March 1, 1966 A. Z. LOPASIC ETAL 3,238,334

ILLUMINATED PUSH BUTTON CIRCUIT BREAKER

Filed Oct. 1, 1962

3 Sheets-Sheet 1

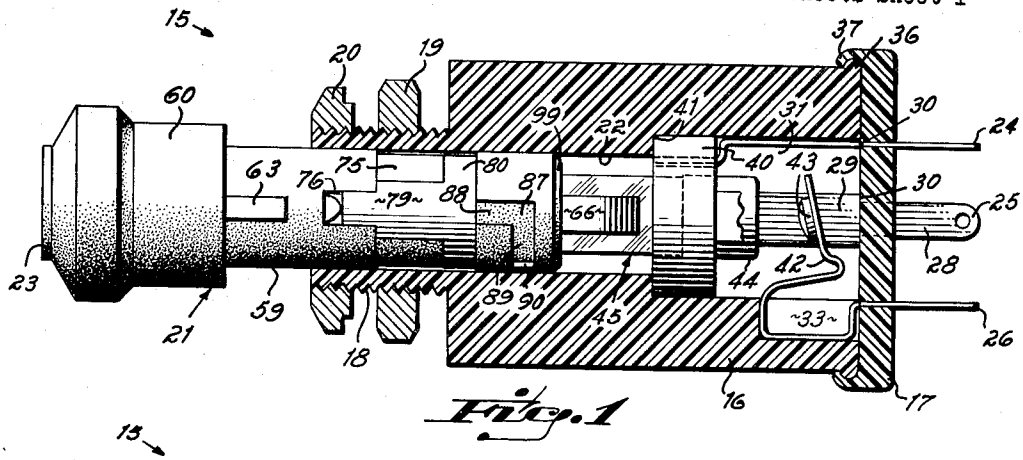

Fig. 1

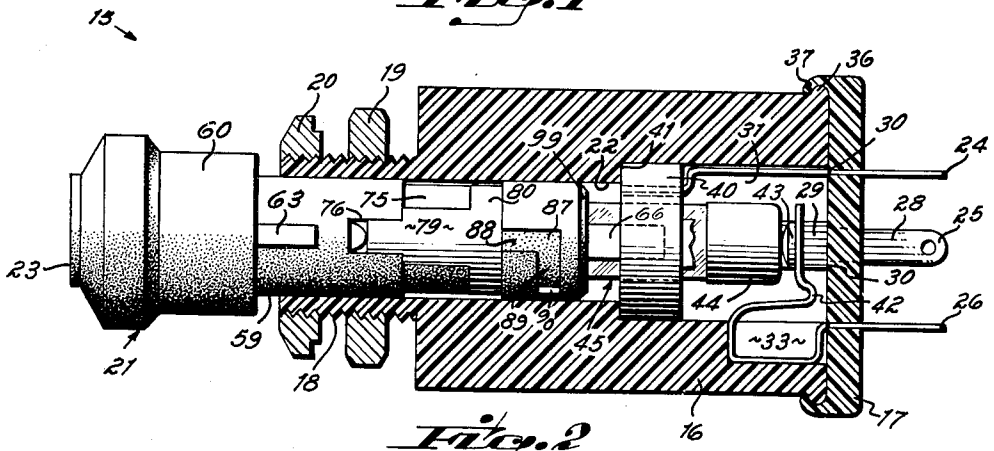

Fig. 2

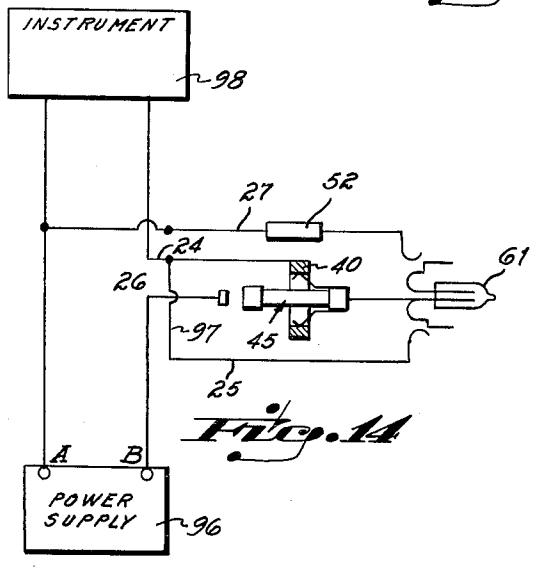

Fig. 14

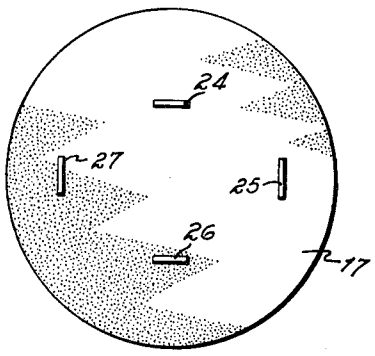

Fig. 13

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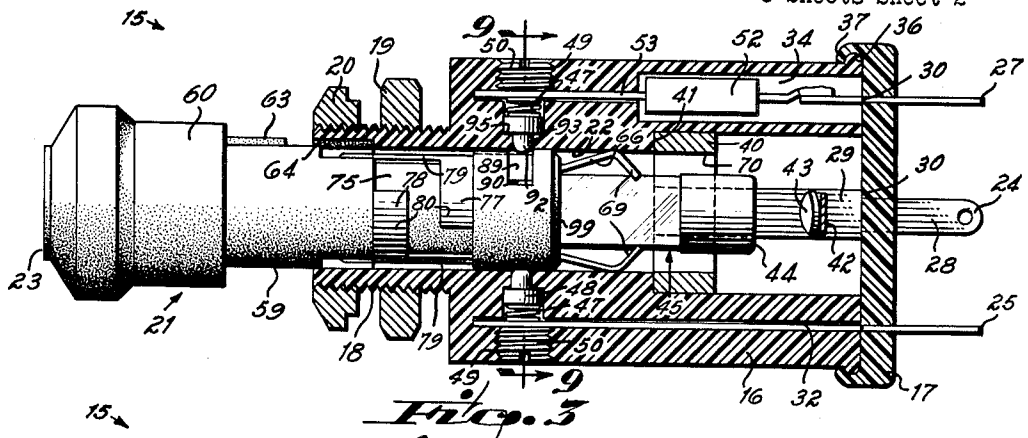

Fig. 3

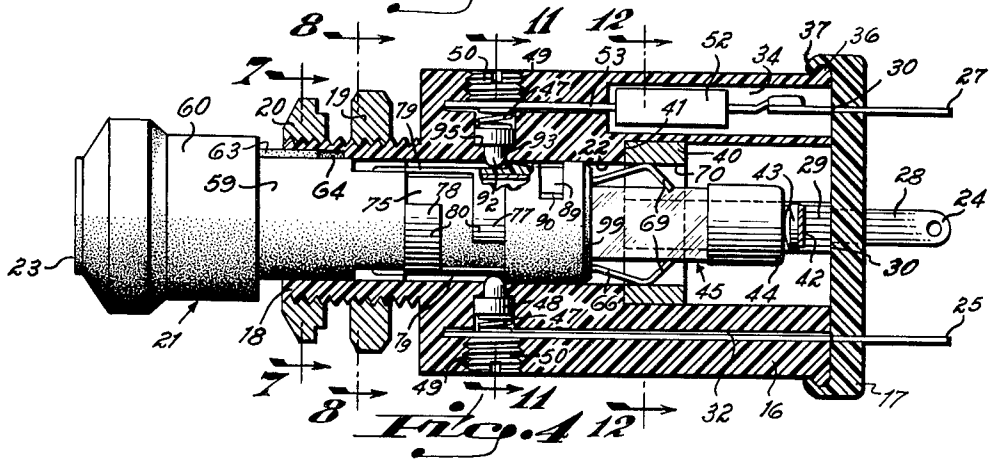

Fig. 4

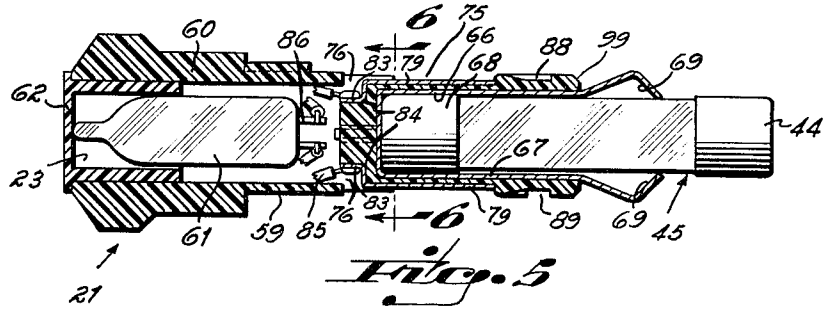

Fig. 5

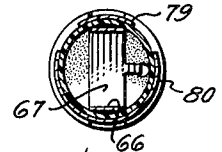

Fig. 6

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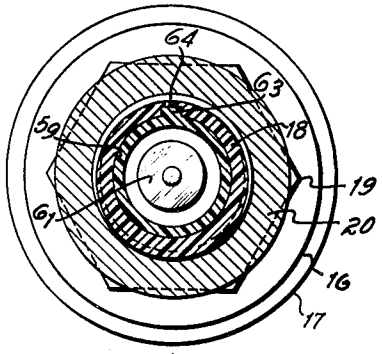

Fig. 7

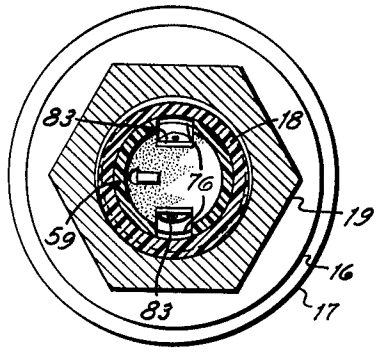

Fig. 8

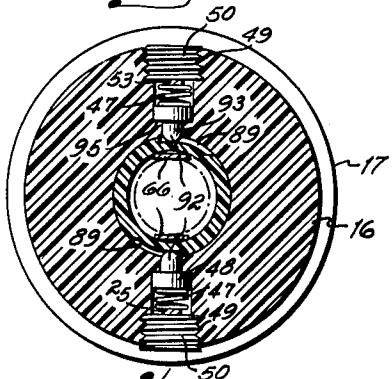

Fig. 9

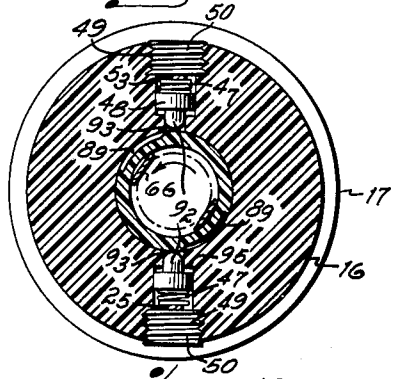

Fig. 10

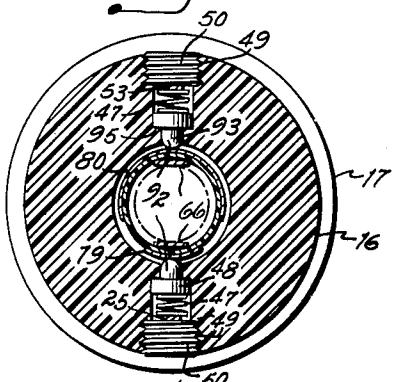

Fig. 11

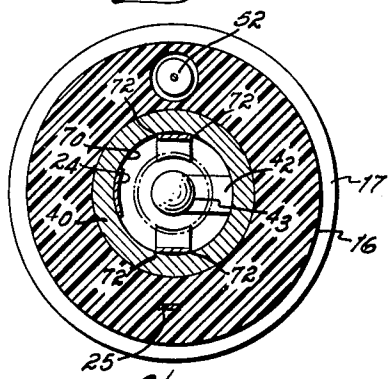

Fig. 12

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3,238,334

ILLUMINATED PUSH BUTTON CIRCUIT BREAKER

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2 Claims. (Cl. 200—121)

This invention relates to a circuit breaker, and more particularly the invention is directed to an "off-on" switch of the type used in controlling the energization of electrical instruments, although the structural features of the invention are not necessarily limited to use in that environment.

In an electrical instrument, for the protection of its circuits, it is normal to provide, as separate devices, an "off-on" switch, a fuse, and an indicator light which shows that the instrument is either energized or de-energized. These three components occupy a substantial area on the front panel of the instrument and require separate assembling steps for their installation.

To eliminate the need for three separate components and without eliminating any of their needed functions, it has been the objective of the invention to provide a push-button "off-on" switch which carries its own easily replaceable fuse and which provides its own auxiliary circuit and indicating light.

Another objective of the invention has been to provide a circuit breaker in which all component parts are, of themselves, easily assembled and reliable in operation.

The circuit breaker of the invention is mountable in an instrument merely by passing an outwardly projecting portion of its casing through a hole in an instrument panel and securing it to the instrument panel by screwing a nut over the projecting portion. Four terminals project from the breaker casing into the instrument by which the circuit breaker and its auxiliary indicating circuit can be connected into the instrument circuit as desired. As a feature of the invention, relating to its ease of assembly, the invention provides for the mounting of the terminal connections merely by disposing them in slots or recesses in the breaker casing which properly orient them and by applying a snap-on cap through which the terminals project and by which the terminals are secured within the breaker casing.

It has been still another objective of the invention to provide the circuit breaker with certain safety or operational features. Included in these features is a detent system by which the circuit breaker push-button can be rotated in its "off" position and thereby prevented from being inadvertently depressed to its "on" position.

Cooperating with that detent are auxiliary contact-detents which engage a groove in the push-button and prevent the inadvertent withdrawal of the push-button during normal operation. In the event of need to replace a fuse, however, a ramp forming a part of the push-button groove permits the push-button to be rotated to a position in which it can be withdrawn.

Another objective of the invention resides in the main contact construction, wherein one of the contact members is a conductive ring of substantial dimensions surrounding the fuse, the contact ring providing a heat sink for the dissipation of heat in the area of the fuse which might otherwise reduce the fusing point of the fuse element below that desired.

Still another objective of the invention has been to provide a simplified construction for the mounting of auxiliary contact-detents in the casing and for mounting cooperating auxiliary contact members on the push-button.

These and other objectives of the invention will become

more readily apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a longitudinal cross-sectional view of the circuit breaker according to the invention showing the elements in an "off" position,

FIG. 2 is a view similar to FIG. 1 showing the elements in an "on" position,

FIG. 3 is a longitudinal cross-sectional view of the circuit breaker, the cross-section being taken through a plane at 90° to the cross-section of FIGS. 1 and 2.

FIG. 4 is a view similar to FIG. 3 showing the elements in an "off" position,

FIG. 5 is a cross-sectional view of the push-button assembly,

FIG. 6 is a cross-sectional view taken along lines 6—6 of FIG. 5,

FIG. 7 is a cross-sectional view taken along lines 7—7 of FIG. 4,

FIG. 8 is a cross-sectional view taken along lines 8—8 of FIG. 4,

FIG. 9 is a cross-sectional view taken along lines 9—9 of FIG. 3,

FIG. 10 is a cross-sectional view taken along lines 9—9 of FIG. 3 showing the push-button rotated to a position permitting its removal,

FIG. 11 is a cross-sectional view taken along lines 11—11 of FIG. 4,

FIG. 12 is a cross-sectional view taken along lines 12—12 of FIG. 4,

FIG. 13 is an end elevational view of the inner end of the circuit breaker, and

FIG. 14 is a circuit diagram illustrating the connection of the circuit breaker to an instrument.

Referring to FIGS. 1 and 2, the circuit breaker indicated at **15** has a casing **16** enclosed by a cap **17** at its inner end. Throughout the specification and claims, reference will be made to the "inner" end of the circuit breaker as being that which projects into the instrument, and the "outer" end of the circuit breaker as being that from which the push-button projects. A threaded neck **18** projects from the outer end of the casing **16** and to it are threaded an inner nut **19** and an outer nut **20** by which the circuit breaker is mounted to a panel. A push-button **21** is slidably and rotatably mounted in a longitudinal bore **22** passing through the circuit breaker casing. The push-button has an auxiliary indicating light **23** at its outer end, the light being adapted to be energized when the push-button is depressed.

From the inner end of the casing project four terminals **24, 25, 26** and **27** (see also FIGS. 3 and 4). Each terminal has a projecting thin portion **28** and a portion **29** of larger width, the two portions providing a shoulder at **30**. The cap **17** has four apertures of a sufficient size to permit the passage of the thin portions **28** but of insufficient size to permit the passage of the wider portions **29**. By sliding the cap over the projecting terminal portions and bringing its surface into engagement with the shoulders **30**, the terminals can be secured within the casing. Additionally, each terminal is seated in a recess in the casing wall, as for example, recess **31** for terminal **24**, recess **32** for terminal **25**, recess **33** for terminal **26**, and recess **34** for terminal **27**. The casing at its inner end has an annular flange **36** which receives a resilient lip **37** projecting from the cap **17**, the flange and lip having mating surfaces by which the cap is secured to the casing when the lip **37** is snapped over the flange. The two main contacts are **24** and **26**. Contact **24** is terminated at its end within the casing by a conductive ring **40** of substantial width and thickness. The ring **40** abuts an annular shoulder **41** within the bore **22** of the casing. Main contact **26** has a resilient portion **42** which

carries a contact tip 43 in axial alignment with the conductive end 44 of fuse 45.

The auxiliary contact terminals are elements 25 and 27 which are best shown in FIGS. 3 and 4. Terminal 25 is simply a flat conductive strip which lies in its recess 32 and has the end within the casing engaged by one end of a compression spring 47. The other end of the compression spring 47 engages a T-shaped auxiliary contact-detent 48, the spring 47 and detent 48 being secured in a radial bore 49 by a threaded plug 50. The auxiliary contact terminal 27 has the end within the casing connected to one end of a resistor 52. The other end of the resistor is connected to a conductive member 53 which is also secured by a spring 47, auxiliary contact-detent 48, and plug 50 within a radial bore 49.

The push-button 21 is a generally cylindrical member whose inner barrel 59 has an outside diameter approximately equal to the inside diameter of the bore to permit the push-button to slide easily within the bore without perceptible transverse motion. The push-button has an outer end 60 of larger dimension to receive a light bulb 61 (FIG. 5) and a translucent cap 62 which together form the indicator light 23. A longitudinally extending detent 63 is formed integrally with the push-button barrel 59 adjacent the enlarged outer end portion 60. A mating slot 64, best shown in FIGS. 3, 4 and 7, receives the detent 63. Only when the detent 63 and slot 64 are aligned can the push-button be depressed to an "on" position.

Within the push-button barrel is a U-shaped conductive contact strip 66. The outer or bight portion 67 of the contact member 66 provides a resilient grip on a conductive outer end 68 of the fuse 45. The inner ends 69 of the U-shaped contact member are V-shaped to form a pair of leaf spring contacts engageable with the inner surface 70 of the contact ring 40. As best illustrated in FIG. 12, the apices of the V-shaped portions 69 provide a reliable contact at four points 72 on the contact ring 40.

The cylindrical wall of the push-button is recessed at 75 and provided with apertures 76 to receive auxiliary contact members 77 and 78. Each contact member 77 and 78 has a longitudinal conductive portion 79 and circumferential portion 80 embracing more than 180° of the push-button barrel. The circumferential portion is resilient and can be applied firmly to the push-button barrel merely by snapping it about the barrel in the recess 75.

The outer ends 83 of the auxiliary contacts have an L-shaped bend to seat them on shoulders 84 formed in the push-button adjacent the apertures 76. The ends 83 have small conductors 85 connected at one end to them and at their other ends to terminals 86 which project from the light bulb 61.

The push-button barrel also has a pair of L-shaped grooves 87, best shown in FIGS. 1 and 2, each L-shaped groove having a longitudinal portion 88 and a circumferential portion 89. The end of the circumferential portion has a ramp 90 connecting the bottom of the groove with the surface of the push-button barrel. The longitudinal portion 88 of the groove is aligned with the longitudinal portions 79 of the auxiliary contact members 77.

Each of the auxiliary contact-detents 48 has a tip 92 projecting through a hole 93 in the casing wall. Complete passage of the contact-detents into the bore 22 is prevented by a flange 94 which bottoms on a shoulder 95 in the casing wall.

Spring 47 resiliently urges the contact-detents, and particularly their tips 92, into engagement with the auxiliary contact members 77 and into engagement with the L-shaped grooves 87. Since the contact-detents 48 are in electrical communication with terminals 25 and 27 through the springs 47, engagement of the contact-detents by the contact members will effect the energization of the light bulb 61.

When the push-button is withdrawn to a de-energized position, the contact-detent tips 92 move into the groove 87. Complete withdrawal of the push-button is prevented by circumferential portion 89 of the groove. However, when the push-button is rotated counterclockwise, as viewed from its outer end, the contact-detents will ride up the ramp 90 bringing the detents on the cylindrical surface of the push-button barrel and permitting complete withdrawal of the push-button.

It can be seen that, by connecting terminals 24 and 26 in series with a power supply for the device to be controlled by the circuit breaker, the device can be energized by pushing in the push-button and deenergized by pulling out the push-button. When the push-button has been pushed in and an overload occurs, the fuse 45 will blow, thereby disconnecting the device from the power supply.

The auxiliary circuit can be operated by an independent power supply merely by connecting the terminals 25 and 27 to the independent power supply. Under these conditions, however, the indicating light would serve only to show that the push-button has been depressed to an "on" position and would not be deenergized upon the blowing of the fuse.

In the circuit of FIG. 14, provision is made for operating the indicating light 61 from a main power supply 96 and associating its auxiliary circuit with respect to the fuse 45 so that, upon interruption of the main circuit by the blowing of the fuse, the indicator light 61 would be de-energized along with the main circuit to the instrument. In effect, the fuse is placed in series with the main power supply 96 with the device to be controlled and the light 61 forming a parallel circuit, that parallel circuit being in series with the fuse 45 and the power supply 96. More specifically, the circuit is formed by connecting a jumper 97 between main terminal 24 and auxiliary terminal 25. The auxiliary terminal 27 is then connected to one side indicated at "A" of the power supply, and main terminal 26 is connected to the other side indicated at "B" of the power supply. The jumper terminals are connected to the instrument to be controlled indicated at 98.

In operation, a fuse is inserted in the push-button with one conductive end 68 in engagement with the U-shaped contact member 66, and the push-button is inserted into the bore 22 of casing 16. The inner end of the push-button barrel is chamfered as at 99 to engage auxiliary contact-detents 48 to force them outwardly to permit the passage of the push-button barrel into the bore 22. When the push-button is properly positioned in its "off" position, the tips 92 of auxiliary contact-detents 48 are disposed in the L-shaped grooves 87 and the push-button is prevented from inadvertent withdrawal.

By rotating the push-button to bring its longitudinally extending detent 63 into alignment with the mating slot 64, the push-button is made ready for depressing to "on" position. When the push-button is depressed to "on" position the U-shaped contact member 66 is first brought into engagement with the inner surface of fixed contact ring 40. Thereafter, continued inward movement of the push-button brings the free conductive end 41 of the fuse 45 into engagement with the contact tip 43. Conversely, upon withdrawal of the push-button, contact tip 43 and fuse end 44 separate, breaking the circuit, before disengagement of contact member 66 with ring 40. That contact tip is specially formed and of a special material (all of known design) to withstand the arcing occurring during the operation of the push-button. As a consequence, to avoid the corrosion and pitting of the ring 40 and U-shaped contact member 66, it is important that the fuse and contact tip 43 perform the circuit opening and closing function. This is provided by the proper sequence of engagement and disengagement of the respective contacts as described above.

The alignment of detent **63** and mating slot **64** which is effected by rotation of the push-button brings the auxiliary contact-detents into alignment with the longitudinal portions **88** of the L-shaped grooves **87**. When the push-button is depressed, the contact-detents ride in the longitudinal portion **88** of each groove until they are brought into engagement with the auxiliary contact members **77**, thus effecting the energization and illumination of the light **61** simultaneously with the energization of the main circuit.

When it is desired to de-energize the circuit, the push-button merely has to be withdrawn. If the instrument controlled by the circuit breaker is not to be used for a time, it may be desirable to rotate the push-button counterclockwise through a small angle to bring the detent **63** out of alignment with the mating slot **64**, thereby making it impossible to close the circuit by inadvertently depressing the push-button. The push-button cannot be inadvertently withdrawn because of the engagement of the auxiliary contact-detent with the circumferential portion **89** of the L-shaped groove.

However, if a fuse has blown and it is necessary to replace it, the push-button can be withdrawn by rotating the push-button through a sufficient angle to cause the contact-detents to ride up on the ramp **90** which terminates each of the circumferential groove portions **89**. When the detents are on the cylindrical portion of the push-button barrel the push-button may be easily withdrawn for replacement of the fuse.

Having described our invention, we claim:

1. A push-button switch comprising,
a casing having an elongated bore,
a push-button longitudinally movable in said elongated bore,
said casing having at least one transverse bore having a shoulder at the inner end thereof,
a contact-detent in said transverse bore projecting into said elongated bore into engagement with said push-button
a compression spring in said bore having its inner end in engagement with said contact detent
an auxiliary contact terminal in said casing,
the inner end of said terminal being engaged by the outer end of said spring,
a contact member on said push-button connected to auxiliary electrical means and engageable by said contact-detent when said push-button is moved from "off" position to "on" position,
at least one L-shaped groove in the side of said push-button, said groove having a longitudinal portion inwardly of said contact members and a circumferential portion inwardly of said longitudinal portion,

said contact detent being engageable with said groove, whereby said push-button can normally be pushed inwardly only when said detent is in the longitudinal portion of said groove.

2. A circuit breaker comprising,
a casing having an elongated bore therein,
a push-button having an elongated hollow barrel rotatably and slidably mounted in said bore,
electrically conductive fuse engaging means in said barrel for holding the outward end of a fuse,
said fuse engaging means including at least one movable contact projecting from said inward end of said push-button,
a first fixed contact at the inward end of said bore engageable by the inward end of a fuse in said push-button, and
a second fixed contact in said bore engageable by said movable contact when said push-button is pushed inwardly,
at least one L-shaped groove in the side of said push-button, said groove having a longitudinal portion and a circumferential portion inward end of said longitudinal portion,
a detent mounted in said casing and engageable with groove,
whereby said push-button can normally be pushed inwardly only when said detent is in the longitudinal portion of said groove.

References Cited by the Examiner

UNITED STATES PATENTS

626,918	6/1899	Medary	200—159
1,602,227	10/1926	Hentschel	200—129
1,819,248	8/1931	Kobayakawa	200—166
1,860,972	5/1932	Wulfhorst	200—16
2,207,837	7/1940	Sundt	200—129
2,417,692	3/1947	Kline	200—121
2,723,389	11/1955	Hallerber et al.	200—167
2,812,400	11/1957	Budd	200—166
2,854,549	9/1958	Duerkob	200—133
2,855,483	10/1958	Swing et al.	200—121
2,914,638	11/1959	Erdtmann et al.	200—133
2,996,702	8/1961	Jentges	200—159
3,047,683	6/1962	Schlesinger	200—4

FOREIGN PATENTS

914,133	12/1962	Great Britain.

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