Dec. 27, 1966 H. F. MASON 3,294,942

PUSH BUTTON SWITCH

Filed Aug. 10, 1964

FIG. 1.

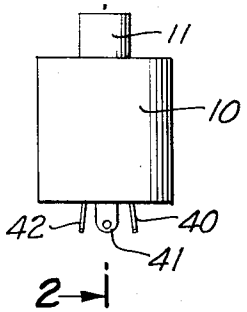


FIG. 2.

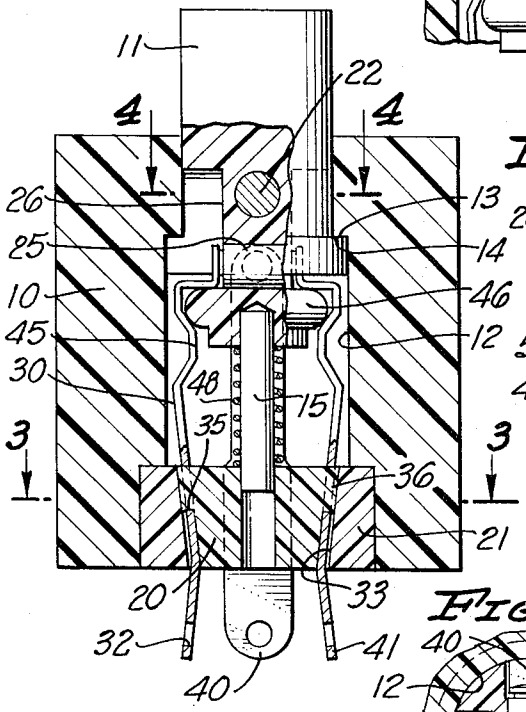


FIG. 3.

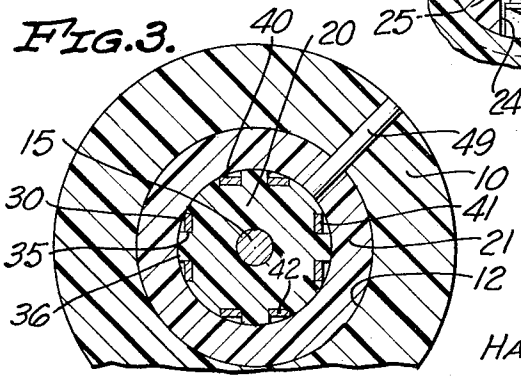


FIG. 4.

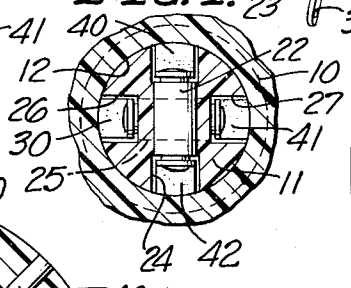


FIG. 5.

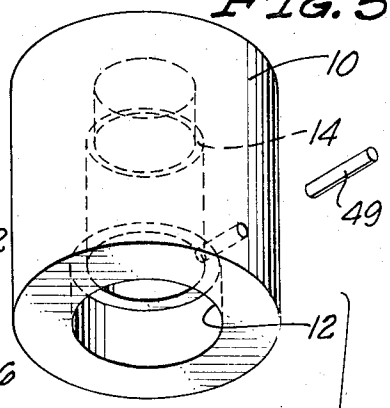


FIG. 6.

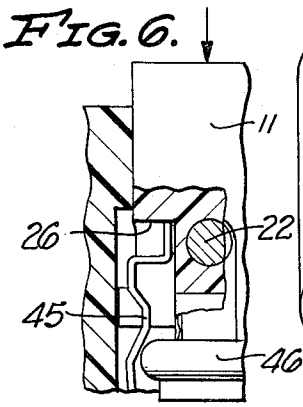


FIG. 7.

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PUSH BUTTON SWITCH

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This invention relates to electrical switches and, in particular, to sliding or reciprocating switches which are particularly adapted for utilization as manually operated push button switches.

It is an object of the invention to provide a small, compact, inexpensive, durable and reliable electrical switch. A further object is to provide a push button or manually actuated switch having such characteristics.

It is an object of the invention to provide such a switch which may be used for making circuits or for breaking circuits or for both making and breaking circuits.

It is an object of the invention to provide such a switch incorporating a cam action which provides fast break and fast make operation and which also provides a detect action while permitting overtravel of the switch plunger without damage to the switch elements.

It is an object of the invention to provide an electrical switch incorporating a housing, a plunger slidably mounted in the housing and movable between first and second positions and having a cam movable therewith, a conductor carried in the plunger and having a pair of exposed contact faces, and a pair of contact carriers mounted in the housing with each carrier including a contact resiliently urged toward the plunger and a cam surface engageable with the cam when the plunger moves intermediate the first and second positions for moving the contacts away from the plunger, with the contacts engaging the contact faces and completing a circuit between the carriers when the plunger is in one of the positions.

It is a further object to provide such a switch incorporating means for manual movement of the plunger from one position to the other and a switch incorporating spring means for urging the plunger to one of the positions. A particular object is to provide such a switch utilizing more than one conductor in the plunger and more than one set of contact carriers permitting control of more than one circuit with a single switch movement. A particular object is to provide such a switch in which the housing is a simple tubular structure with the contact carriers mounted in one end thereof and with the plunger slidably carried in the opposite end.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. The drawing merely shows and the description merely describes a preferred embodiment of the present invention which is given by way of illustration or example.

In the drawing:

FIG. 1 is a side view of a preferred form of the switch;

FIG. 2 is an enlarged sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 2;

FIG. 4 is a partial sectional view taken along the line 4—4 of FIG. 2;

FIG. 5 is an exploded view showing the assembly of the switch of FIG. 2;

FIG. 6 is a partial sectional view corresponding to that of FIG. 2 showing the switch with the plunger depressed; and

FIG. 7 is a view similar to that of FIG. 6 illustrating the movement of the contact during switch operation.

The switch includes a housing **10** and a plunger **11** both preferably made of electrical insulating material. In the preferred form illustrated herein, the housing is tubular having a passage **12** therethrough. The plunger **11** carries a peripheral shoulder **13** which engages a mating shoulder **14** of the housing for limiting movement of the plunger in one direction. A guide pin **15** is carried in and projects from the inner end of the plunger **11** and slides in a passage of a plug **20** fitted in a ring **21** in the other end of the housing **10**. The plug and ring preferably are made of electrical insulating material and support contact carriers in a manner to be described below.

A conductor **22**, typically a cylindrical slug of copper or silver, is mounted in the plunger **11**. The ends of the conductor **22** are exposed at slots **23, 24** provided in the plunger. Another conductor **25** is similarly mounted in the plunger **11** spaced from the conductor **22** and at a different orientation, typically at 90° to the conductor **22**. The ends of the conductor **25** are exposed at slots **26, 27** formed in the plunger **11**.

A contact carrier **30** having an electrical contact **31** at the upper end thereof and an opening **32** at the lower end for connection of a wire is mounted between the plug **20** and ring **21**. The ring **21** may have a tapered opening **33** which converges away from the housing, with the plug **20** having a corresponding tapered form for a push fit into the ring. Slots **34** are provided in the periphery of the plug for receiving contact carriers, with a contact carrier having a slot **35** for engaging a boss **36** of the plug for fixing the carrier relative to the plug. Three additional carriers **40, 41, 42** are provided identical to the carrier **30**.

The contact carriers are made of an electrical conducting resilient material and are installed so as to urge the contacts into engagement with the plunger when in the normal positions as shown in FIGS. 2 and 6. Each carrier is provided with a cam surface which may be produced by forming a convex section **45** in the strip of metal comprising the carrier. An annular shoulder **46** on the plunger serves as a cam for engaging the cam surfaces of the carriers as the plunger moves between the positions of FIGS. 2 and 6. In the embodiment illustrated herein, a spring **48** is positioned around the guide pin **15** and engages the plunger **11** and plug **20** for urging the plunger to the upward position of FIG. 2. The plunger may be moved downward to the position of FIG. 6 by manual pressure or by various mechanical or electrical actuating devices. A pin **49** serves to hold the switch together after it has been assembled.

When the switch is in the position of FIG. 2, the contacts of the carriers **30** and **41** engage the faces of the conductor **25**, providing an electrical circuit between the two carriers. At this time, the contacts of the carriers **40** and **42** rest on the insulating material of the plunger, resulting in an open circuit between the carriers **40, 42**. When the plunger is moved downward, the cam **46** engages the cam surfaces **45** of the carriers, moving all four contacts radially outward from the plunger. When the plunger has moved downward to the position of FIG. 6, the cam **46** has moved past the highest portion of the cam surfaces, permitting the contacts of the carriers to move radially inward and engage the plunger. At this time, the contacts of the carriers **40** and **42** engage the exposed faces of the conductor **22**, providing a closed circuit between the carriers **40, 42**. The contacts of the carriers **30, 41** now rest on insulating material and provide an open circiut between the carriers **30** and **41**. The motion of a contact relative to the plunger is indicated by the line **52** of FIG. 7.

Similar operation occurs when the plunger is moved upward from the position of FIG. 6 to the position of FIG. 2. The cooperation of the cam of the plunger and

the cam surfaces of the carriers provides a fast break and fast make action for the contacts. The cam and cam surface operation also provides a detenting action tending to locate the plunger either in the position of FIG. 2 or of FIG. 6. When the switch is used as a manual push button, this detenting action can be felt by the operator, giving an indication of the switch position. The particular cam and cam surface arrangement utilized also permits overdriving of the plunger without damaging the camming structure.

While the switch illustrated herein provides for both breaking of one circuit and making of another circuit, the switch of the invention could be produced only for making a circuit or only for breaking a circuit by utilization of only one of the conductors **22, 25** and the corresponding pair of contact carriers. In another alternative arrangement, the spring **48** could be omitted and the switch could be moved from one position to the other in either driection by a positive driving force which may be manual or powered as desired.

Although exemplary embodiments of the invention have been disclosed and discussed, it will be understood that other applications of the invention are possible and that the embodiments disclosed may be subjected to various changes, modifications and substitutions without necessarily departing from the spirit of the invention.

I claim as my invention:

1. In an electrical switch, the combination of:

a housing;

a plunger slidably mounted in said housing and movable between first and second positions and having a cam of electrical insulating material movable therewith;

a conductor carried in said plunger and having a pair of exposed contact faces; and

a pair of contact carriers mounted in said housing each including a contact resiliently urged toward said plunger and each including a cam surface separate from the contact and engageable with said insulating cam when said plunger is intermediate said first and second positions for moving said contacts away from said plunger and maintaining an open circuit between said carriers, with said contacts engaging said contact faces and completing a circuit between said carriers when said plunger is in one of said positions.

2. In an electrical switch, the combination of:

a housing;

a plunger slidably mounted in said housing and movable between first and second positions and having a cam movable therewith;

a first conductor carried in said plunger and having a pair of exposed contact faces;

a second conductor carrier in said plunger and having a pair of exposed contact faces; and

first and second pairs of contact carriers mounted in said housing, each carrier including a contact resiliently urged toward said plunger and each including a cam surface engageable with said cam when said plunger is intermediate said first and second positions for moving said contacts away from said plunger, with the contacts of said first pair engaging the contact faces of said first conductor and completing a circuit between said first pair of carriers when said plunger is in said first position, and with said contacts of said second pair engaging said contact faces of said second conductor and completing a circuit between said second pair of carriers when said plunger is in said second position.

3. A switch as defined in claim **2** including spring means engaging said housing and plunger for urging said plunger toward said first position, said plunger including means for manual movement to said second position.

4. In an electrical switch, the combination of:

a housing;

a plunger of insulating material slidably mounted in said housing and movable between first and second positions and having a cam of electrical insulating material movable therewith;

an elongate conductor carried in said plunger disposed normal to the axis of movement of said plunger and having a pair of opposed exposed contact faces; and

a pair of opposed contact carriers mounted in said housing each including a contact resiliently urged into engagement with said plunger and each including a cam surface separate from the contact and engageable with said insulating cam when said plunger is intermediate said first and second positions for moving said contacts radially away from said plunger and maintaining an open circuit between said carriers, with said contacts engaging said contact faces and completing a circuit between said carriers when said plunger is in one of said positions and engaging said plunger providing an open circuit between said carriers when said plunger is in the other of said positions.

5. In an electrical switch, the combination of:

a tubular housing;

a plunger slidably mounted at one end of said housing and movable between first and second positions and having a cam movable therewith;

a conductor carried in said plunger and having a pair of exposed contact faces;

a retainer ring mounted in the other end of said housing and having a tapered passage converging away from said housing;

a mating plug positioned within the passage of said ring and having carrier receiving slots with bosses projecting therein; and

a pair of contact carirers each disposed in a plug slot and having a slot for receiving the plug boss for fixing the carrier between the ring and plug, each carrier including a contact resiliently urged toward said plunger and each including a cam surface engageable with said cam when said plunger is intermediate said first and second positions for moving said contacts away from said plunger, with said contacts engaging said contact faces and completing a circuit between said carriers when said plunger is in one of said positions.

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