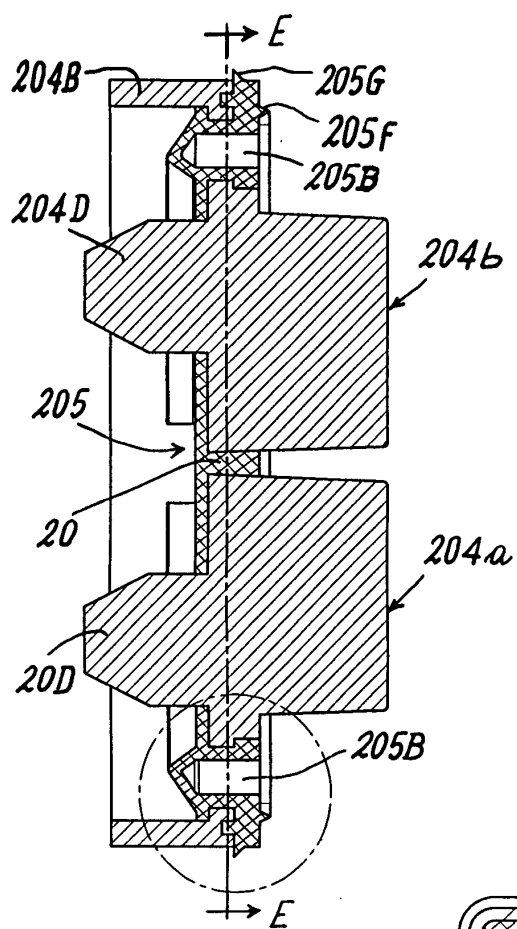


FIG. 4A

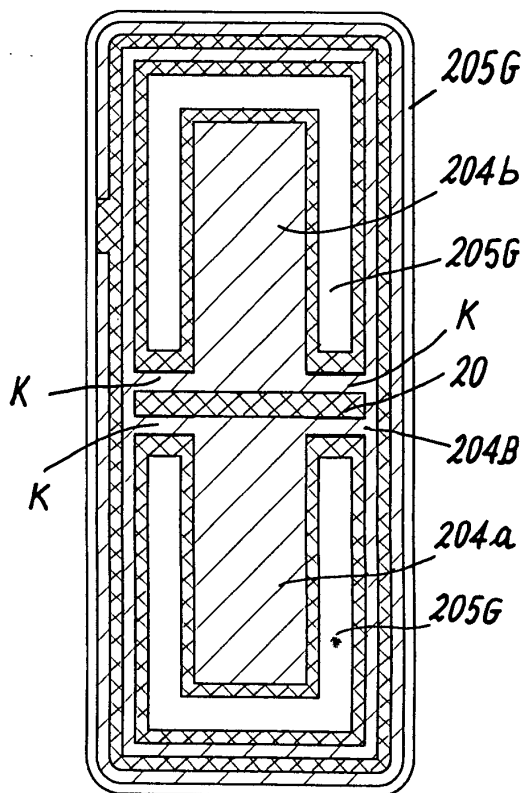


FIG. 4B