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# (54) RETRACTIVE SWITCH FOR THE PRODUCTION OR INTERRUPTION OF AN ELECTRICAL CONNECTION

(71) We, ROBERT BOSCH GmbH, a German company, of Postfach 50, 7 Stuttgart 1, Federal Republic of Germany, do hereby declare the invention, for which we pray that

a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to retractive switches.

A retractive switch having a film-like retractive diaphragm is already known from German Offenlegungsschrift 2623229, the diaphragm in the resting state being kept at a distance from the electrode pairs, by spacing members thereunder. The spacing members thereby form special parts which have to be disposed either on the retractive diaphragm or on the contact plate, disposed thereunder. Furthermore an electrically conductive layer is to be applied to the rearside of the retractive diaphragm so that during actuation the electrode pairs, located below the diaphragm, are connected to each other by the electrically conductive layer. Switches of this kind have the disadvantage that the retractive diaphragm, which is flat in the resting state, must be curved downwards and stretched during every actuation so that in the course of time it no longer returns completely to its initial position. The mounting of a switch of this kind on machines and other devices in the case of which as for example in motor vehicles, strong vibration stresses occur, would in the case of retractive diaphragms, not tensioned sufficiently, lead to faulty switching. Moreover the conductive layer on the rearside of the retractive diaphragm is also stretched during actuation and is thus also stressed mechanically under tension in addition to the electrical stress. Since the contact pressure is determined by the pressure of the finger which actuates it and consequently can be very different, there arises a further disadvantage that this contact

layer is damaged during too weak an actuation by the formation of sparks or during too strong an actuation by the contour of the switching electrodes, disposed thereunder.

A retractive switch is also known from German Utility Model 7247174 in which an electrically conductive retractive diaphragm, which curves in the shape of a spherical segment, with a sharp peripheral curve, is supported on a first annular contact surface which itself is disposed with a corresponding insulating layer on a lower second contact plate. The retractive diaphragm during actuation snaps through downwards and is supported by means of its central region on the second contact plate in order to produce the electrical connection. In this solution the retractive diaphragm must be fixed on the upper annular contact surface so as to be electrically conductive, which requires additional securing means. Moreover the retractive diaphragm is to be provided with an insulating layer in order to avoid faulty switching or to protect the person operating the switch sufficiently from shock-hazard voltages which could occur at the retractive diaphragm.

The present invention provides a retractive switch for the production or interruption of an electrical connection, having at least one actuation diaphragm, disposed on the front side of the switch and at least two switch contacts, disposed thereunder, and wherein the actuation diaphragm consists of an upwardly curved thin region of a thick-walled housing part which has in its centre a projection which projects into the switch interior and under whose end is located an elastically flexible switch contact which co-operates with a fixed counter-contact.

The retractive switch in accordance with the invention has in contrast to the known embodiments the advantage that the upwardly curved actuation diaphragm even during the strongest vibration stresses is less

prone to trigger any faulty switching, that it is integrated in the front plate of the retractive switch which consists of an insulative material and that it is less subject to wear both mechanically as well as electrically. Despite the robust switch design and the wide operating possibility, thereby achieved, the retractive switch is to be actuated with a correspondingly small force due to the small mass of the actuation diaphragm.

By means of a suitable choice of the material and of the thickness of the actuation diaphragm it is possible to ensure that it is pretensioned by the upwards curvature in such a manner that it snaps downwards during actuation and thus triggers an accurate switching procedure. If in the case of the retractive switch in accordance with the invention, one of the switch contacts is constructed as a snap contact then it is advantageous to harmonise the snapping position of the actuation diaphragm and that of the switch contact with each other in order to further improve the switching behaviour of the retractive switch.

The present invention is further described hereinafter, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 shows a cross-section of a retractive switch in accordance with the invention and having an actuation diaphragm integrated in the upper housing part;

Fig. 2 shows the same retractive switch in a plan view;

Fig. 3 shows a cross-section of a steering column assembly for motor vehicles, having several actuation diaphragms disposed near to one another and integrated in the housing part; and

Fig. 4 shows an enlarged representation of the individual parts of the steering-column mounted switch in a section along the line IV—IV in Fig. 3.

The retractive switch, shown in Figs. 1 and 2, serves, for example, to be used as a warning flasher switch in motor vehicles. An actuation diaphragm 11 is disposed on the front side of the retractive switch 10 and is integrated into the housing part constructed as a front plate 12. Two switch contacts 14 and 15 are located in the switch housing 13, of which the upper switch contact 14 is free stamped from a metallic spring plate 16, the spring blade 26, thus formed, curves upwards and is provided in its centre with a contact rivet 17. The spring plate 16 is riveted to a contact pin 18, inserted at the rearside of the switch housing 13. The counter-contact 15 is located on the end of a second contact pin 19, projecting into the housing, at the rearside of the switch housing. The actuation diaphragm 11 forms an upwardly curved thin region of the thick-walled front plate 12. It is provided in its centre with a projection 20 which

projects into the switch interior, under the end of the projection the elastically flexible switch contact 14 being located, which cooperates with its fixed counter-contact 15 to operate a switching procedure. The contact rivet 17 thereby projects into the opening of the tubular projection 20 by means of its free end which projects through the spring blade of the switch contact 14. This prevents the projection 20 from being pressed to the side during a lateral actuation of the diaphragm 11.

The actuation diaphragm 11 lies in a recess in the front plate 12, which encloses by means of its stiffened edge the support shoulder 13a of the switch housing 13. By this means almost the entire width of the retractive switch can be used as an actuation diaphragm. By means of the curvature of the actuation diaphragm 11 it is pretensioned so that it snaps through downwards during actuation simultaneously with the rivet 17 of the switch contact 14 and in this manner produces an electrical connection between the contacts 14 and 15 during the actuation. The projection 20 thereby serves to transmit directly the actuation force to the switch contact 14. Two contact bars, which are riveted onto the contact pins 18 and 19 and cannot be seen, make possible contact with the built-in holder 21 of a wedge base bulb 22 in the switch housing 13. The holder 21 is guided during assembly into an octagonal recess 23 at the base of the switch housing 13 and rotated by 90°. The lighting up of the symbol in the retractive switch 10 is made possible by a transparent symbol plate 24 which is locked in an appropriate opening in the front plate 12 above the actuation diaphragm 11. The retractive switch 10 can be inserted into an appropriate opening in the instrument panel, which is not shown, of a motor vehicle by means of two lateral expanding clips 25.

Such a switch can however also be used without additional adaptation measures in machines, switching systems or other superstructures of industrial devices. In the same manner several individual retractive switches could also be disposed near to one another or several actuation diaphragms could be disposed near to each other in a common enclosed front plate, where they in each case cooperate with switch contacts, associated with them.

Figs. 3 and 4 show as a further embodiment a steering column assembly 30 for a motor vehicle in which the retractive switch 31 is attached at the free end of a bent tube 32. The tube 32 accommodates several connection lines 33 which lead from the retractive switch 31 to an electronic unit in the motor vehicle, the unit not being shown.

The switch housing here consists of an upper housing part 34 and a lower housing 130

part 35, which, as Fig. 4 shows, are both constructed in a shell shape. The upper housing part 34 is provided with several actuation diaphragms 36, disposed near to each other, which in each case lie in a recess in the housing part 34. It can be seen from Fig. 4 that the actuation diaphragms 36 comprise an upwardly curved thin region of the thick-walled housing part 34, which region has in its centre a projection 37, projecting into the switch interior, under whose end an elastically flexible switch contact 38 is located, which cooperates with a fixed counter-contact 39 to trigger a switching procedure. The switch contacts 38 which are associated with the actuation diaphragms 36 and are also disposed near to each other are free stamped laterally from a metallic spring plate 40, the thus formed spring blade 41, which can be seen in Fig. 4, curves upwards in each case and is provided in its centre with a contact rivet 42. The spring plate 40 is attached to corresponding recesses in a printed circuit board 44 by means of bent hooks 43, in which board the counter-contacts 39 are located. The counter-contacts 39 are in contact on the rear side of the printed circuit board 44 in each case with conducting paths which are associated with them and cannot be seen. The conducting paths lead to the connections of the connection lines 33 at the right-hand end of the printed circuit board 44. One of the connection lines 33 is thus in contact with the spring plate 40.

The printed circuit 44 lies in the lower housing part 35 on laterally moulded-on support ribs 45 and it is clamped together with the spring plate 40 by means of further support ribs 46, moulded-on laterally in the upper housing part, between the two housing parts 34 and 35, in that the two housing parts are pressed together and catches 47, moulded-on at the upper housing part 34, thereby lock into corresponding recesses at the lower housing part 35.

In joining together the two housing parts 34 and 35 each contact rivet 42 is guided into the lower opening of the tubular projection 37 of the actuation diaphragm 36 associated with it by means of its free end projecting through the spring blade 41. In this manner each switch contact is accommodated in the end of a projection 37 of the associated actuation diaphragm 36 so that the actuation diaphragms 36 act directly by way of the projection 37 on the switch contacts 38, disposed near to each other, without being able slide down laterally during actuation. The housing parts 34 and 35 consist of a thermoplastic plastics material. The actuation diaphragm 36 is thereby selected to be so thin that the tension caused by its curvature has almost no effect during actuation and the switching moment is alone defined by the

snapping of the spring blade with the switch contact 38. By means of a slightly reinforced diaphragm however a further snapping effect can be achieved by means of its curvature, which effect supports the snapping effect on the spring blade 41 of the switch contact 38.

An axially displaceable press button 49 is disposed at the left-hand end of the retractive switch and can act by way of its central inwardly projecting tubular projection 50 on a further switch contact 38a which is free stamped at the bent end 40a of the spring plate 40. By means of the retractive switch 31, when the actuation diaphragms 36 or the push button 49 are pressed in, control current circuits are closed which lead by way of the connection lines 33 to an electronic control device and by way of which the electrical loads of the motor vehicle can be switched on and off.

By means of an appropriately constructed electronic circuit the push button 49 can, for example, be used to actuate a signal horn in such a manner that the signal horn is only switched on during the actuation of the push button 49. If on the other hand the connection lines are connected to flip-flop components, the switching state, selected in each case, remains in existence after actuation of the retractive switch and is only released after renewed actuation.

#### WHAT WE CLAIM IS:—

1. A retractive switch for the production or interruption of an electrical connection, having at least one actuation diaphragm, disposed on the front side of the switch and at least two switch contacts, disposed thereunder, and wherein the actuation diaphragm consists of an upwardly curved thin region of a thick-walled housing part which has in its centre a projection which projects into the switch interior and under whose end is located an elastically flexible switch contact which co-operates with a fixed counter-contact.

2. A retractive switch as claimed in claim 1, wherein the actuation diaphragm lies in a recess in the housing part.

3. A retractive switch as claimed in claim 1 or 2, wherein the actuation diaphragm snaps through downwards during actuation due to the curvature upwards.

4. A retractive switch as claimed in any of the preceding claims wherein the switch contact located below the projection of the actuation diaphragm is stamped free from a metallic spring plate, the spring blade thus formed curving upwards and being provided in its centre with a contact rivet.

5. A retractive switch as claimed in claim 4, wherein the projection is tubular at its end in order to accommodate the switch contact rivet.

6. A retractive switch as claimed in claim 130

4 or 5, wherein the contact rivet projects into the opening of the tubular projection by means of its free end which projects through the spring blade.

5 7. A retractive switch as claimed in any of the preceding claims, wherein the housing part having the actuation diaphragm can be locked on another housing part, carrying the switch contacts.

10 8. A retractive switch as claimed in any of the preceding claims, wherein the housing part has several actuation diaphragms which are disposed near to each other and in each case co-operate with switch contacts associated with them.

15 9. A retractive switch as claimed in claim 8, wherein a printed circuit board having fixed counter-contacts and a spring plate, supported on the board, and having a free stamped switch contact, projecting in each case beyond a counter-contact, is clamped between the two housing parts.

20 10. A retractive switch as claimed in claim 9, wherein it is attached as part of a steering column assembly at the free end of a tube in which the connection lines are located, which lead to the printed circuit board, carrying the counter-contacts and to the spring plate.

30 11. A retractive switch substantially as hereinbefore described with reference to Figs. 1 and 2 of the accompanying drawings.

35 12. A retractive switch substantially as hereinbefore described with reference to Figs. 3 and 4 of the accompanying drawings.

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Fig. 1

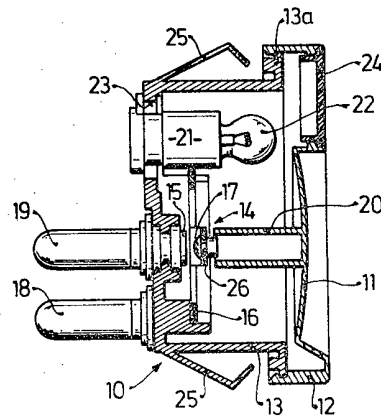


Fig. 2

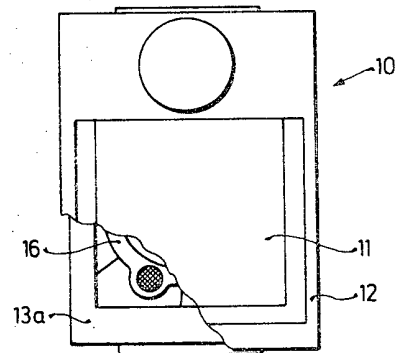


Fig. 3

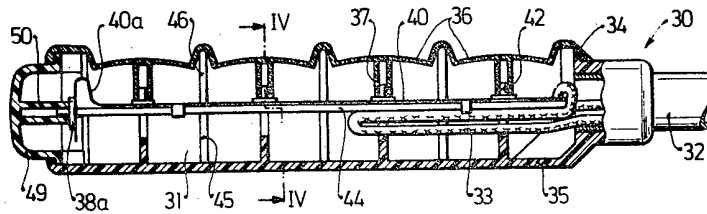


Fig. 4

