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(54) **Improvement in the push buttons for a keyboard**

(57) The push button comprises an axially displaceable head (8) to actuate electric contacts (5) provided on a support base (2) with guide members (7). Between the head and corresponding guide members there is provided at least a slide member (14) which is axially joined to and capable of sliding transversally with respect to the head. The slide member is linked to at

least a corresponding guide member through slidably interacting pin-and-slot means (19, 20), the slot means (19) extending slopingly with respect to the base, so that the axial displacement of the head is caused to bring about a corresponding transversal displacement of the slide member.

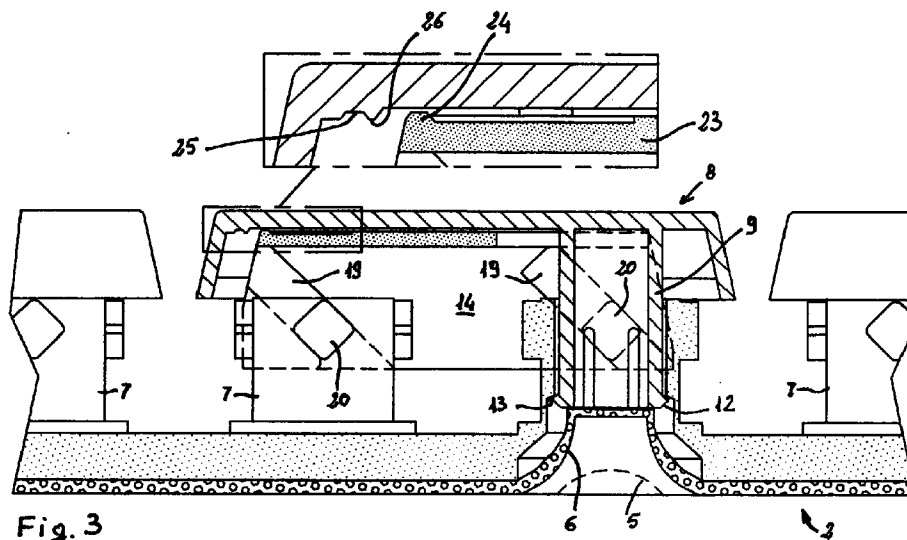


Fig. 3

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Description

The present invention relates to an improved push button device for keyboards of the type adapted to be used in conjunction with a plurality of electric contacts, such as for instance keyboards for computers, electronic cash registers and the like.

These keyboards are generally known to usually include a support base carrying a set of modular guide members with respect to which a plurality of push buttons are displaceable elastically, in a direction which is orthogonal with respect to the support base, in order to actuate, between a first and a second operational condition, respective electric contacts arranged in correspondence of the same support base.

The head portions of the push buttons can have variable dimensions; usually, in fact, a keyboard comprises push buttons with unitary dimensions (ie. push buttons associated to a respective modular guide member) and push buttons with multiple dimensions, ie. having a head with a large surface that extend upon at least a pair of modular guide members. Said large-surface push buttons must be made and provided in such a manner as to enable them to move smoothly and without tilting or jamming, with respect to the corresponding guide members, regardless of the point at which the pressure is applied on their head.

Various solutions aimed at overcoming this problem are known. For instance, push buttons are known in which the head thereof is connected to the associated guide members (which are included in the support base) by means of an appropriate parallelogram-like stabilizing frame which on one side is hinged on a side of the same head and, on the other side, is hinged in correspondence of the guide members. Such a solution calls for the use of a limited number of component parts; nevertheless, it actually turns out to be particularly critical and complex, and therefore undesirably expensive, in connection with the assembly and disassembly of the stabilizing frame and the head of the push button, said component parts being preferably made of plastic material and linked with each other by means of very small, delicate linking and hinging means. Also the overall robustness of the whole push button assembly turns therefore out as being unsatisfactory.

In order to enable the push button to be assembled and disassembled, ie. fitted and removed, without affecting or even damaging the adjacent devices, the solution has been proposed, so as this is described in US-A-4 902 862, to link the head of the push button with the corresponding guide members through the use of linking means of the double-scissors type, or in the shape of a stirrup, the end portions of which are capable of snap-fitting, in a disjoinable manner, into corresponding seats provided on the head of the push button and on the guide members, respectively.

Even in this case, however, the linking means comprise thin and relatively long parts which are therefore

all too brittle and cause the whole push button assembly to be poorly reliable. Furthermore, in view of obtaining a substantial stabilization of the push button, the linking means are preferably of the most complex, ie. double-scissors type, so that they usually call for the use of further intermediate linkage or hinging means which undesirably complicate both the structure and the assembly of the push button.

Conclusively, it can be therefore said that such a solution is rather expensive and scarcely reliable. In addition, it has a significant drawback connected with its use: it is generally known that the user has quite often the need to disassemble and remove at least some of the parts making up the push buttons, for instance in order to carry out due modifications in the setting of the keyboard or appropriate maintenance or servicing operations. In such a case, in order to ensure a correct re-assembly, by snap-fitting, of the various push-button parts as described above, the same push-button parts shall be mutually pre-arranged in a well-defined position and with a well-defined orientation, so that this can only be carried out by the user, generally just a layman, if adequately detailed instructions are available.

In both above cited prior-art solutions, furthermore, for the connection of its head to the guide members the push button requires the use of component parts the dimensions of which shall substantially correspond to the dimensions of the same head, so that they just cannot be made as modular elements. Such a drawback is clearly against the actual requirements of a large-scale industrial production.

It therefore is a main purpose of the present invention to provide an improved type of push button for a keyboard, which has the capability of being displaced in a smooth, jam-free and stable manner, along with a particularly simple and inexpensive structure comprising a reduced number of robust and modularly built component parts.

It is a further purpose of the present invention to provide a push button of the above cited type, the reassembly of which on the related keyboard is particularly easy and convenient to carry out and can be completed also by unskilled people without the need for particularly detailed instructions being available.

According to the present invention, all such aims are reached in an improved push button device for keyboard, which includes the characteristics and features as recited in the appended claims.

The characteristics and the advantages of the present invention will anyway be more readily and clearly understood from the description which is given below by way of non-limiting example with reference to the accompanying drawings, in which:

- Figure 1 is a schematical bottom view of a push button according to a preferred embodiment, which includes the head with slide-type members;

- Figures 2 and 3 are partial sectional views, along the A-A line of Figure 1, showing the push button according to the present invention, mounted on a keyboard, in respective operational positions;
- Figure 4 is a sectional view similar to those appearing in Figures 2 and 3, in which the push button is however shown in a position enabling the same to be disassembled for removal;
- Figure 5 is a partial schematical plan view of the support base of the keyboard;
- Figure 6 is a schematical view of the B-B section of the push button shown in Figure 1.

With reference to the above listed Figures, the push button is adapted to be mounted on a keyboard of the type having a support base 2 carrying a plurality of electric contacts 5 (only one of which being shown here for simplicity sake) which can be actuated selectively so as to send corresponding control signals to an associated apparatus. For instance, the support base 2 comprises a rigid plastic layer 3 extending upon a flexible rubber layer 4 provided, in correspondence of the electric contacts 5, with respective shaped elastic portions 6 which tend to maintain a normal raised resting position as shown in Figure 3.

The rigid layer 3 comprises a plurality of modular guide members 7 which protrude upwards and are provided with an axial through-hole 10 (Figure 5) aligned with a respective elastic portion 6.

The push button mainly comprises an actuation head 8 having multiple dimensions, ie. having a large surface extending upon at least a pair of modular guide members 7. In the example described here, in particular, the head 8 has a substantially plane configuration extending upon four guide members 7.

When the head 8 is pressed axially downwards (ie. towards the base 2, as this is shown in Figure 2), pushing means are adapted to elastically actuate at least one of the associated electric contacts 5 between a first and a second operational position. In a preferred manner, said pushing means consist substantially of at least an axial protrusion 9 extending from the lower surface of the head 8 and adapted to freely slide, along a certain length, in one of said guide members 7. The thrust exerted by the corresponding elastic portion 6 tends to keep said protrusion 9, and the whole push button, normally raised, as this will be more clearly appreciated in the following. The free end of said pushing protrusion 9 is capable of being deformed elastically thanks to longitudinal grooves 11 (Figure 6), while the edge thereof comprises teeth 12 that protrude radially outwards. As this can be best seen in Figure 3 (resting position), these teeth are adapted to abut against a shoulder 13 provided in the hole 10 so as to define a corresponding end-of-stroke provision for the push-button and to pre-

vent the head 8 from accidentally disengaging from and coming off the keyboard.

Between the head 8 of the push button and the corresponding guide members 7 there are provided linking means comprising at least a slide member 14. In the example being described here two such slide members 14 are used, which are substantially similar to each other and are provided in a parallel, side-by-side arrangement, as this is illustrated in Figure 1. In this case, the two (or more) slide members in said side-by-side arrangement are preferably interconnected to each other by a crosspiece 15 or similar means.

Each slide member 14 is axially joined to, but capable of sliding transversally with respect to the head 8. In particular (Figures 1 and 6), each slide member 14 is slidably joined by snap-fitting to the head 8 in a disjoinable manner by means of undercuts 16, or the like, which engage appropriate teeth or elastic ribs 17 provided on the head 8.

Each slide member 14 has preferably a section in the shape of a U turned upside down, on the stems 18 of which (Figure 6) there are provided slot-like or similar impressions 19 extending slopingly, preferably with an inclination of 45°, with respect to the support base 2. In a preferred manner, on each one of the afore cited stems 18 there is provided a pair of said slots 19 extending upwards from the free end of the same stem.

The slots 19 of the slide member 14 interact slidably with pins 20, or similar means, which the guide member 7 are provided with. These guide members, in particular, have a square-profiled outer surface on each side of which there is projecting one of said pins 20, which have preferably a profile in the shape of substantially a rhombus whose sides have the same inclination as the slots 19. This enables the slots 19 to selectively engage in a correct manner, according to the angular orientation of the head 8, corresponding pins 20 of the guide members 7.

Furthermore, in order to advantageously minimize the surface of friction between each slide member 14 and the head 8, the latter is provided to rest on the upper surface of the same slide member through lugs 21 (Figure 6) that are appropriately distributed on the lower surface of the head 8.

As shown in Figure 1, the upper portion of the slide member 14 comprises of course a recess 22 or similar indentation adapted to possibly accommodate the protrusion 9 pushing the head 8.

The operation of the push button according to the present invention is now fully apparent. In the resting position shown in Figure 3, the head 8 is kept in a raised condition with respect to the support base 2 owing to the thrust exerted on the protrusion 9 of the same head by the elastic portion 6. Correspondingly, the slide members 14 and the head 8 are in a pre-determined transversal position relative to each other, wherein the pins 20 of the guide elements engage the lower portion of respective slots 19.

By pressing the head 8 downwards in order to actuate the electric contacts 5, the same head travels axially into the position shown in Figure 2, so as this is defined by the stroke of the pushing protrusion 9 through the hole 10 of the guide member 7 associated therewith. Owing to the interaction between the pins 20 and the slots 19, such an axial displacement causes a corresponding transversal displacements of the slide members 14 to take place with respect to the head 8 of the push button, so as this is clearly apparent from a comparison between the illustrations in Figures 2 and 3. In this way, the head 8 is constantly resting on a large support surface formed by the slide members 14 which therefore constantly ensure a correct parallelism of the same head (regardless of the point at which it is actually pressed), along with a constantly smooth, jam-free operation of the whole push button.

It is furthermore fully apparent that the push button according to the present invention is made with the use of a small number of simple component parts that are capable of being snap-fitted to each other in a simply disjoinable manner, enabling the same push button to be most easily disassembled for removal. All such component parts advantageously have a configuration that is substantially free of thin portions and or portions having such a shape as to prove scarcely reliable, ie. undesirable brittle in use. Furthermore, the whole push button, except for the head 8, is advantageously made with modular component parts capable of being linked or associated with each other in accordance with the different application requirements.

According to another important feature of the present invention, the push button can furthermore be easily removed from and mounted back in the keyboard also by substantially unskilled people, without any need arising for particular instructions being made available to them. In fact, the upper portion of each slide member 14 integrally includes at least a flexible-tab portion 23 provided with a coupling protrusion 24 (Figures 1, 3 and 4), the latter being adapted to engage, by passing over a bulge 26, a corresponding impression 25 provided on the lower surface of the head 8.

In particular, under regular operation conditions as shown in Figures 2 and 3, said flexible tab is disengaged from said impression 25. When on the contrary the need arises to temporarily remove or disassemble the push button, for instance for maintenance purposes, the head 8 is pulled upwards in order to force the teeth 12 of the pushing protrusion 9 to elastically disengage the end-of-stroke device 13. For the afore cited mutual engagement of the pins 20 and the slots 19, such a forced axial raising of the head 8 translates into a corresponding further transversal displacement of each slide member 14 with respect to the head 8, as shown in Figure 4. In other words, such a further transversal displacement automatically provides for the protrusion 24 of the flexible tab 23 to pass elastically over the bulge 26 and snap-fit into the impression 25.

As shown in Figure 4, the impression 25 defines a predetermined relative transversal position of the slide members 14 that enables the pins 20 to be taken out of the lower end portion of the slots 19 and, as a result, the head 8 to be disassembled and removed along with the same slide members. In an advantageous manner, such a pre-determined transversal position is maintained also after said component parts have been disassembled and removed as described above, so that, when the head 8 and the slide members 14 must be mounted back on the guide members 7, they are still mutually positioned (as shown in Figure 4) in such a manner as required in order to restore the previous pin-and-slot linkage between the slide members 14 and the guide elements 7.

If the head 8 is therefore pressed axially from the position shown in Figure 4, the protrusion 24 of the tab 23 is caused to elastically disengage the impression 25 and pass over the bulge 26 in the reverse direction, so as to enable the slide member 14 to regain a normal transversal operational position. In addition, the pushing protrusion 9 links up again inside the corresponding guide member 7, so that the push button is again in its afore described resting position shown in Figure 3.

It will of course be appreciated that the push button described here merely by way of example may be subject to a number of modifications as considered appropriate, without departing from the scope of the present invention.

For instance, the various component parts described may in each case be sized and mutually positioned so as to optimize the operation of the push button for the given application, without however affecting the characteristics as recited in the appended claims.

Claims

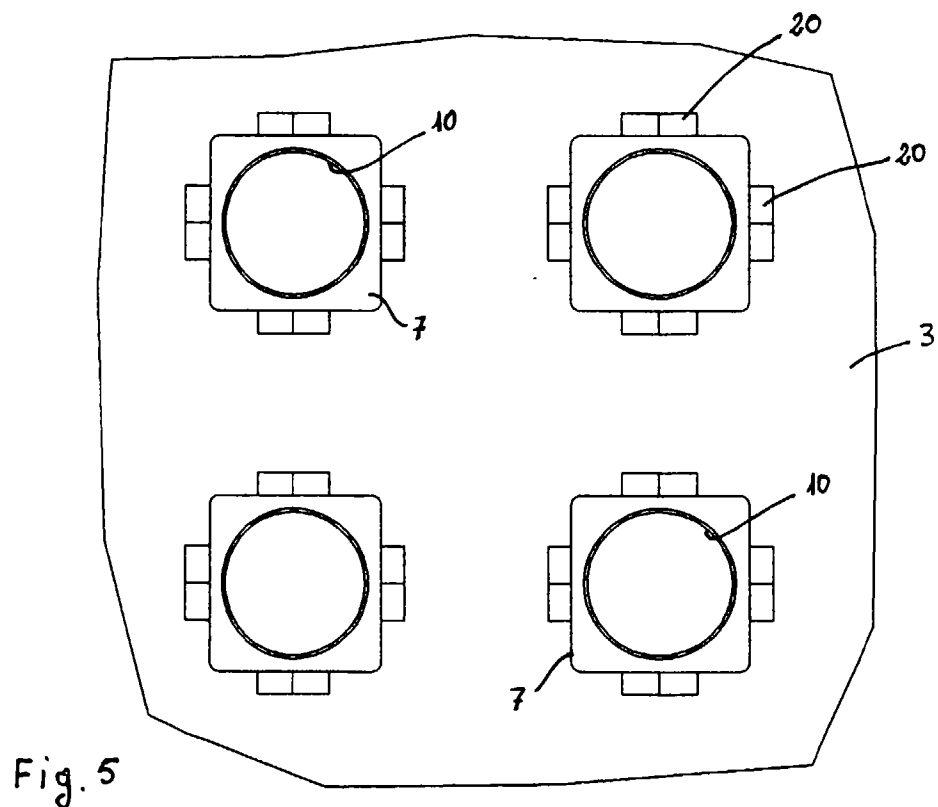
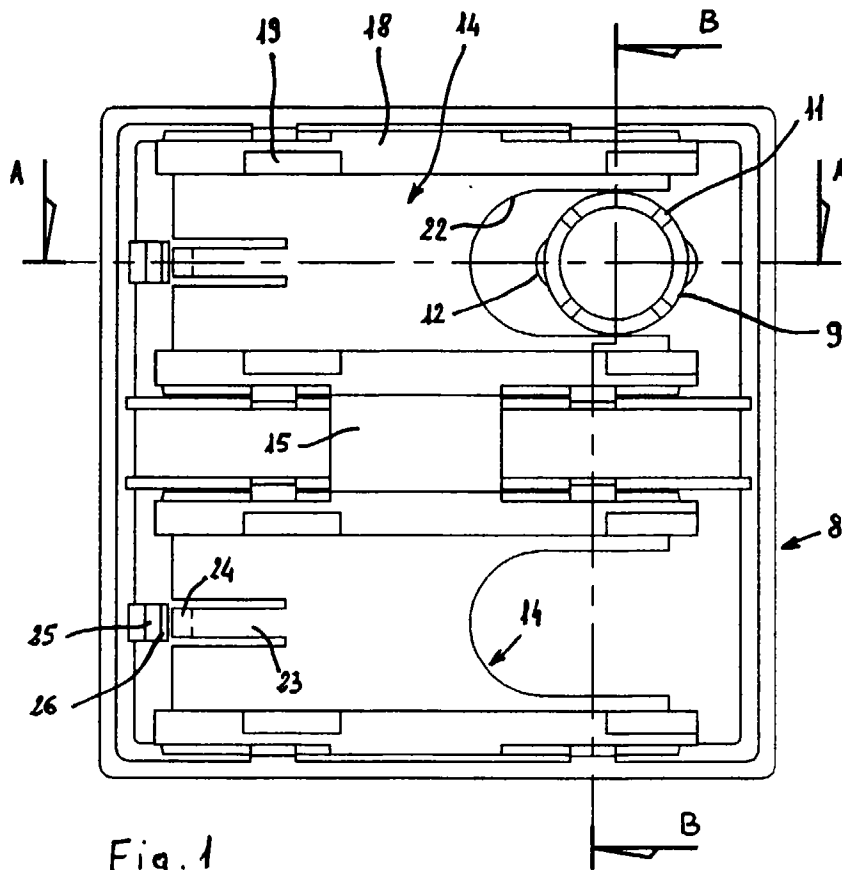
1. Push button for a keyboard with a support base carrying a plurality of modular guide members, said push button comprising an actuating head capable of being displaced axially in an elastic manner, in a direction which is substantially orthogonal to the support base, to actuate between a first and a second operational positions, through pushing means, respective electric contacts provided in correspondence of the same support base, linking means being further provided between the head of the push button and at least a pair of corresponding guide members, **characterized in that** said linking means comprise at least a slide member (14) which is axially integral with, and capable of sliding transversally with respect to said head (8), the slide member being linked to at least one of said corresponding guide members (7) through respective slidably interacting pin-and-slot means (19, 20), the slot means (19) extending inclined with respect to the support base (2) so that the axial displacement of said head determines a corresponding transver-

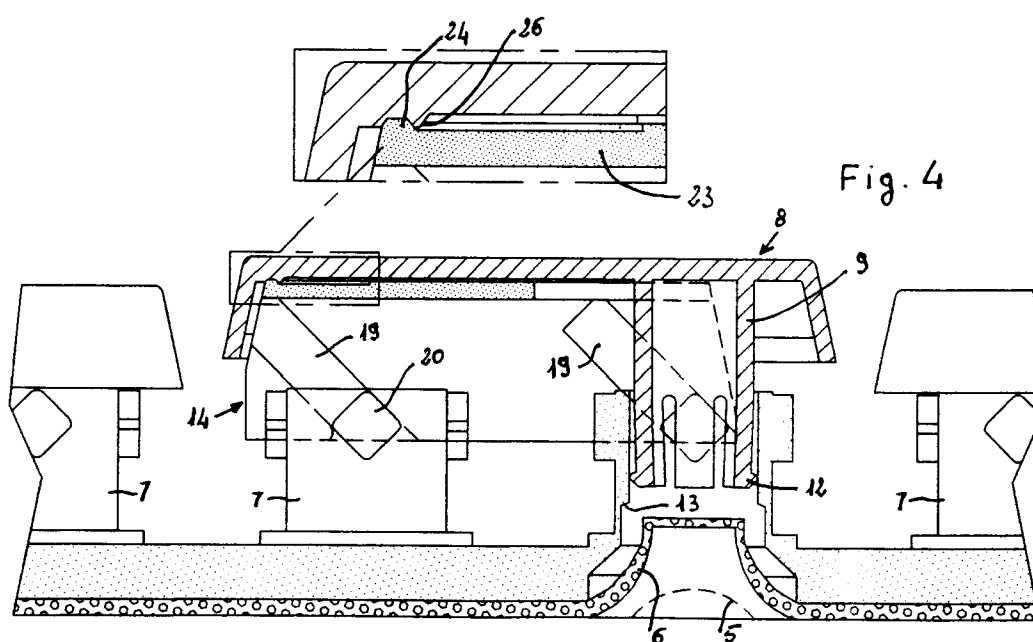
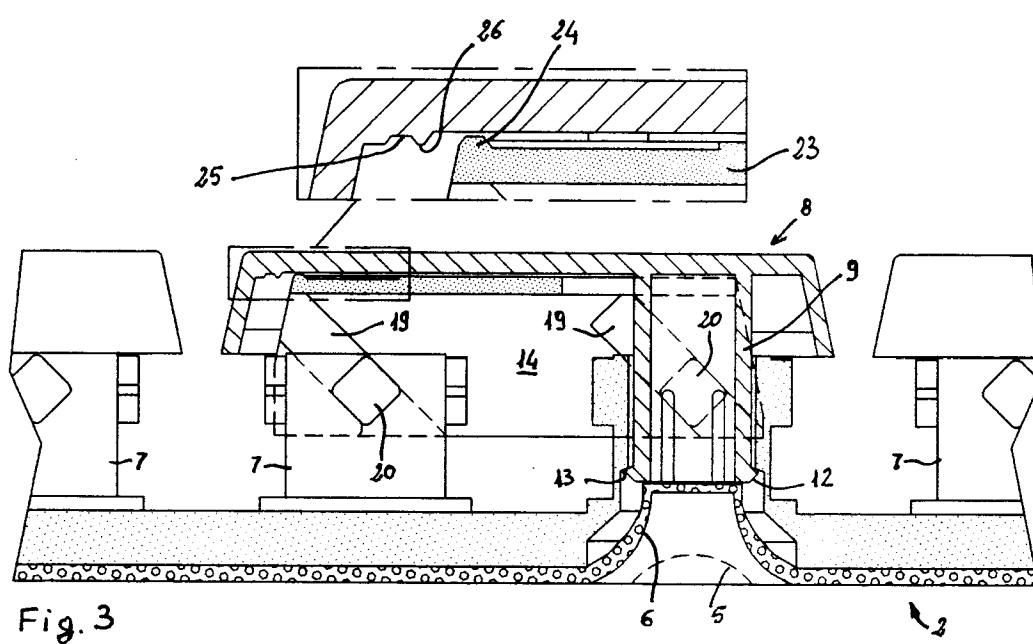
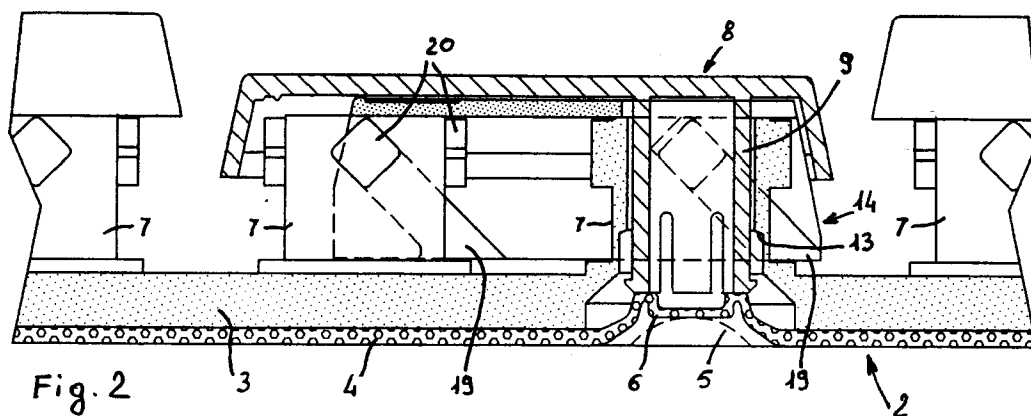
sal displacement of the slide member (14) with respect to the head of the push button.

2. Push button according to claim 1, **characterized in that** said linking means comprise at least two of said slide members (14) which are substantially similar to each other and are arranged in parallel in a side-by-side configuration, each one of them being linked to respective guide members (7). 5
3. Push button according to claim 1, **characterized in that** each one of said guide members (7) extends axially from the support base (2) towards the head (8) of the push button and has a square-profile outer surface from each side of which a pin (20) is protruding that is adapted to selectively engage, according to the angular orientation of said head, a corresponding slot-like impression (19) of said slide member (14). 10 15 20
4. Push button according to claim 3, **characterized in that** each one of said pins (20) has a profile in the shape of substantially a rhombus, the sides of which have the same inclination as the slot-like impressions (19). 25
5. Push button according to claim 3, **characterized in that** at least one of the guide members (7) is provided with an axial hole (10) in which said pushing means (9) protruding from the lower surface of said head (8) are capable of sliding freely for a certain length defining the axial stroke of the push button. 30
6. Push button according to claim 1, comprising elastic abutment means (12) co-operating with end-of-stroke means (13) provided on at least one of the guide members to normally prevent said head from moving off axially from the support base with respect to an axial resting position, **characterized in that** the head (8) is adapted to be forced into moving off axially from the support base (2), with respect to the resting position, so as to cause said abutment means (12) to elastically disengage said end-of-stroke means (13) and bring about a forced transversal displacement of the slide member (14) with respect to said head, the push button further comprising elastic snap-fitting means (23-25) adapted to be actuated by said forced displacement of the slide member so as to lock said slide member in a predetermined transversal position, with respect to said head, that enables it to be conveniently disassembled and re-fitted with respect to the guide members (7). 35 40 45 50
7. Push button according to claim 6, **characterized in that** said elastic snap-fitting means comprise at least a flexible tab (23) made integrally with the slide member (14) and provided with a coupling 55

protrusion (24) which, owing to said forced displacement, is adapted to engage a corresponding impression (25) of said head (8) that defines said pre-determined transversal position.

8. Push button according to claim 1, **characterized in that** the lower surface of said head (8) rests slidably on the upper surface of the slide member (14) through lugs (21) adapted to minimize the surface of friction between the head and the slide member.
9. Push button according to claim 1, **characterized in that** said slide member (14) is kept axially joined to the head (8) of the push button by disjoinable snap-fitting coupling means (16, 17).





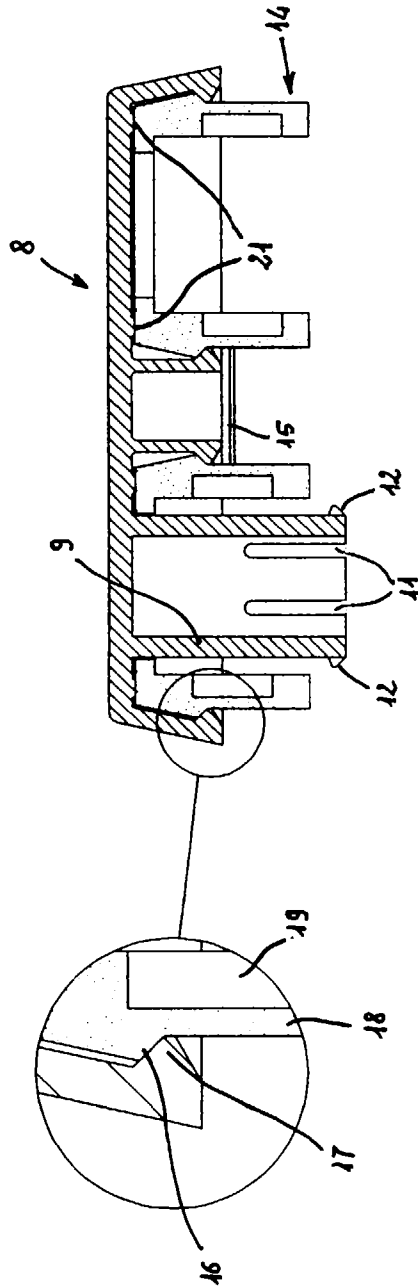


Fig. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 97 11 1112

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,A	US 4 902 862 A (OELSCH JURGEN ET AL) 20 February 1990 * abstract *	1,6	H01H3/12
A	FR 2 175 105 A (LEUVENBERGER PETER) 19 October 1973 * page 2, line 17 - page 3, line 16 *	1	
A	DE 43 16 998 A (EATON CONTROLS GMBH) 24 November 1994 * abstract *	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6) H01H
Place of search THE HAGUE		Date of completion of the search 15 October 1997	Examiner Libberecht, L
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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