

5

10

15

A LATCHABLE SWITCH

The present invention relates to a latchable
20 switch which may find numerous applications in systems
for controlling electric and electronic installations or
apparatus. In such installations, there is often a need
of switches which may be operated by simply pressing with
a finger and which may be installed and connected readily
25 in places where space is often limited.

The switch of the invention answers very well
these requirements and has the further advantage of a
reduced cost because of the small number of parts which
form it and the great simplicity in assembling them. Its
30 latching function may be readily eliminated by the user
himself if required, which gives to this switch a very
great flexibility in use.

Numerous solutions already exist for latchable
switches generally combining flexible blade or sliding
35 contact means and complex latching means formed of
numerous moving parts.

These devices have the disadvantage of requiring close tolerances in the construction of the parts and delicate and costly assembly operations.

05 Moreover, and because of their complexity, their lifespan is often limited.

The present invention provides a latchable switch of the pusher type comprising, in a switch body :

- 10 - contact means including a contact plate pivotable about two pivots one at least of which, made from a conducting material, is connected to one connection terminal of the switch, said plate resting alternately on one of two stops placed on each side of the pivoting axis, one at least of which stops is conducting and is connected to another connection terminal of the switch, the pivoting position being defined by the differential pressure of
15 at least two springs the length of which and the stiffness of which are different, said springs being compressed by a pusher of the switch ;
- 20 - means for limiting the stroke of the pusher including a pawl integral with the pusher and serving for locking the pusher in the switch body at the time of assembly, said pawl comprising a tooth which is engaged in an axial elongated opening formed in said body so as to provide a stroke limitation of the pusher by coming into
25 abutment against the ends of the opening, said tooth having a ramp surface to enable the tooth to retract during assembly of the pusher in the switch body ;
- 30 - latching means including a spring in the form of a wire which extends substantially parallel to the direction of movement of the pusher with a first end fixed to said body and a second end provided with a bent portion which forms a finger bearing on a track provided on a lateral

area of the pusher and having bearing surfaces, said track forming a closed loop about a raised portion which is defined by two lateral portions of said track which extend substantially parallel to the direction of movement of the pusher, and by a V-shaped portion of said track which forms a cavity in said raised portion and which connects two facing ends of said lateral portions and by a slanted portion of said track which connects the two other ends of said lateral portions, said slanted portion facing the finger when the pusher is in an unlatched position, said V-shaped portion having its vertex pointed towards the slanted portion, said lateral portions, V-shaped portion and slanted portion forming some of said bearing surfaces, said track comprising a first further bearing surface which extends from the junction of a shorter one of the two lateral portions and one of the bearing surfaces of the V-shaped portion and which is substantially perpendicular to said one bearing surface of the V-shaped portion, and defines a step relative to the one lateral portion, and a second further bearing surface which is substantially perpendicular to the first further bearing surface, extends from the junction of the other of the two lateral portions and the other of the bearing surfaces of the V-shaped portion and defines a step relative to the vertex of the V-shaped portion, said bearing surfaces causing said finger to follow said track in a single direction, whereby, when the pusher is depressed from the unlatched position and then released, the finger is moved along the slanted portion, the one lateral portion, over the upper edge of the first further bearing surface and then latched in the V-shaped portion; and when the pusher is depressed from the latched position and then released, the finger is moved along the first further bearing surface, crosses over the upper edge of the second further bearing surface, along the other of

the two lateral portions to return to the unlatched position.

05 One embodiment will be described hereafter by way of non limitative example, with reference to the accompanying drawings in which :

Figure 1 is a general axial section with parts cut away of a latchable switch ;

Figure 2 is a right hand view showing the rear part of the switch of Figure 1 ;

10 Figure 3 is a left hand sectional view of the switch of Figure 1 ;

Figure 4 is a right hand sectional view of the switch of Figure 1 ;

Figure 5 is a front view of the contact plate of the switch of Figure 1;

Figure 6 is a sectional view of the contact plate of Figure 5;

5 Figure 7 is a top view showing an enlargement of the latching means of the switch of Figure 1

Figure 8 illustrates the operating sequence of the latching means of Figure 7;

10 Figure 9 is a perspective view of the latching means of Figure 7 showing their operating sequence.

Such as shown in Figure 1, the latchable switch is formed of:

- a hollow body 1 substantially of revolution about an axis 2, a part 3 of which may be positioned
15 against a front face 4 by means of a shoulder 5, an opposite part 8 of which is formed for receiving contact and latching means, and comprising means for securing to said front face 4 which may be a nut 6 screwed on a screw thread 7 external to said body 1, or any other means;

20 - a pusher 9, also hollow, substantially of revolution about axis 2 which may slide inside body 1 while being guided in translation in a bearing surface 65 of said body 1 by a collar 10 which serves as bearing surface for operating the switch on the one hand and, in
25 a bearing surface 64 of the same body 1, by a part 11 of said pusher opposite the collar 10 on the other, the inside of which, including particularly two guides 19 and 20, is provided for cooperating with the contact means, and whose outside includes a part of the latching means
30 as well as a pawl 12 for locking this pusher 9 in body 1 at the time of fitting, for preventing any rotation of said pusher and defining the limits of its stroke;

- three blades 13, 14 and 15, made from a
conducting material, with, at one of their ends, means
35 for connection to external circuits, placed in housings formed in body 1 so as to provide fixing and electric

insulation thereof, and the other ends of which, placed inside body 1, have a form adapted to the switching functions;

- a contact plate 16 also made from a conducting material, substantially circular in shape and which includes pivoting and guide means;

- two springs 17 and 18, guided inside the pusher by guides 19 and 20, bearing on the contact plate 16 and whose different stiffnesses and lengths ensure pivoting of said plate;

- a spring 60, placed between body 1 and collar 10 of pusher 9, for maintaining said pusher in the rest position;

- a spring 34, forming the second part of the latching means, preferably in the form of a suitably bent wire fixed in a housing formed in body 1.

Figure 2 shows in a right hand view the arrangement of the three blades 13, 14 and 15 which are advantageously placed at 120° from each other and whose ends serving for the external connections are situated in compartments 35, 36 and 37 formed in part 8 of body 1.

Spring 34 is fitted in a hole 38 formed in part 8 of body 1 in a zone separating two compartments, for example 35 and 36.

Figure 3, which is a sectional view of the switch whose pusher 9 and contact plate 16 have been removed, show the arrangements of the inside of part 8 of body 1 forming the contact means. These comprise:

- the cylindrical bearing surface 64 serving as guide for pusher 9;

- the internal parts of the three blades 13, 14 and 15 whose ends will serve as contacts, the end of blade 13 being preferably pointed so as to serve as first pivot for the contact blade 16, the ends of the other two blades, 14 and 15, being preferably rounded so as to serve alternately as support for the contact plate in

respectively the rest and work positions;

- a pin 39 integral with the bottom of part 8, whose axis is preferably parallel to the axis 2 of body 1, whose end 40, preferably conical, will serve as second
5 pivot for the contact plate 16 and is situated substantially at the same height as the pointed end of blade 13 so that the line or axis 47 which joins them is substantially perpendicular to the axis 2 and in a plane of symmetry of body 1;

10 - two housings 41 and 42, preferably cylindrical, parallel to axis 2 whose entrances are advantageously widened and whose inner diameters are adapted so as to hold guides 19 and 20 of pusher 9 in position while allowing them to slide.

15 Figure 3 also shows the finger 43 of spring 34 penetrating inside body 1 through a slit 44 for cooperating with the latching means of pusher 9.

Figure 4 is a right hand sectional view of the complete pusher. It comprises:

20 - body 1 pierced with slit 44 on the one hand and with an opening 45 parallel to axis 2 which serves for guiding the pawl 12 on the other;

- the pusher 9 to the bottom of which are fixed guides 19 and 20 and which has an imprint 46 cooperating
25 with spring 34 to provide the latching function, said imprint being preferably molded in a part of the pusher including a sector 50 encroaching inside its cavity;

- pawl 12 integral with pusher 9 including at least one ramp 61 and a bearing surface 62 and whose
30 width is slightly less than that of the opening 45 of body 1 ;

- guides 19 and 20 which are parallel and advantageously cylindrical in shape placed so that their plane is parallel to axis 2, is substantially
35 perpendicular to line 47 which joins the tops of pin 39 and blade 13 and is substantially at equal distances from

each of these two tops;

- springs 17 and 18 fitted about guides respectively 19 and 20;

- the contact plates 16 formed advantageously with a single opening 52 through which the two guides 19 and 20 pass, bearing on springs 17 and 18 through bearing surfaces respectively 48 and 48a on the one hand, 49 and 49a on the other, and including recesses or housings 54 and 53 for the tops of blade 13 and pin 39.

10 Figures 5 and 6, associated with Figure 4, and which show the contact plate in a left hand sectional view show better the role of the different bosses and recesses which it comprises.

15 In these figures 4, 5 and 6, the bearing surfaces 48, 48a, 49 and 49a are bosses formed advantageously by pressing the contact carrying plate 16. They are formed so that the two straight lines joining the tops of the bosses 48 and 48a on the one hand, 49 and 49a on the other, are substantially perpendicular to the largest
20 direction of opening 52 and perpendicular to the pivoting direction materialized by two recesses formed on the other face of the contact carrying plate. One of these recesses 53 is preferably conical in shape. The other 54, in the form of a V, has an inner edge whose direction
25 passes substantially through the top of the cone of the other recess.

30 These two recesses 53 and 54 come to bear on the tops of blade 13 and pin 39 and form the pivoting axis for the contact plate 16. They perfectly define the position of said plate and are positioned thereon so that it may pivot freely inside the pusher 9.

 Figure 7 shows the side of the switch whose body 1 is cut away so as to show the enlarged imprint 46 for a better understanding.

35 In this Figure 7, spring 34 passes through a groove 55 parallel to axis 2 and which widens on slit 44

side into a widened portion 56. Said spring is thus held firmly at its base, but may move resiliently on its finger 43 side, its rest position being perfectly defined by groove 55.

5 The imprint 46 includes bearing surfaces 31, 32, 27, 33, 28, 29 and 63 and ramps 23, 57, 58, 59 and 21 separated by edges 24, 25, 26 and 22, the detail of which is shown more clearly in Figure 7 and in the perspective view of Figure 9, on which the finger 43 of spring 34
10 comes to bear for providing the latching function and the subsequent explanation of the operation of which will better define the respective roles.

Bearing surfaces 31, 32, 27, 63 and 29 define a raised portion 65 about which finger 43 will rotate under
15 the effect of the movements of the pusher. Bearing surfaces 32 and 29 are parallel to each other and substantially parallel to the direction of movement of the pusher. Bearing surface 31 defining the raised portion 65 faces finger 43 when the pusher is at rest and
20 forms an acute angle with bearing surface 29. The bearing surfaces 27 and 63, forming a reentrant V inside the raised portion 65, define the fourth side of the raised portion.

Bearing surface 33 extends from the junction
25 point of bearings surfaces 32 and 27, is substantially perpendicular to said bearing surface 27 and its upper edge 25 is lower than the raised portion 65.

The bearing surface 28 extends from the junction point of bearing surfaces 29 to 63, is substantially perpendicular to said bearing surface 63 and forms
30 an edge 26 with ramp 58 defined by the bearing surfaces 33, 27 and 63.

The switch thus described performs a contact function in the following way.

35 At rest, the pusher 9 is held in position by spring 60 and pawl 12 in the opening 45, as can be seen

in Figure 1. The contact plate 16 bearing on blade 13 and pin 39 also rests on blade 14 under the effect of spring 17 which, already compressed in this position of pusher 9, through the bosses 48 and 48a exerts a torque on said plate about the pivoting axis 47 which is greater than the one produced by spring 18, stiffer but very little compressed and which bears against bosses 49 and 49a.

The contact plate 16 establishes a contact between blades 13 and 14.

When the pusher is driven in, the torque exerted by spring 18 on the contact plate increases quicker than that exerted by spring 17 and exceeds it, causing said plate to pivot which comes to rest on blade 15, establishing the contact between blades 13 and 15 after breaking the contact between blades 13 and 14.

The stroke of the pusher is limited by the bearing surface 62 of pawl 12 which abuts against the bottom of opening 45 of body 1.

When the pusher is released, and if the switch is not provided with a latching system, everything returns to the initial position.

It should be noted that:

- bosses 48 and 48a, 49 and 49a form, for springs 17 and 18, a sort of hinge which reduces the friction, perfectly defines the bearing point of the forces and overcomes any uncertainty concerning the value of the pivoting torques;

- the height of said bosses may advantageously be adjusted as a function of the desired pivoting speed, as a man skilled in the art will readily understand.

The latching system operates in the following way.

Figure 8 illustrates the relative positions assumed respectively by imprint 46 and finger 43 of spring 34.

Figure 9 shows in perspective the path 51 over

which finger 43 travels on imprint 46.

In the successive positions of Figure 8, it can be clearly seen that finger 43 only moves from right to left or left to right under the combined effects of its stiffness, the bearing surfaces of imprint 46 and the friction of said finger on the ramps of said imprint, whereas this imprint, integral with pusher 9, only moves from top to bottom and bottom to top.

It should also be noted that the initial stress of spring 34 tends to cause finger 43 to move into body 1 and so to hold it under pressure on the ramps of the imprint.

At rest, position a, finger 43 bears on the ramp 23 and is substantially centered.

When the pusher is pressed, bearing surface 31 meets finger 43 and moves it leftwards.

This latter slides up over ramp 23, is then held at the left by bearing surface 32, position b, crosses edge 24 and falls onto ramp 57, position c, where it remains until the end of the travel of pusher 9.

When pusher 9 is released, finger 43 meets ramp 27 which drives it rightwards, crosses edge 25 and falls onto ramp 58 and is stopped, position d, in the V formed by bearing surfaces 27 and 63, blocking movement of pusher 9 which is thus latched in the work position.

When a new pressure is exerted on pusher 9, bearing surface 33 meets finger 43 which moves leftwards and crosses edge 26 to fall on ramp 59, position e.

If pusher 9 is again released, the bearing surface 28 pushes finger 43 rightwards which then slides, position f, along bearing surface 29 up over ramp 21 then crosses edge 22 to fall back on ramp 23, position g, a little before pusher 9 reaches its rest position.;

At the time of a new operation, bearing surface 31, will move finger 43 leftwards, whatever its position on ramp 23.



CLAIMS

1. A latchable switch of the pusher type comprising, in a switch body :

- 05 - contact means including a contact plate pivotable about two pivots one at least of which, made from a conducting material, is connected to one connection terminal of the switch, said plate resting alternately on one of two stops placed on each side of the pivoting axis, one at least of which stops is conducting and is connected to
10 another connection terminal of the switch, the pivoting position being defined by the differential pressure of at least two springs the length of which and the stiffness of which are different, said springs being compressed by a pusher of the switch ;
- 15 - means for limiting the stroke of the pusher including a pawl integral with the pusher and serving for locking the pusher in the switch body at the time of assembly, said pawl comprising a tooth which is engaged in an axial elongated opening formed in said body so as to
20 provide a stroke limitation of the pusher by coming into abutment against the ends of the opening, said tooth having a ramp surface to enable the tooth to retract during assembly of the pusher in the switch body ;
- 25 - latching means including a spring in the form of a wire which extends substantially parallel to the direction of movement of the pusher with a first end fixed to said body and a second end provided with a bent portion which forms a finger bearing on a track provided on a lateral area of the pusher and having bearing surfaces,
30 said track forming a closed loop about a raised portion which is defined by two lateral portions of said track which extend substantially parallel to the direction of movement of the pusher, and by a V-shaped portion of said track which forms a cavity



in said raised portion and which connects two facing ends of said lateral portions and by a slanted portion of said track which connects the two other ends of said lateral portions, said slanted portion facing the finger when the pusher is in an unlatched position, said V-shaped portion having its vertex pointed towards the slanted portion, said lateral portions, V-shaped portion and slanted portion forming some of said bearing surfaces, said track comprising a first further bearing surface which extends from the junction of a shorter one of the two lateral portions and one of the bearing surfaces of the V-shaped portion and which is substantially perpendicular to said one bearing surface of the V-shaped portion, and defines a step relative to the one lateral portion, and a second further bearing surface which is substantially perpendicular to the first further bearing surface, extends from the junction of the other of the two lateral portions and the other of the bearing surfaces of the V-shaped portion and defines a step relative to the vertex of the V-shaped portion, said bearing surfaces causing said finger to follow said track in a single direction, whereby, when the pusher is depressed from the unlatched position and then released, the finger is moved along the slanted portion, the one lateral portion, over the upper edge of the first further bearing surface and then latched in the V-shaped portion ; and when the pusher is depressed from the latched position and then released, the finger is moved along the first further bearing surface, crosses over the upper edge of the second further bearing surface, along the other of the two lateral portions to return to the unlatched position.

2. A latchable switch, according to claim 1, wherein :
- said body is a hollow cylindrical body having first and second bearing surfaces and said elongated opening,



- 05 - said pusher having a collar sliding on the first said bearing surface and having a cylindrical part sliding in the second bearing surface, the assembly of the pawl, after fitting in said elongated opening, providing guidance and stroke limitation of the pusher.
3. A latchable switch, according to either of claims 1 and 2, wherein the contact means include :
- 10 - three conducting blades whose ends external to the body are provided with connection means, the inner end of one said blade being pointed, the ends of the other said blades being rounded, the three blades being fixed substantially parallel to said direction of movement in a first part of the body opposite a second part of the body where the pusher is located, the position of
- 15 said blades being substantially on a circle and at 120° from each other ;
- a pin parallel to the axis of the body, integral with the inner bottom of the first part of the body, and whose top, in the form of a cone, is situated
- 20 substantially at the same height with respect to said bottom as the top of said one blade ;
- the said contact plate being formed with two recesses, one of which is conical and the other of which is in the form of a V whose edge, directed towards the conical
- 25 recess, forms therewith a pivoting axis placed substantially in the middle of said contact plate also having two pairs of bosses, each pair of bosses being aligned parallel to said pivoting axis and placed one on one side and one on the other side of said pivoting
- 30 axis, each element of each pair of bosses being placed on each side of an opening formed substantially perpendicular to the pivoting axis in said contact plate;
- two cylindrical guides parallel to the axis of the pusher and integral therewith and sliding in housings whose
- 35 entrance is widened and which are integral with said



first part of the body ;

- two springs fitted on the cylindrical guides of the pusher and whose lengths and stiffnesses are different so as to allow pivoting of the contact plate.

05 4. A latchable switch, according to either of claims 1 and 2, wherein the latching means are formed of :

- said latching spring which has said finger fitted in a hole formed in the said body held in position by a groove ending in a widened portion formed in
10 said body parallel to the axis and said finger of which penetrates into a slit of the body so as to bear on an imprint which includes said track ;

- said imprint which is molded on a part of the pusher and which includes said bearing surfaces acting
15 successively on the finger for deflecting it or pushing it back, namely : with the imprint seen from the front deflecting the finger leftwards when the pusher moves down, holding the finger on the left, raising the finger during the downward movement of the pusher and ending
20 in an edge beyond which, at the end of the stroke of the pusher, the finger falls back, bringing the finger rightwards when the pusher is released and begins to rise again, until it reaches the bottom of said V-shaped portion, the finger then falling back, deflecting the
25 finger rightwards when the pusher moves down again, deflecting the finger further to the right during the next rising movement of the pusher, holding the finger on the right during this latter rising movement, during which said finger moves up before crossing an edge to
30 fall back and begin the cycle again.

5. A latchable switch substantially as described herein with reference to the accompanying drawings.
