



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/SE89/00164 (22) International Filing Date: 30 March 1989 (30.03.89) (31) Priority Application Number: 8801194-5 (32) Priority Date: 30 March 1988 (30.03.88) (33) Priority Country: SE</p> <p>(71) Applicant (for all designated States except US): ELEC- TROLUX MECATRONIK AKTIEBOLAG [SE/SE]; Industrigatan 26, S-205 25 Malmö (SE).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only) : RUBBMARK, Jan, Ragnar [SE/SE]; Kungshällagatan 26, S-212 30 Mal- mö (SE).</p> <p>(74) Agents: HAGELBÄCK, Evert et al.; AB Electrolux, S- 105 45 Stockholm (SE).</p>		<p>(81) Designated States: AT (European patent), AU, BE (Eu- ropean patent), CH (European patent), DE (Euro- pean patent), DK, FI, FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), NO, SE (European patent), US.</p> <p>Published <i>With international search report.</i></p>
<p>(54) Title: ELECTRONIC PUSH-BUTTON SWITCH</p>		
<p>(57) Abstract</p> <p>An electronic push-button switch (10) comprises a housing (11) with a recess (16) in which the push-button (12) is movably mounted. A first optical light conductor (15) has one end opening in the recess (16) to conduct light to and from said recess. A second optical light conductor (13) has one end opening in the recess (16) and is arranged to conduct light to a point of indication (14) in the housing (11) adjacent to the push-button (12). The first light conductor (15) extends through the recess (16) so as to open in an area adjacent to the opening of the second light conductor (13). The push-button (12) is operably connected with the first light conductor (15) to move it between a first position in which the two light conductors (15, 13) are coupled to each other and a second position in which the first light conductor (15) is arranged to conduct light to a light detector (22) provided for initiating the operation of the switch.</p>		

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Electronic push-button switch

The present invention refers to an electronic push-button switch of the kind referred to in the preamble of appending claim 1.

In U.S.-patent 4,135,147 there is disclosed a switch of the kind indicated having a housing with a recess wherein a push-button is movably mounted. The push-button is made of light-conductive material and has an interior part which can be moved between two positions in the recess. The interior part of the knob has the shape of a prism having a slant surface. Two fiber optic light conductors open in opposite walls in the recess in positions situated in front of each other. In one position of the push-button the slant surface of the prism is positioned so as to interrupt the flow of light between the light conductors. Said flow of light is instead directed through the push-button lighting up the operating surface of the push-button. In the other position the slant surface of the prism is positioned such that without being obstructed the flow of light can pass between the light conductors. In this position the operating surface of the push-button remains unilluminated.

In the switch described the push-button has the shape of a prism. This design offers the advantage that in a suitably designed switch the push-button will be illuminated when pushed indicating a switched-in condition. At the same time a disadvantage results from the fact that the prism is an integral part of the push-button which unnecessarily restricts the possibility of varying the push-button design.

The object of the invention is to remedy the disadvantage of the known arrangement and to provide a switch in which the light-indicating function has been placed outside of the push-button. The advantage will be that the push-button not necessarily need to be made of a light-conductive material and, further, that the light conductive prism part of the known push-button can be dispensed with.

The object is achieved in a switch which in accordance with the invention has been given the characterizing features indicated in claim 1. Preferred embodiments appear from the appending sub-claims.

The invention will now be described more in detail in connection with a few different embodiments and with reference to the enclosed drawing.

Fig. 1 shows a push-button switch with the push-button being inoperated.

Fig. 2 shows the switch of Fig. 1 in operated condition.

Fig. 3 shows the light ray path of the embodiment of Figs. 1 and 2.

Fig. 4 schematically shows an alternative embodiment wherein the push-button is inoperated.

5 Fig. 5 shows the embodiment of Fig. 4 with the push-button in the operated position.

Fig. 6 and 7 show another alternative embodiment with the push-button taking the inoperated and the operated position, respectively.

10 In Figs. 1 - 3 an embodiment is shown in which a switch 10 has a housing 11 and a push-button 12 which is movably mounted in the housing. The push-button has the shape of a membrane fixed on the upper side of the housing. Also on the upper side of the housing a light conductor 13 opens to form an indication surface 14. A fiber optic light conductor 15 extends through the housing 11 and opens in a recess 16 centrally disposed in said housing. The light conductor 15
15 is connected to a light source 17 in the shape of a light emitting diode. The light conductor 15 extends further through the recess 16 to a point in front of the opposite end of the light conductor 13, said opposite end having a slant surface 18. This end of the light conductor 13 has the shape of a prism. A stop 19 co-operates with the free end of the light conductor 15 to limit the
20 upward movement of said light conductor as will be described below. The light conductor 15 is stiffly connected with the push-button 12 by a pin 20. A light conductor 21 also extends through the housing 11 opening in the wall of the recess 16 below the slant surface 18 of the light conductor 13. The other end of the light conductor 21 is connected to a light detector 22, in the example
25 a photodiode. By means of conductors 23, 24 the light detector is connected to a block representing an electronic switch 25.

In Fig. 1 the switch is shown in its inoperated position. The thin push-button membrane has a bulge or bubble which is directed upwards and which via pin 20 biases the light conductor upwards such that the free end of
30 the conductor bears against the stop 19. The bulgy shape of the push-button has been achieved by the membrane being made of a polyester film in which a bubble has been preformed. The biasing force, of course, can be performed in many different ways, for example by the use of different spring arrangements. In the position shown light from the light source 17 is conducted via the light
35 conductor 15 to the slant surface 18 of the prism light conductor 13 from which the light is deviated so as to illuminate the indication surface 14. In the upper part of Fig. 3 the ray path of the light is shown for the position of the switch shown in Fig. 1.

Fig. 2 discloses what happens when the push-button 12 is being pushed. Via pin 20 the part of the light conductor 15 situated in the recess 16 is forced to participate in the movement which is stopped when the free end of the light conductor hits a stop 26. Thereby, the free end of the light conductor 15 will
5 line up with the light conductor 21 and light will be conducted to the light detector 22 for activating of the switch 25. At the same time the light supplied to the indicator surface 14 will cease. In the lower part of Fig. 2 there is shown more clearly the ray path for the light in this case.

Sometimes it might be desirable to permit a certain amount of light to reach the indication surface 14 even in the case where light is conducted through the light conductor 21. This is made possible in the embodiment shown in Figs. 4 and 5. For this purpose the light conductor connected to the light source, here having the reference numeral 27, has a larger diameter than the light conductor referred to by 28, leading to the light detector. Fig. 4 shows the light ray path
15 when the push-button is inoperated, whereas Fig. 5 shows the propagation of light when the push-button is operated. As appears from the last-mentioned Figure a certain portion of the incoming light hits the slant surface 18 illuminating to a certain extent the indication surface 14 also when the switch is operated. For this purpose the light conductor 28 extends through the slant
20 surface 18 whereby all light not hitting the light conductor 28 will be led to the indication surface 14.

In Figs. 6 and 7 a modified embodiment is shown wherein the same light conductor 29 is being used both for incoming and for outgoing light. Hence, light is being reflected back through the common light conductor to the light
25 detector which can be situated in the same area as the light source. For this purpose in the embodiment of Figs. 1 and 2 a mirror 30 is disposed in the area of opening of the light conductor 21. Fig. 6 shows the ray path when the push-button is inoperated while Fig. 7 shows how, when the button is pushed, the light is reflected back by the mirror 30.

C l a i m s

1. An electronic push-button switch (10) comprising a housing (11) with a recess (16) in which a push-button (12) is movably mounted, a first optical light conductor (15) having one end which opens in the recess (16) to conduct light to or from said recess, and a second optical light conductor (13) having one end which opens in the recess and is arranged to conduct light to a point of indication (14) in the housing (11) adjacent to the push-button (12), characterized in that the first light conductor (15) extends through the recess (16) so as to open in an area adjacent to the opening of the second light conductor (13), the push-button (12) being operably connected to the first light conductor (15) so as to move it between a first position in which the two light conductors (15,13) are coupled to each other and a second position in which the first light conductor (15) is arranged to conduct light to a light detector (22) provided to initiate operation of the switch.
2. A switch according to claim 1, characterized in that the second light conductor (13) has the shape of a prism, the part of which opening in the recess (16) having a slant surface (18), wherein in the first position light from the first light conductor (15) falls on the slant surface (18) to be conducted to the point of indication (14).
3. A switch according to claim 1 or 2, characterized in that an optical light conductor (21) leading to the light detector (22) opens in the recess (16) at a point situated in the same vertical plane as the slant surface but completely at the side of the said surface.
4. A switch according to claim 1 or claim 2, characterized in that an optical light conductor (28) leading to the light detector (22) extends through the slant surface, said light conductor (28) having a smaller sectional area than the first light conductor (27).
5. A switch according to claim 1 or claim 2, characterized in that the first optical light conductor (29) is arranged to conduct light also to the light detector (22), wherein in the second position the light conductor (29) is connected to a mirror (30) reflecting the light.
6. A switch according to any of the preceding claims, characterized in that the push-button (12) has the shape of a membrane which is stiffly connected with the first optical light conductor (15) by means of a pin (20).

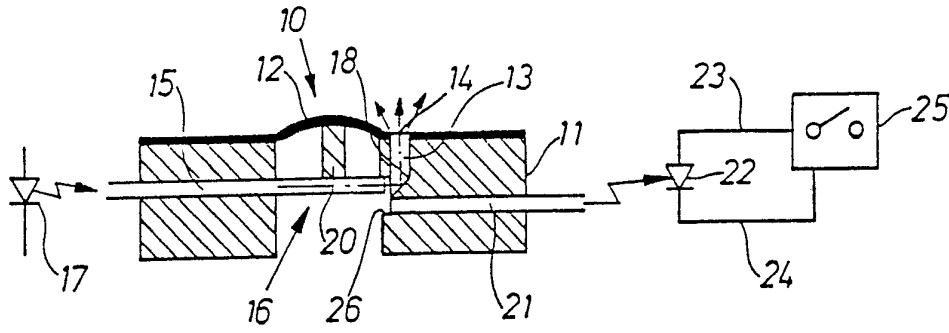


Fig. 1

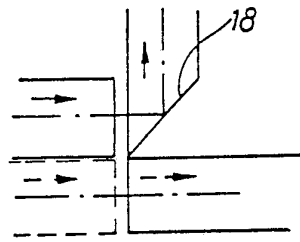


Fig. 3

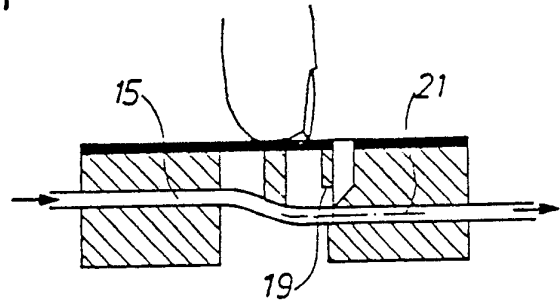


Fig. 2

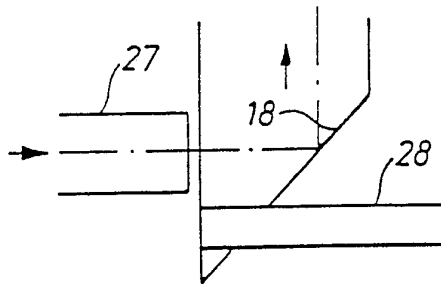


Fig. 4

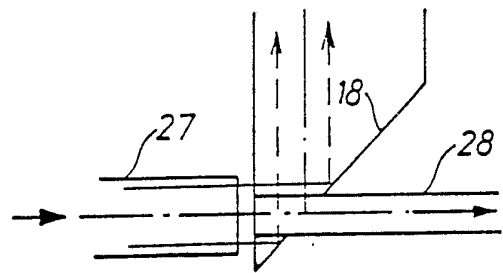


Fig. 5

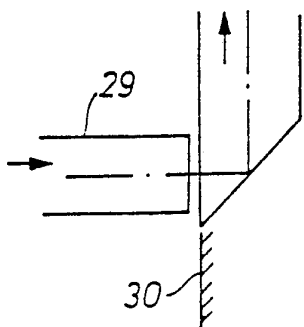


Fig. 6

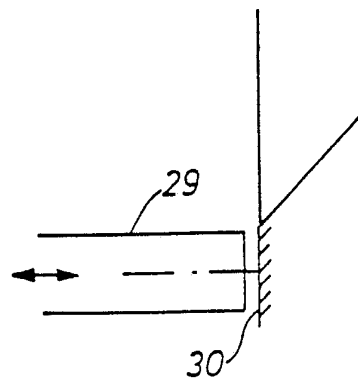
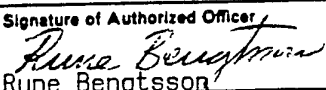


Fig. 7

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 89/00164

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC IPC4: H 03 K 17/968		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC4	H 03 K, H 01 H	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched ⁸		
SE, NO, DK, FI classes as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	US, A, 4315147 (A.L. HARMER) 9 February 1982, see the whole document, cited in the application --	1-6 -
A	DE, A1, 3535551 (BRUNINGHAUS, GUNTER) 9 April 1987, see figures 6,8 --	1-6
A	US, A, 4480184 (R.I. ELY) 30 October 1984, see the whole document --	1-6
A	US, A4, 4322126 (J. MINOWA ET AL) 30 March 1982, see figure 1 --	1-6
A	EP, A1, 0246938 (BATTAREL, CLAUDE) 25 November 1987, see the whole document --	1-6
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IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
1989-06-19	1989 -06- 19	
International Searching Authority	Signature of Authorized Officer	
Swedish Patent Office	 Rune Bengtsson	

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category*	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	Patent Abstracts of Japan, Vol 10, No 352, E458, abstract of JP 61-150411, publ 1986-07-09 MATSUSHITA ELECTRIC IND CO LTD --	1-6
A	EP, A1, 0200592 (VISSIERE, DANIEL) 10 December 1986, see the whole document --	1-6
A	US, A, 3526775 (K. FRIEDRICH ET AL) 1 September 1970, see the whole document -- -----	1-6

ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO. PCT/SE 89/00164

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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DE-A1- 3535551	09/04/87	NONE	
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