March 21, 1967 E. F. GOETZ 3,310,762

PUSHBUTTON SNAP ACTION SWITCH WITH PERMANENT MAGNET LATCHING MEANS

Filed Feb. 1, 1966 2 Sheets-Sheet 1

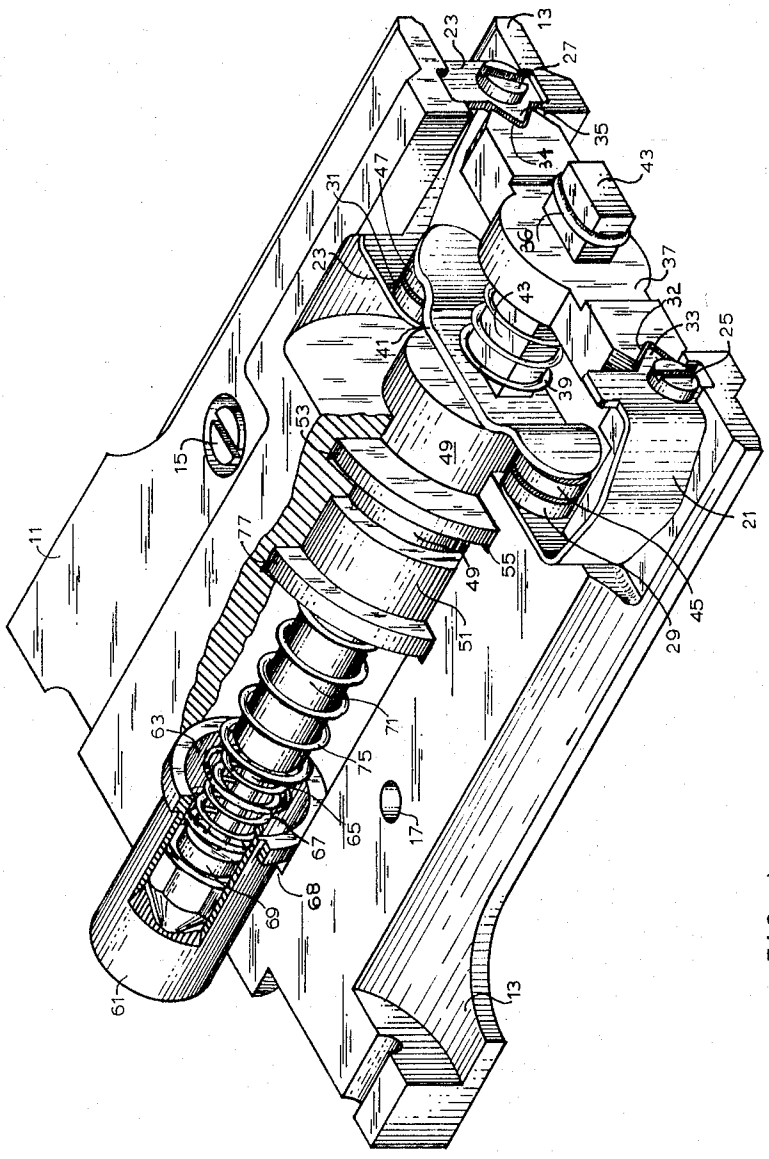


FIG. 1

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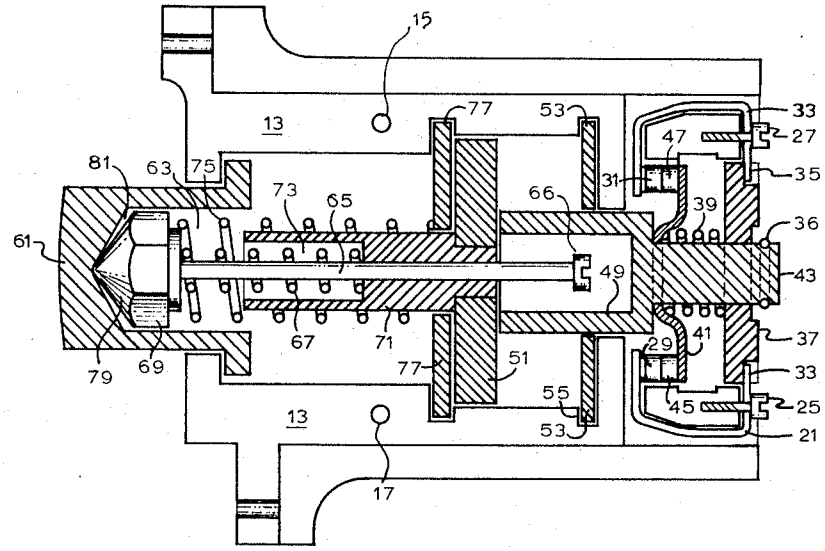


FIG. 2

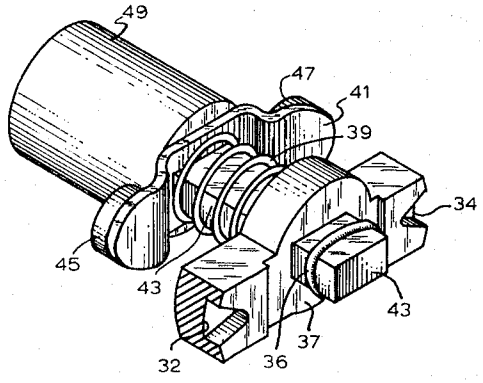


FIG. 3

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PUSHBUTTON SNAP ACTION SWITCH WITH PERMANENT MAGNET LATCHING MEANS

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1 Claim. (Cl. 335—188)

This invention is directed to a device for interrupting energy delivered in an electrical circuit, and, more particularly, relates to a manually operated circuit breaker and the like, sometimes referred to as a "snap-action" switch.

Essentially the invention resides in the provision of the linear alignment of mechanical components in a device of this type for economizing space in respect to ganged units for enabling rapid and reliable operation, and for permitting easy access to the actual contacting members in respect to the inspection and maintenance.

In many applications such as in cam operated switches it is desirable to contain the ganged contact operating mechanisms to a small space. In the usual lever and overcenter travel contact operating mechanisms a great amount of valuable space is occupied by the leverage mechanism.

It is therefore an object of this invention to provide an improved construction which will produce a switch having its components so arranged whereby the usual toggles, levers, and overcenter travel mechanisms are completely eliminated, thereby allowing for increased density of ganged arrangement of snap-action switches.

The basic goal of snap-action switches is to provide reasonably fast contact operation by a relatively slow moving operator such as in a cam switch or a float switch. The usual method in which this is attained is by lever and overcenter travel mechanisms, wherein linear forces are transferred to angular motions such as in bearing pins, through which mechanical life of the switch is curtailed.

Another object of this invention is to provide an improved snap-action mechanism in which all the moving components are arranged linearly, thereby increasing the mechanical life of the switch by eliminating the wear associated with the usual toggles, levers, and overcenter travel mechanisms.

In all electrical circuit interrupting devices there is a possibility that the electrical contacts, through the action of the electrical arc, become welded in the closed position, so that the force produced by the springs associated with the overcenter travel mechanisms is insufficient to overcome the weld and thereby fail to perform the primary function of the component which is to interrupt the circuit.

Another object of this invention is to provide an improved construction which will produce a switch in which the contact opening feature is completely failsafe.

When individual circuit breakers are mounted in close proximity to each other as in a ganged arrangement in a cam operated mechanism, or in any location where space for inspection and maintenance is restricted, it becomes essential that under those circumstances the entire snap-action switch has to be removed. This usually involves disconnecting the electrical wiring with which the switch is associated and the removal of mounting screws whereby the switch is affixed to the cam operator mechanism or the like.

It is therefore yet another object of this invention to provide an improved construction which will produce a switch in which inspection and maintenance of the electrical contacts may be performed without removal of the entire switch from its supporting members.

The invention is set forth with particularity in the appended claim. The principles and characteristics of the invention, as well as other objects and advantages are revealed and discussed through the medium of the illustrative embodiments appearing in the specification and drawings which follow.

In the drawings:

FIGURE 1 illustrates a cutaway view of the snap-action switch which is provided with the "in-line" construction.

FIGURE 2 of the drawings shows a cross-sectional view of snap-action switch, showing the relationship of the springs and other moving parts with the stationary parts.

FIGURE 3 shows the movable contact unit, removed from the switch as during contact tip inspection.

Referring now to FIGURE 1, the housing consisting of a front portion and back portion **11** and **13**, respectively, is shown assembled and fastened together by screw **15**. The front portion **11** is partially broken away to show hole **17** in back portion **13** which is used for fastening front portion **11** to back portion **13** with a screw similar to screw **15**. Stationary contact supports **21** and **23**, supporting contacts **29** and **31**, respectively, are shaped to fit in slots therefore provided in the housing front and back portions **11** and **13**, respectively, and contain threaded holes for connection screws **25** and **27**.

FIGURE 3 shows the movable contact unit consisting of pushrod **43** having an enlarged cylindrical portion **49** which forms a shoulder to which movable contact support **41** with electrical contacts **45** and **47** is urged by contact spring **39**. Pushrod guide **37** which is slidably assembled onto pushrod **43** and which is held in position by O-ring **36** which is inserted into a notch therefore provided in pushrod **43**. Pushrod guide **37** is provided with two depressions **32** and **34** into which the specially shaped ends **33** and **35** of stationary contact supports **21** and **23** are fitted as shown in FIGURE 1.

Removal of the movable contact unit is accomplished by compressing contact spring **39** so that stationary contact supports ends **33** and **35** become disengaged from depressions **32** and **34** in pushrod guide **37**. A 45° counterclockwise twist of the pushrod guide will allow retraction of the entire movable contact unit from the switch.

When the movable contact unit is installed in the switch, contact spring **39** urges movable contacts **45** and **47** to engage with stationary electrical contacts **29** and **31**, respectively.

The cylindrical portion **49** of the pushrod **43** passes slidably through a central opening in a first magnetizable stationary member **53**, which is located in cavity **55** therefore provided in the front and back portions of the housing **11** and **13**, respectively.

The actuating portion of the snap-action switch consists of a button **61** having within it a concentric cavity **63** as shown in FIGURE 2. A conical portion **79** of spring seat **69** nests pivotally within a conical cavity **81** of button **61**. The cross-sectional view in FIGURE 2 shows stem guide **71** connected to magnet **51** having stem **65** slidably passing through it. The trip spring **67** which passes into cavity **73** of stemguide **71** and rests against the spring seat **69** is not under compression until button **61** is depressed. The return spring **75** urges against spring seat **69** at one end while the opposite end presses against the second stationary member **77**.

In operation with the switch in the normal position, as illustrated in FIGURE 2, return spring **75** which is a relatively low gradient spring, urges button **61** against seat projection **68** of housing **11** and **13**.

Trip spring **67**, a relatively high gradient spring, is practically at free length.

Depression of button **61** causes compression of trip spring **67** and return spring **75**. The pressure buildup of trip spring **67** is such that when the space between spring seat **69** and stem guide **71** is zero, the magnetic attraction between magnet **51** and second stationary member **77** is slightly greater than the compressive force of trip spring **67**.

Continued movement of the button **61** will cause the magnetic seal between magnet **51** and second stationary member **77** to be broken, at which time trip spring **67** will expand and propel magnet **51** toward first stationary member **53**. Together with the magnet **51**, pushrod **43**, supporting movable contacts **45** and **47**, is moved in the direction of first stationary member **53**. This causes movable contacts **45** and **47** to disconnect from stationary contacts **29** and **31**, respectively, thereby opening the electrical path consisting of terminal screw **25**, stationary contact support **21**, stationary contact **29**, movable contact **45**, movable contact support **41**, movable contact **45**, stationary contact **31**, stationary contact support **23** and connection screw **27**.

Assuming now that the movable contacts **45** and **47** have become welded to stationary contacts **29** and **31**, respectively, then, continued stroke applied to button **61** will positively break the weld and open the electrical path.

When the pressure on button **61** is removed, return spring **75** urges the button toward its normal position. The compressive force thus removed from trip spring **67** allows the spring to expand to free length, hence removing the pressure from magnet **51**. The magnetic attraction between magnet **51** and first stationary member **53** is now the only force to maintain the position of the magnet **51**, pushrod **43** and associated contacts **45** and **47**, against the compressive force of contact spring **39**. However, just before button **61** reaches its normal position, the head **66** of stem **65** engages with magnet **51** and the combined force of return spring **75** and contact spring **39** break the magnetic seal between first magnetizable stationary member **53** and magnet **51**. This combined force persists until button **61** reaches its normal position, at which time the force of contact spring alone returns the magnet **51**, pushrod **43** and electrical contacts **45** and **47** to the normal position, with the magnet coacting with second stationary member **77**, as represented by FIGURES 1 and 2.

The electrical path from terminal screw **25** through the components named above to terminal screw **27** is now closed, hence allowing electrical current to flow through the snap-action switch.

While the invention has been explained and described with the aid of particular embodiments thereof, it will be understood that the invention is not limited thereby and that many modifications retaining and utilizing the spirit thereof without departing essentially therefrom will occur to those skilled in the art in applying the invention to specific operating environments and conditions. It is therefore contemplated by the appended claim to cover all such modifications as fall within the scope and spirit of the invention.

What is claimed is:

A circuit breaker having fixed and movable contacts, a contact operating spring normally urging said contacts together, positive operating means for ultimately separating said contacts, a trip spring coacting with said operating means for initially separating said contacts, a return spring coacting with said contact operating spring to resist said operating means, said operating means including a permanent magnet, a first, fixed magnetizable member coacting with said magnet to provide snap-action to bring said contacts together, a second, fixed magnetizable member coacting with said magnet to provide snap-action to separate said contacts, a fixedly detachable abutment for said contact operating spring, the tension of said spring against said abutment normally retaining the alignment of said movable contacts with said fixed contacts, and a support engaging and disengaging said abutment upon its displacement whereby the alignment of said contacts is disrupted to permit said movable contacts to be removed from said circuit breaker.

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