United States Patent

[11] 3,614,697

[72] Inventors **Robert W. Dunham; Charles D. Vyskocil, both of Cedar Rapids, Iowa**

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[73] Assignee **Square D Company Park Ridge, Ill.**

[54] MOLDED CASE ELECTRIC CIRCUIT BREAKER WITH FUSE AND INDICATOR LAMP

5 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **337/6,** 337/8, 337/79
[51] **Int. Cl.** **H01h 85/00**
[50] **Field of Search** 337/4, 6, 8, 79; 335/17

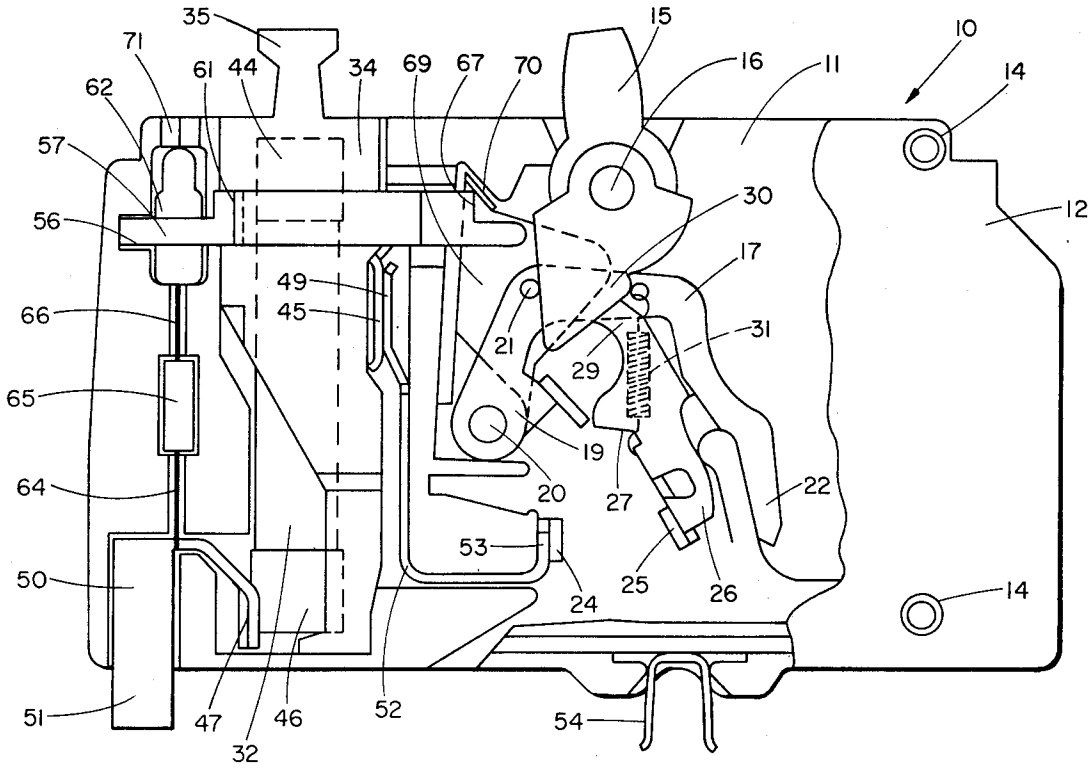
[56] **References Cited**

UNITED STATES PATENTS

3,354,277	11/1967	Stanback et al.	337/8
3,474,373	11/1969	Myers	337/8

Primary Examiner—Bernard A. Gilheany
Assistant Examiner—F. E. Bell
Attorneys—Harold J. Rathbun and Paul J. Rose

ABSTRACT: A circuit breaker is provided with a current-limiting fuse mounted in a removable fuse holder and electrically connected in series with the circuit breaker contacts. A self-biasing mechanical interlock member prevents insertion or removal of the fuse unless an operating lever is in the OFF position. An indicator lamp is connected across the fuse and circuit breaker contacts to indicate an open circuit caused either by blowing of the fuse or tripping of the circuit breaker. A switch in the energizing circuit of the lamp prevents lighting thereof when the operating lever is in the OFF position. The interlock member carries current to the lamp and serves as a movable contact for the switch.



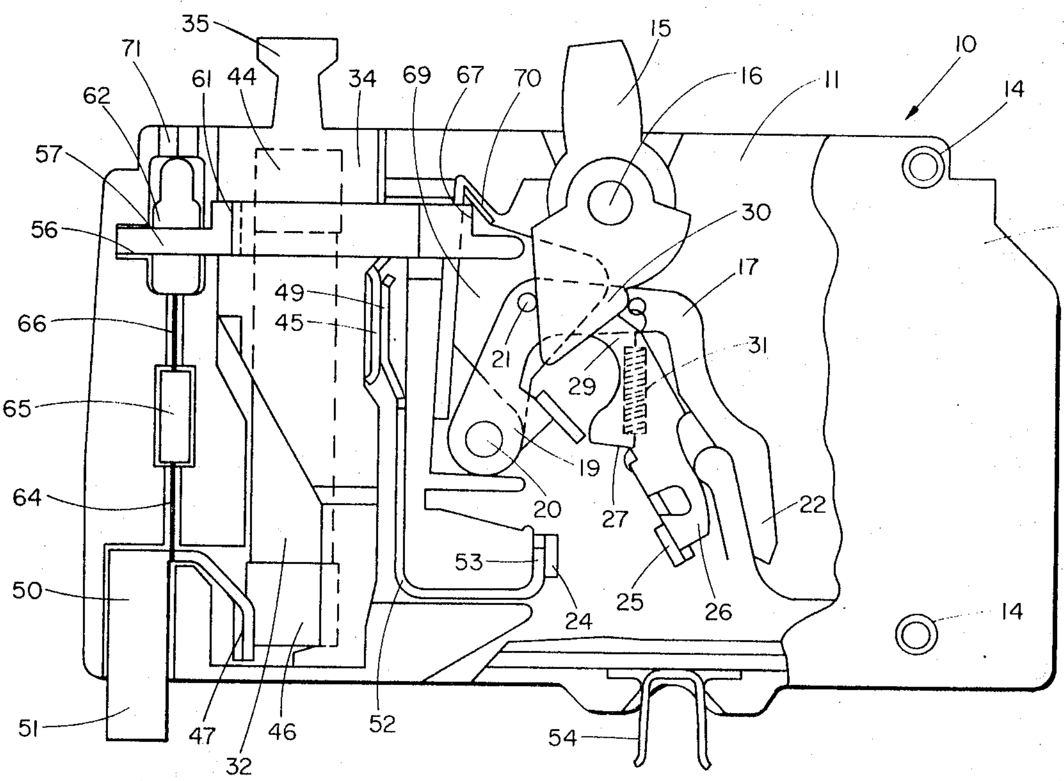


FIG. 1

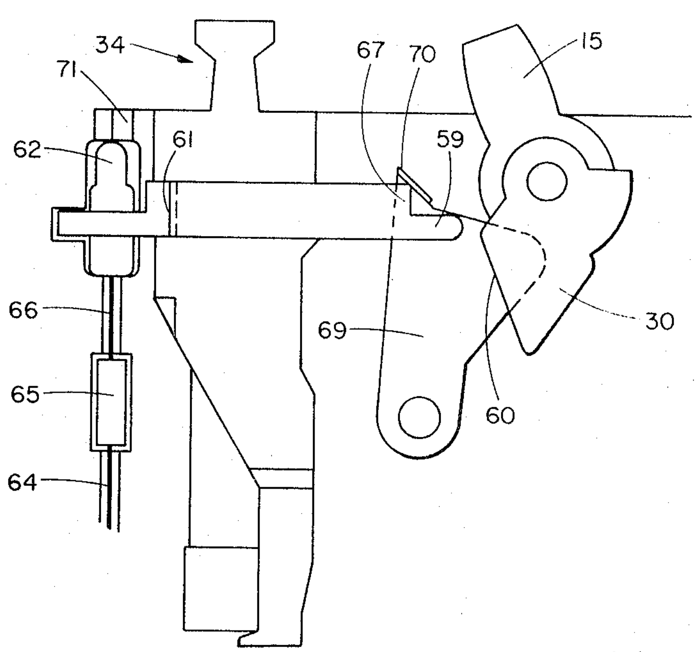


FIG. 2

INVENTOR.
Robert W. Dunham
Charles D. Vyskocil
BY
Harrel J. Watkins
Atty

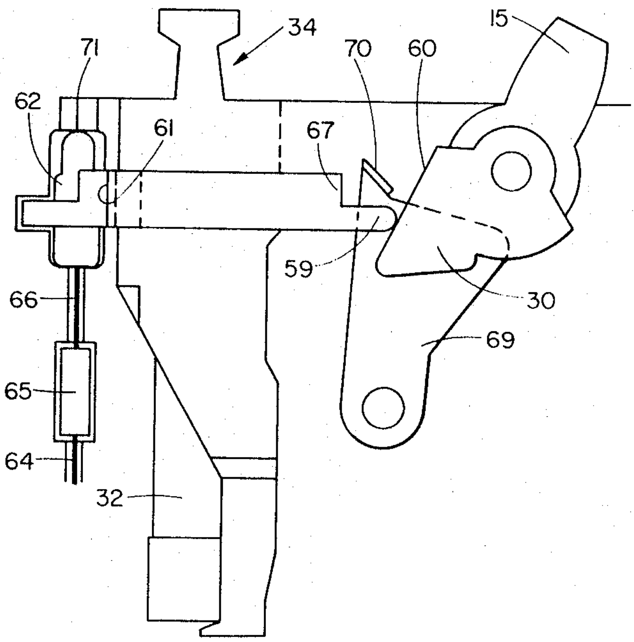


FIG. 3

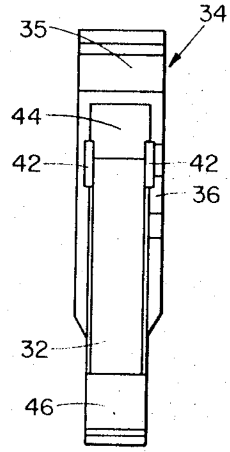


FIG. 4

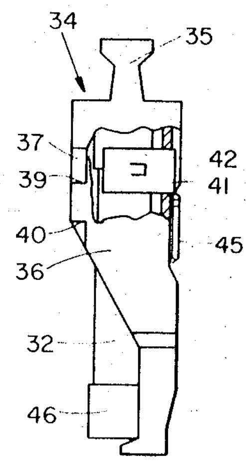


FIG. 5

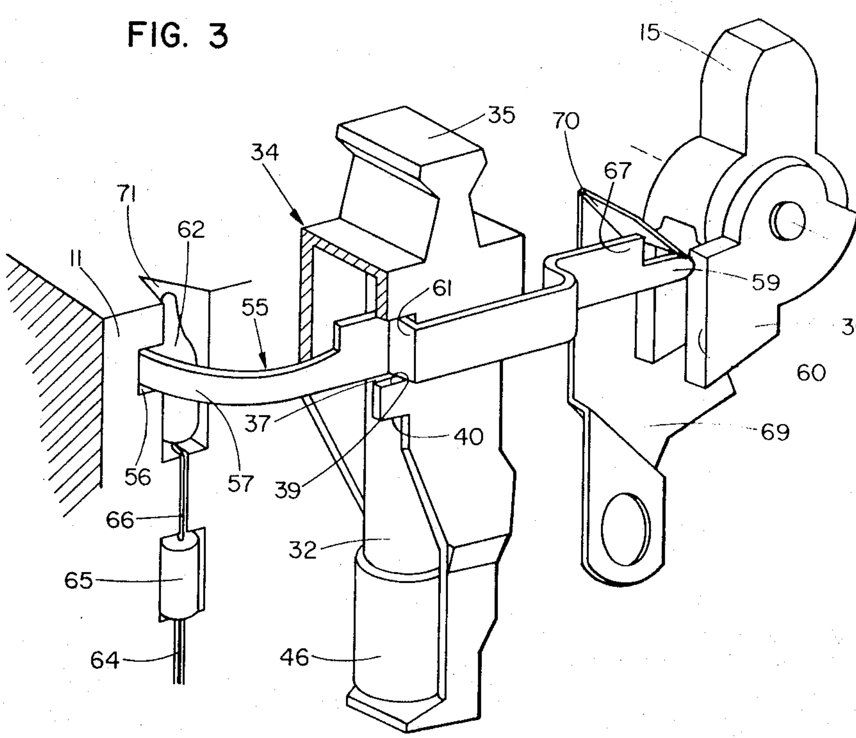


FIG. 6

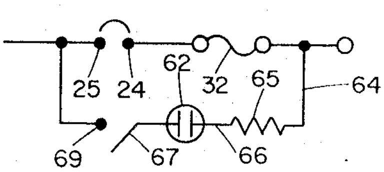


FIG. 7

INVENTOR.
Robert W. Dunham
Charles D. Vyskocil
BY [illegible]
Atty.

MOLDED CASE ELECTRIC CIRCUIT BREAKER WITH FUSE AND INDICATOR LAMP

BACKGROUND OF THE INVENTION

Compact molded case circuit breakers, such as the one disclosed in U.S. Pat. No. 2,902,560, issued on Sept. 1, 1959, to Harris I. Stanback and Ralph H. Kingdon, have proved their ability to efficiently and economically guard against overload and fault currents. They are rapidly replacing fusible installations in industrial plants, commercial buildings, and homes.

There is, however, one problem which may arise in the use of any circuit breaker. The operation of a circuit breaker requires the separation of a pair of contacts whenever an overload occurs in the circuit. If this overload is due to a short circuit, the magnitude of the fault current can exceed the interrupting rating of the circuit breaker. Although modern circuit breakers have much larger interrupting ratings than were formerly possible to provide, in some more heavily industrial areas the available fault currents are so large that even the higher interrupting ratings can be exceeded. The resulting arcs are then too great to be extinguished by a small circuit breaker.

For this reason compact, fusible circuit breakers have been introduced. The fuse limits the current through the circuit breaker and interrupts the circuit in event of large fault currents. Under ordinary fault conditions, the circuit breaker trips to open the circuit without the fuse blowing.

To facilitate rapid location of the tripped circuit breaker or blown fuse (or both) it is necessary to provide some visible indicator on the device, especially in installations containing large numbers of circuit breakers. Mechanical trip indicators, such as are disclosed in our U.S. Pats. Nos. 3,401,363 and 3,443,258 issued on Sept. 10, 1968 and May 6, 1969, respectively are impractical by themselves in a fusible circuit breaker since a mechanical indicator shows only a tripped breaker condition. Should the fuse inadvertently blow when the circuit breaker trips, resetting of the circuit breaker would reset the indicator and show completed circuit conditions when, in fact, the circuit was open. If the fuse blows without tripping of the circuit breaker, no indicator appears at all and an extensive search may be required to locate the blown fuse.

Indicator lights have been used in circuit breakers and with fuses to indicate an open circuit condition. However, the prior art devices are generally not appropriate for fusible circuit breakers either because contacts in the indicator circuit are closed mechanically by the tripping of the circuit breaker or because the indicator circuit is closed at all times which results in a false fault indication, and a corresponding slight current through the load, when the circuit breaker is manually moved to the OFF position. The present invention overcomes these, and other, disadvantages of the prior art.

SUMMARY OF THE INVENTION

The fusible molded case circuit breaker of this invention includes luminous indicator means which becomes illuminated under both tripped breaker and blown fuse conditions but not when the circuit breaker is in the OFF position or when the circuit is complete through the fuse and circuit breaker. The fuse is mounted in a fuse holder formed for insertion in only a single orientation. Shoulders on the fuse holder cooperate with a self-biasing interlock member to prevent insertion or removal of the fuse when the circuit breaker is in its ON or TRIPPED condition. The manual operating mechanism disengages the interlock when it is in the OFF position.

The luminous indicator circuit includes a switch which is closed when the manual operating mechanism is in its ON or TRIPPED positions. The current from the indicator to the switch is carried by the interlock member which also is the movable contact for the switch. The switch is opened when the interlock member is cammed by the manual-operating mechanism upon movement to the OFF position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of a fusible molded case circuit breaker constructed in accordance with the present invention with a portion of a cover removed, an operating handle therefor being in the TRIPPED position;

FIG. 2 is a fragmentary view of the circuit breaker of FIG. 1 with the operating handle in the ON position;

FIG. 3 is a fragmentary view similar to FIG. 2 with the operating handle in the OFF position;

FIG. 4 is an end view of a fuse holder for the circuit breaker of FIG. 1 with a fuse in place;

FIG. 5 is a partially cut-away side view of the fuse holder;

FIG. 6 is a fragmentary perspective view of the circuit breaker of FIG. 1; and

FIG. 7 is a schematic wiring diagram of the indicator circuit.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to FIG. 1, a fusible circuit breaker **10** constructed in accordance with the invention includes a casing molded of insulating material and having a base portion **11** and a cover portion **12** each provided with appropriate recesses and projections for receiving and entrapping the various working parts of the fusible circuit breaker **10** and secured together by a plurality of rivets **14**.

A manual operating means or lever **15** is mounted in the casing for pivotal movement to ON, OFF and TRIPPED positions by means of trunnions **16** formed integrally with the operating lever **15**. The operating lever **15** can be manually moved to the ON and OFF positions and is moved to the TRIPPED position by the automatic operation of the circuit breaker.

A trip member **17** is rotatably mounted at one end portion **19** on a hub **20** and is preferably a U-shaped member having a pin **21** mounted thereon. The end portion **22** of the trip member **17** opposite the hub **20** is adapted to seat in a corresponding part in current-responsive means (not shown) of the circuit breaker **10**. The current-responsive means may be any mechanism sensitive to overload and fault currents, and is preferably similar in construction and operation to the one shown in the aforementioned U.S. Pat. No. 2,902,560. Release of the trip member **17** by the current responsive means opens the circuit breaker contacts in a manner known in the art and described in that patent.

The circuit breaker **10** is provided with a fixed contact **24** and a movable contact **25**. The movable contact **25** is brazed to one end portion **26** of a movable contact arm **27** for movement between open and closed positions of the contacts. The movable contact arm **27** has a substantially U-shaped cross section and is provided with legs **29** at the opposite end portion from the movable contact **25**. The legs **29** are rounded at their ends and engage recesses (not shown) in depending leg portions **30** formed integrally with the operating lever **15**. An operating spring **31** is tensioned between apertures provided in the trip member **17** and the movable contact arm **27** for snap action of the movable contact arm **27**.

A cartridge fuse **32** is held for insertion into the circuit breaker **10** by a fuse holder **34** best shown in FIGS. **4** and **5**. The fuse holder **34** is substantially similar to the one shown in U.S. Pat. No. 3,354,277, issued on Nov. 21, 1967, to Harris I. Stanback and Harry W. Curtis, and is molded of insulating material and is provided with a handle **35** to facilitate insertion and removal. The fuse holder **34** is shaped to prevent insertion in the circuit breaker case **11–12** unless it is properly oriented and aligned and one side **36** is molded to form a recess **37** and spaced shoulders **39** and **40**.

An electrically conductive fuse holder clip **41** is mounted in the fuse holder **34** and has inner jaw portions **42** arranged to grip an upper ferrule **44** of the fuse **32** and secure it in the holder **34**. The fuse holder clip **41** has a contact plate portion **45** extending outside the case of the fuse holder **34**.

Upon insertion of the fuse holder **34** into the case of the circuit breaker **10** through an opening provided for the purpose,

a lower ferrule 46 of the fuse 32 is brought into electrically connective abutment with a stationary contact plate 47 (FIG. 1) while the contact plate portion 45 of the fuse holder clip 41 abuts a stationary contact clip 49 in electrically conductive relationship. The stationary contact plate 47 is formed integrally with or electrically connected to a jaw-type spring clip 50 having a lower end portion 51 comprising a pair of spaced jaws extending outside the case 11–12 of the circuit breaker 10 to engage a line terminal on a panelboard, load center or other current distribution device (not shown). The stationary contact clip 49 forms one end portion of a conducting strap 52 the other end portion 53 of which has the stationary contact 24 brazed thereto. The spring clip 50 cooperates with a mounting clip 54 to secure the circuit breaker 10 to the load center.

The movable contact arm 27 is electrically connected to the current-sensitive means by a flexible conductor (not shown). The current-sensitive means is in turn connected to a load terminal (not shown). Therefore, when the operating lever 15 is in the ON position, the path of the current is from the line terminal to the spring jaw clip 50, through the fuse 32 to the fuse holder clip 41, then to the stationary contact clip 49 and stationary contact 24 to movable contact 25 and movable contact arm 27 and through the flexible conductor and current-responsive means to the load terminal.

An interlock, best seen in FIG. 6, is provided to prevent insertion and removal of the fuse holder 34 unless the operating lever 15 is in the OFF position. An interlock member or interlock switch arm 55 is formed of conducting material and has one end portion engaging a recess 56 in the base 11 to form a spring portion 57 biasing the interlock switch arm 55 toward the operating lever 15. The other end portion 59 of the interlock switch arm 55 is positioned to be moved in a direction opposite the direction of biasing when the operating lever 15 is shifted to the OFF position (FIG. 3) but is not engaged by the operating lever 15 when in the ON position (FIG. 2) or in the TRIPPED position (FIG. 1). The interlock switch arm 55 is moved by a camming surface 60 on the leg portion 30 of the operating lever 15.

An interlock bend 61 is formed in the interlock switch arm 55 and rests in the recess 37 of the fuse holder 34 when biased toward the operating lever 15 by the spring portion 57. The interlock bend 61 engages the shoulder 39 of the fuse holder 34 to prevent its removal when the operating lever 15 is in the ON or TRIPPED position. If the fuse holder 34 is not within the circuit breaker case 11–12, an attempt to insert it will cause the interlock bend 61 to engage the shoulder 40 thereby preventing the insertion. Movement of the operating lever 15 to its OFF position, as shown in FIG. 3, cams the interlock bend 61 out of engagement with the fuse holder 34 allowing insertion or removal of the fuse holder 34.

A luminous indicator comprising a neon lamp 62 is used to indicate that the fuse 32 has blown or the circuit breaker has tripped. The circuit for the lamp 62 is best shown with reference to FIGS. 1, 6 and 7. A conductor 64 connects the jaw spring clip 50 to a resistor 65 of suitable value which is in turn connected by a conductor 66 to one terminal of the lamp 62. The other terminal of the lamp 62 is held in the recess 56 by, and electrically connected to, the spring portion 57 of the interlock switch arm 55. The interlock switch arm 55 has a movable switch contact portion 67 biased by the spring portion 57 into electrical contact with a stationary switch contact 69 having a bent over contact tab 70. The stationary switch contact 69 is mounted on the hub 20 for electrical contact with the trip member 17. The spring 31 conductively connects the trip member 17 to the movable contact arm 27. When the circuit breaker is not tripped, the portion of the circuit through the spring is paralleled by a circuit through the member 17 to the current-responsive mechanism.

While the fuse 32 is intact and the circuit breaker contacts 24–25 are closed, the indicator circuit is short circuited (FIG. 7) and the lamp 62 is not illuminated. However, if the fuse 32 blows or the circuit breaker trips, current flows through the indicator circuit and the lamp 62 lights. The light is visible through an aperture 71 formed in the case 11–12 of the circuit breaker 10.

When the operating lever 15 is in the ON position (FIG. 2) or in the TRIPPED position (FIG. 1), the indicator circuit switch is closed. This enables the lamp 62 to light upon the occurrence of an open circuit due to an overload or fault current in the load. When the operating lever 15 is in the OFF position (FIG. 3) the interlock switch arm 55 is cammed by the surface 60 on the leg 30 to open the contacts 67–70 of the indicator switch.

Thus a fusible circuit breaker has been disclosed having a fuse interlock and a luminous indicator for showing a blown fuse or open circuit breaker condition wherein the interlock switch arm is self biasing, prevents fuse insertion or removal while the breaker is in the ON or TRIPPED position, carries current from the lamp to the indicator switch and serves as the movable contact for the switch.

We claim:

1. A fusible circuit breaker having a housing, a fuse holder insertable in said housing, manual-operating means on said housing having an OFF position, luminous indicator means electrically connected across said fusible circuit breaker operable to indicate blown fuse conditions and tripped breaker conditions, said luminous indicator means including an indicator switch, interlock switch means in said housing biased to interlock said fuse holder against insertion or removal from said housing and to close said switch, and camming means on said manual-operating means to disengage the interlock between the interlock switch means of the fuse holder and to open said indicator switch when said manual-operating means is moved to the OFF position.

2. A fusible circuit breaker in accordance with claim 1 wherein said indicator switch has a movable contact and said interlock switch means is the movable contact of said indicator switch.

3. A fusible circuit breaker in accordance with claim 2 wherein said interlock switch means is self-biasing.

4. A fusible circuit breaker in accordance with claim 1 wherein said luminous indicator means includes a light source, said indicator switch means has a stationary contact, said interlock switch means is an elongated member having ends, one of said ends engages said stationary contact, and the other of said ends is electrically connected to said light source.

5. In a circuit breaker comprising a stationary breaker contact and movable breaker contact separable therefrom, operating means including a manual-operating lever having OFF and ON positions, a movable breaker contact carrier, means operably related with said breaker contact carrier for actuating said breaker contact carrier to open and closed positions of said breaker contacts upon operation of said manual-operating lever to said OFF and ON positions, a pivoted trip member releasable to effect automatic opening movement of said breaker contact carrier, and current-responsive means for releasing said trip member, the improvement comprising a fuse holder insertable in said circuit breaker and formed to provide a shoulder thereon, an interlock member having ends and biased at one end to engage said shoulder and moved out of engagement with said shoulder by movement of said manual-operating lever to said OFF position for insertion and removal of said fuse holder, a fuse held by said fuse holder and serially electrically connected on one side to one side of said breaker contact, luminous indicator means electrically connected between the other side of said fuse and said one end of said interlock member, and a fixed indicator contact electrically connected on said other side of said breaker contacts and positioned in said circuit breaker so that said interlock member is biased into abutment with said fixed indicator contact and is moved out of abutment by movement of said manual-operating lever to said OFF position.