United States Patent [19]

Layton et al.

[11] **3,820,046**

[45] **June 25, 1974**

[54] **AUXILIARY SWITCH FOR MOLDED-CASE CIRCUIT BREAKER**

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

[22] Filed: **Oct. 15, 1973**

[21] Appl. No.: **406,729**

[52] **U.S. Cl.** **335/13,** 335/25

[51] **Int. Cl.** **H01h 71/46**

[58] **Field of Search** 335/13, 17, 25

[56] **References Cited**

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Primary Examiner—Harold Broome

Attorney, Agent, or Firm—Harry G. Thibault; Harold J. Rathbun

[57] **ABSTRACT**

A molded-case circuit breaker is provided with a separate compartment containing an auxiliary switch. The switch may be constructed and arranged to be in an open condition when the circuit breaker is ON, and connected in series with a remote warning device activated upon tripping of the circuit breaker and closing of the switch, or it may be constructed and arranged to be in a closed condition when the circuit breaker is ON, and connected in series with a remotely energizable shunt trip coil provided in the separate compartment and deenergized upon tripping of the circuit breaker and opening of the switch.

5 Claims, 11 Drawing Figures

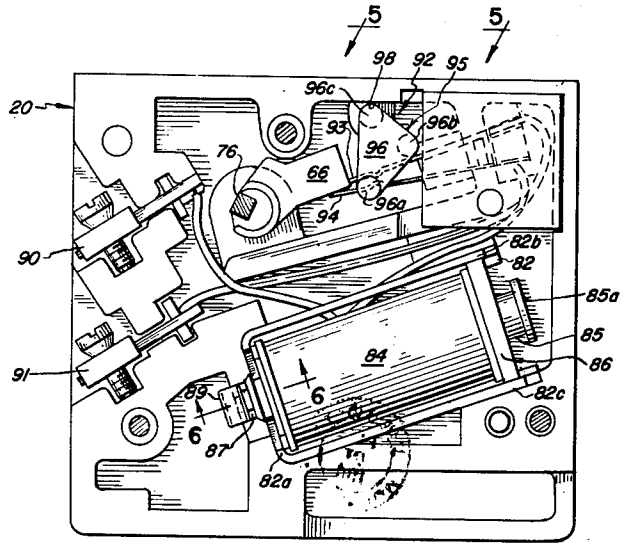


FIG. 1

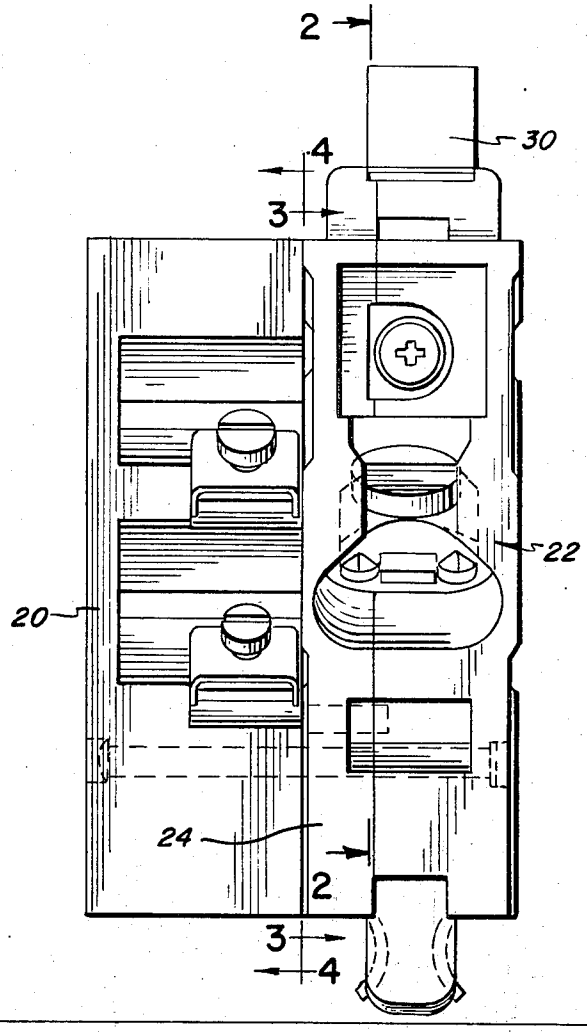

2
30
4
3
22
20
24
2
3
4

FIG. 9

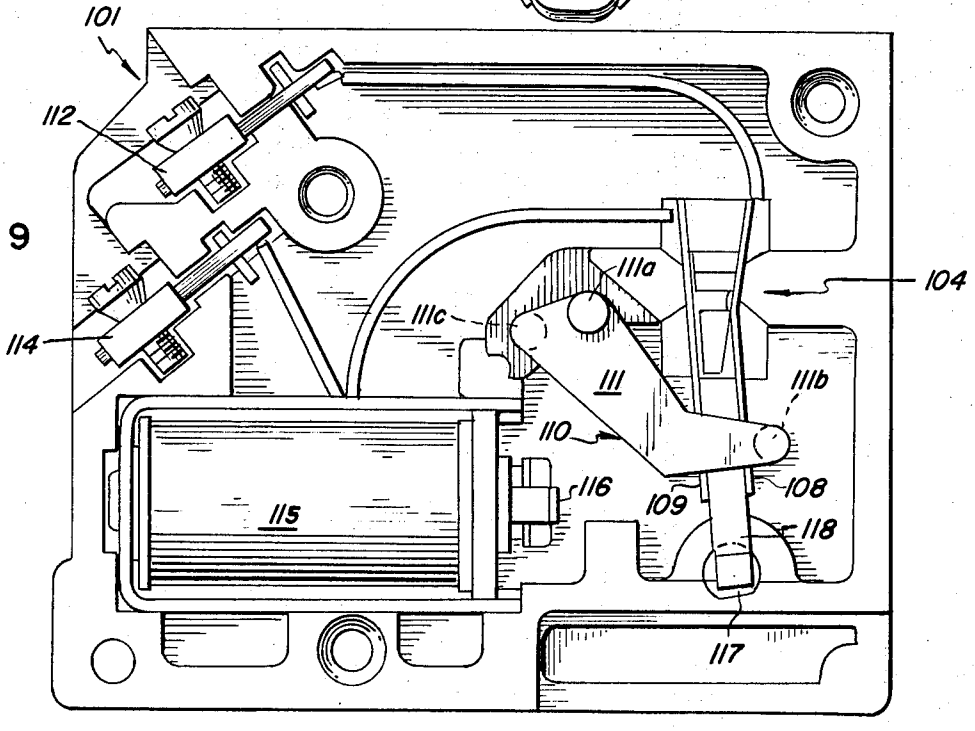

101
112
114
111a
104
111c
111
111b
110
108
116
109
118
115
117

FIG. 2

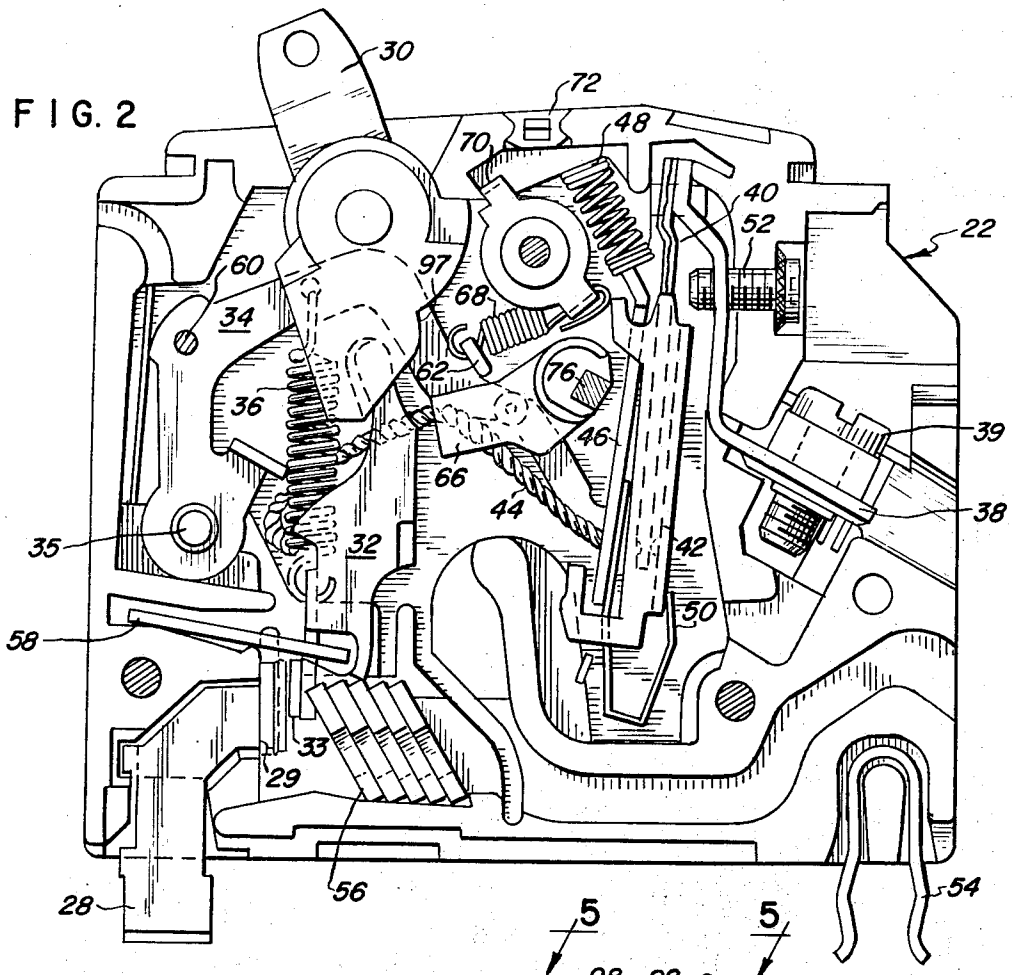

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72
70
48
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97
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34
62
76
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5

FIG. 4

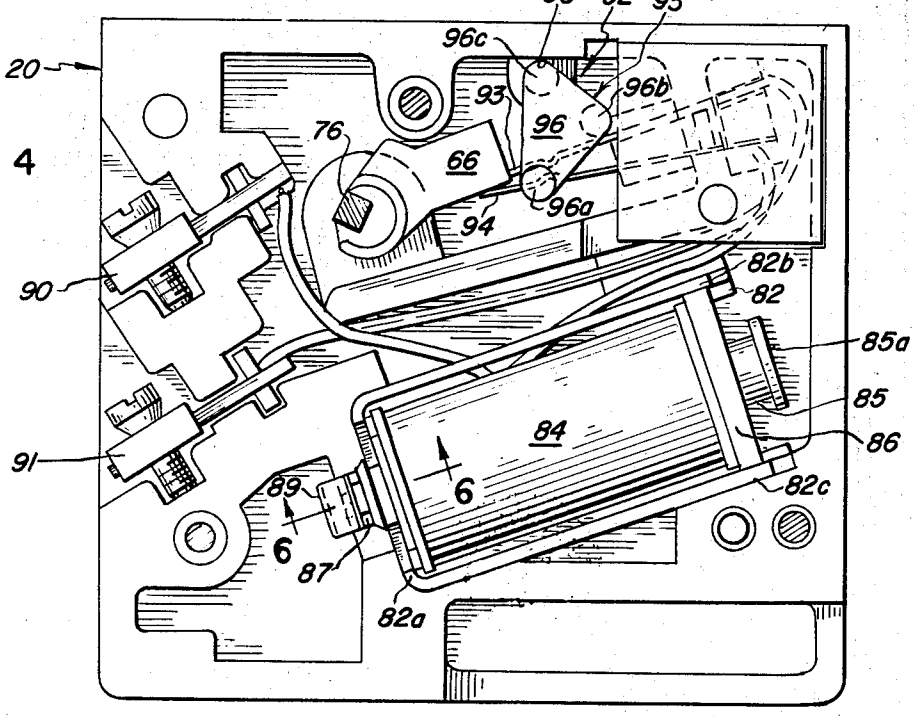

98
92
95
96c
20
96b
93
96
76
66
96a
94
82b
90
82
85a
85
84
86
91
6
89
82c
6
87
82a

FIG. 3

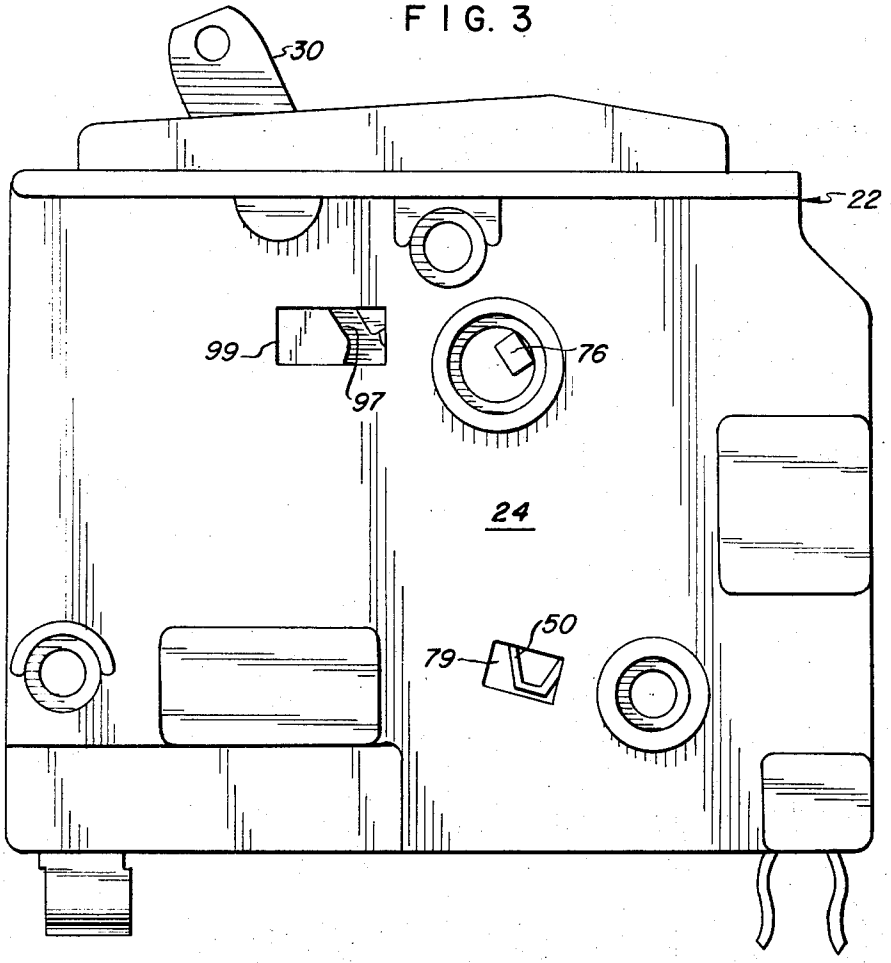


FIG. 6

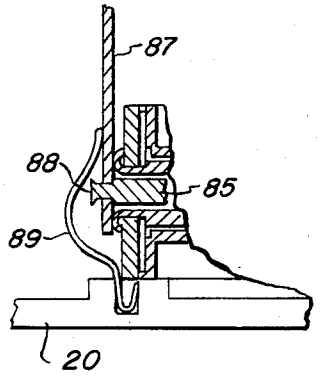
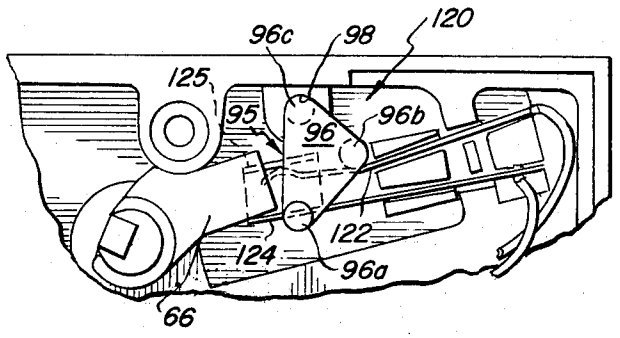


FIG. 10



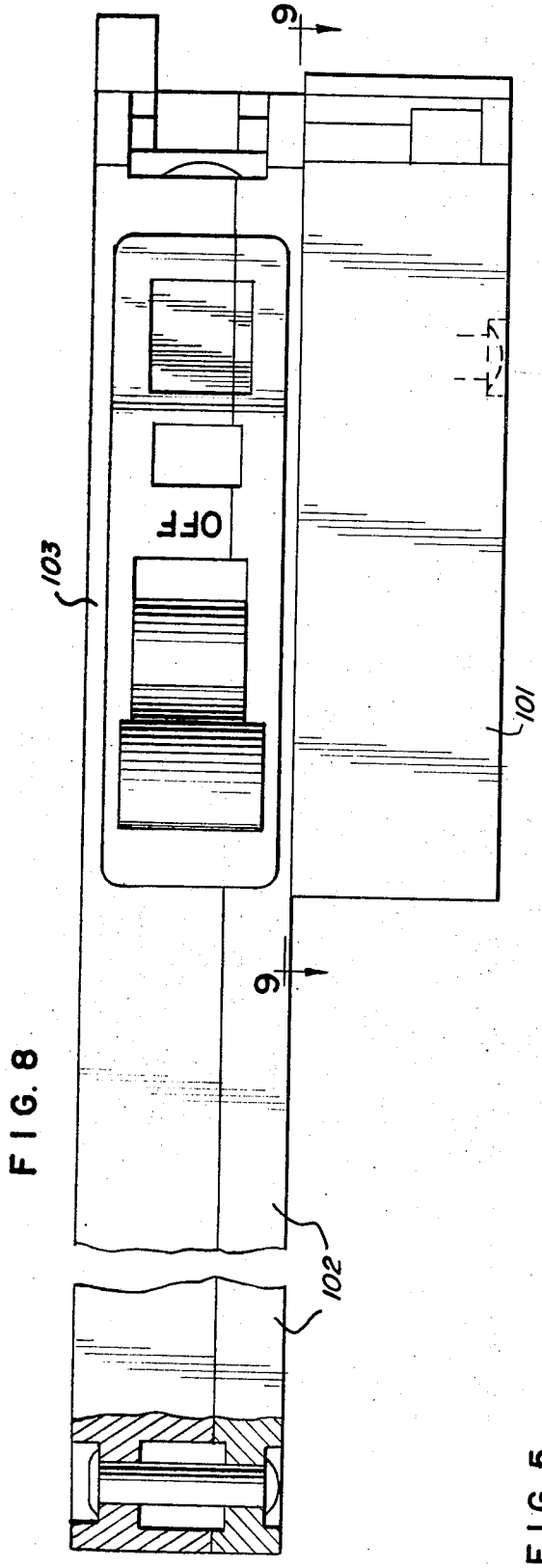


FIG. 8

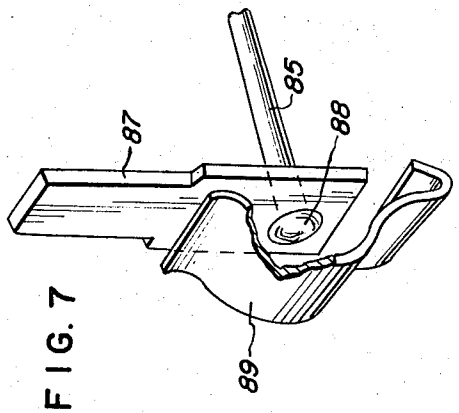


FIG. 7

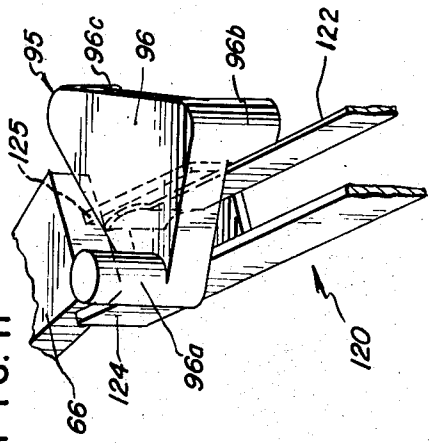


FIG. 11

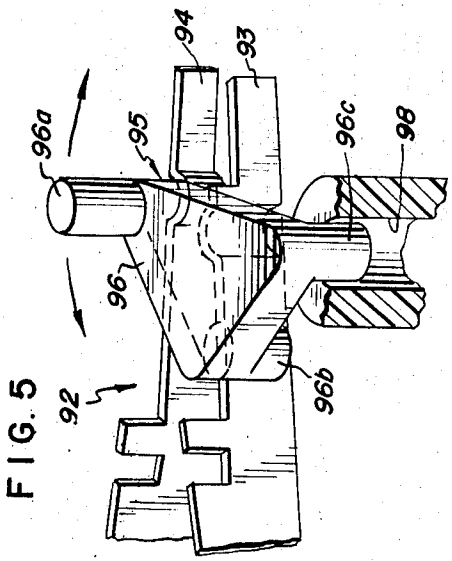


FIG. 5

AUXILIARY SWITCH FOR MOLDED-CASE CIRCUIT BREAKER

This invention relates to an auxiliary switch for a molded-case circuit breaker. In the preferred embodiment, the switch is closed when the circuit breaker is ON, is connected in series with a shunt trip coil, and is opened upon tripping of the circuit breaker. If tripping of the circuit breaker is the result of persistent conditions which would cause continuous energization of the shunt trip coil, the opening of the auxiliary switch would prevent the coil from burning out. In a modified version, the switch is open when the circuit breaker is ON, is connected in series with a remote warning device, and is closed upon tripping of the circuit breaker.

A principal object of the invention is to provide an auxiliary switch as protection means for a shunt trip coil of a molded-case circuit breaker.

Other objects and advantages will become apparent when the following specification is considered along with the accompanying drawings in which:

FIG. **1** is an end elevational view of a single-pole molded-case electric circuit breaker constructed in accordance with the invention and including a separate compartment for auxiliary devices;

FIG. **2** is a sectional view taken generally along the line **2—2** of FIG. **1** and showing a circuit breaker mechanism in an ON condition;

FIG. **3** is a sectional view taken generally along the line **3—3** of FIG. **1** and showing a partition wall between compartments;

FIG. **4** is a sectional view taken generally along the line **4—4** of FIG. **1** and showing auxiliary devices in the separate compartment;

FIG. **5** is a fragmentary perspective view of portions of an auxiliary switch of FIG. **4**, taken generally in the direction of arrows **5—5**;

FIG. **6** is a fragmentary sectional view taken generally along the line **6—6** of FIG. **4** and showing an end portion of a shunt trip coil and an actuating core member;

FIG. **7** is a perspective view, with portions broken away, of certain parts of FIG. **6**;

FIG. **8** is a front view of a modified single-pole molded-case electric circuit breaker constructed in accordance with the invention and including a separate compartment for auxiliary devices;

FIG. **9** is a sectional view taken along the line **9—9** of FIG. **8** and showing auxiliary devices in the separate compartment;

FIG. **10** is a fragmentary sectional view showing a modification of the auxiliary switch of FIG. **4**; and

FIG. **11** is a fragmentary perspective view of portions of the auxiliary switch of FIG. **10.**

In accordance with the invention and as shown in FIG. **1**, a casing portion **20** forms a separate compartment for auxiliary devices and a casing portion **22** houses a single-pole circuit breaker having a mechanism similar to that shown in U.S. Pat. No. 2,902,560, to which reference may be had for a more complete description. The present invention is not confined to single pole circuit breakers but may also be incorporated in multi-pole molded-case electric circuit breakers such as disclosed in U.S. Pat. No. 2,889,428.

The circuit breaker mechanism of the casing portion **22** is shown in FIG. **2** and includes a plug-in type line terminal member **28** having a stationary contact **29** secured to an inner end portion thereof, a pivotally mounted reciprocable operating handle **30**, a movable contact arm **32** pivotally mounted adjacent one end in a pair of spaced depending leg portions of the handle **30** and having a movable contact **33** adjacent the other end, a releasably latchable trip lever **34** pivotally mounted on a pin portion **35** of the casing portion **22**, a tension spring **36** connected adjacent one end to the contact arm **32** and adjacent the other end to the trip lever **34**, a load terminal strap **38** provided with a clamping screw **39**, a bi-metallic strip **40** attached adjacent one end to an inner end of the strap **38** and having a generally U-shaped magnetizable core **42** secured to its other end portion, a braided conductor **44** having one end portion secured between the bi-metallic strip **40** and the core **42** and its other end portion secured to the contact arm **32**, an armature member **46** pivotally mounted on the core **42** and releasably latching the trip lever **34**, a compression spring **48** biasing the armature **46** away from the core **42**, a generally U-shaped ambient temperature compensating bimetallic member **50** having one leg portion secured to the armature **46** and its other leg portion loosely overlapping the core **42**, a calibrating screw **52** for resiliently deforming the terminal strap **38** to vary the amount of latching engagement between the trip lever **34** and the armature **46**, a mounting clip **54** opposite the line terminal **28**, a stack **56** of arc suppressing plates adjacent the contacts **29** and **33**, an arc shield **58** of insulating material hooked to the movable contact arm **32**, a pin **60** carried by the trip lever **34** and cooperable with the handle **30** to effect the relatching of the trip lever, and a bent tab portion **62** of the trip lever **34** adjacent a pivotally mounted trip bar **76** and an armature actuating first crank member **66** when the trip lever is in a latched position, and engageable, on movement of the trip lever away from the latched position, with an outer end portion of the first crank member **66.** The tab **62** also retains a biasing spring **68** connected to an indicating member **70**, the indicator **70** being movable into an exposed position with respect to a viewing window **72** in an upper wall of the casing portion **22** when the trip lever **34** is moved to the tripped position.

On the flow of a sustained moderate overload current through the bimetallic strip **40** of the circuit breaker mechanism of the casing portion **22**, deflection thereof causes counterclockwise (as viewed in FIG. **2**) movement of the core **42**, ambient temperature compensating member **50**, and armature **46** about the upper end of the bimetallic strip **40** and releases the trip lever **34.** Also, upon flow of a high fault current through the bimetallic strip **40** of the circuit breaker mechanism, the armature **46** is attracted toward the core **42** and releases the trip lever **34.** The trip lever **34** of the circuit breaker mechanism is thus provided with a thermally and magnetically responsive tripping means including the bimetallic strip **40**, core **42**, armature **46**, and bimetallic member **50.**

The casing portion **20** is connected to the casing portion **22**, with an intermediate wall portion **24** therebetween, by appropriate fastening means and the compartments in the two casing portions are traversed by the trip bar **76** on which the first crank member **66** in the casing portion **22** and a second crank member **66** in the casing portion **20** are mounted.

The release of the trip lever **34** of the circuit breaker mechanism, biased clockwise (as viewed in FIG. **2**) by

the spring **36**, causes movement of the upper end of spring **36** to the opposite side of the pivotal connection between the contact arm **32** and the handle **30**, to effect disengagement of the movable contact **33** from the stationary contact **29**. The release of the trip lever **34** also causes movement of the tab **62** into engagement with the first crank member **66** to effect pivotal movement thereof counterclockwise (as viewed in FIG. **2**), and, through the trip bar **76**, to also effect pivotal movement of the second crank member **66** in the casing portion **20**.

As shown in FIG. **4**, the casing portion **20** forms a compartment for electromagnetically operable actuating means for effecting movement of the latching armature member **46** to release the trip lever **34** of the circuit breaker mechanism of the casing portion **22**, the actuating means including a generally U-shaped magnetizable frame **82** having a bight portion **82***a* and a pair of spaced parallel leg portions **82***b* and **82***c*. A solenoid or trip coil **84** mounted within the frame **82** has a reciprocable actuating core member **85**. Mounted opposite the bight portion **82***a* adjacent the free end portions of the leg portions **82***b* and **82***c* is a guide plate **86** having an opening therein which receives one end of the core member **85**. An opposite end of the core member **85** passes through a hole in the bight portion **82***a* of the frame **82**. An elongated actuating tab **87** is suitably secured to the end of the core member passing through the bight portion of the frame **82**, as by a rivet-like portion **88** best shown in FIG. **7**. A biasing spring **89** mounted in the casing portion **20** biases the actuating tab **87** and core member **85** toward the right in FIG. **4**. The free end portion of the tab **87** extends through an opening **79** (FIG. **3**) in the intermediate wall portion **24** into cooperative relationship with the ambient temperature compensating bimetallic member **50**, which is connected to the armature **46**. When the trip coil **84** is energized, the tab **87** strikes the bimetallic member **50** to drive the armature **46** toward the core **42** and release the trip lever **34** to trip the circuit breaker mechanism of the casing portion **22**. The end of the core member **85** adjacent the guide plate **86** has a peripheral ring **85***a* to limit its travel.

Terminals **90** and **91** on the casing portion **20** are connectable to an external circuit for energizing the coil **84**. Thus the coil **84** can be energized from a remote location to trip the circuit breaker mechanism of the casing portion **22**.

In accordance with this invention, the casing portion **20** has a switch **92** provided therein as shown in the upper right-hand corner of FIG. **4** and in FIG. **5**. The switch **92** comprises a pair of contacts in the form of flexible resilient contact fingers **93** and **94** which are normally open. A switch operating member or lever **95** includes a triangular plate **96** having an upper surface and a lower surface (the terms "upper" and "lower" referring specifically to the orientation of the plate **96** as shown in FIG. **5**), a driving pin **96***a* extending perpendicularly from the upper surface of the plate **96** at one of the vertices thereof, and a switch operating pin **96***b* and a mounting pin **96***c* extending respectively from the lower surface of the plate **96** at the remaining two vertices thereof. The mounting pin **96***c* is pivotally mounted in a hole **98** in the casing portion **20**. The switch operating pin **96***b* is engageable with the contact finger **93** of the switch **92**. The driving pin **96***a* extends through a hole **99** (FIG. **3**) in the intermediate wall portion **24** and is engageable with a surface **97** (FIG. **2**) of the operating handle **30** of the circuit breaker mechanism.

When the circuit breaker handle is moved to the ON position, the driving pin **96***a* cooperates with the surface **97** of the operating handle **30** of the circuit breaker to pivot the plate **96** counterclockwise about the mounting pin **96***c* as viewed in FIGS. **4** and **5**, the switch operating pin **96***b* moving contact finger **93** into engagement with the contact finger **94**. Thus, when the circuit breaker handle **30** is in the ON position, the switch **92** is closed.

With the switch **92** closed, a current path exists from the terminal **91**, through the contact fingers of the switch **92** and the coil **84** to the terminal **90**. When a circuit is completed at a remote location, current flow through the coil **84** actuates the core member **85** to cause the tab **87** to push the bimetallic member **50** and drive the armature **46** of the circuit breaker mechanism of the casing portion **22** toward the core **42** to release the trip lever **34**.

The release of the trip lever **34** causes movement of the tab **62** into engagement with the first crank member **66** of the circuit breaker **22** to affect pivotal movement thereof counterclockwise as viewed in FIG. **2**. The movement of the first crank member **66** is transmitted through the trip bar **76** to effect pivotal movement of the second crank member **66** in the casing portion **20** clockwise as viewed in FIG. **4**, moving the second crank member **66** into engagement with the contact finger **94** of the switch **92** and moving the contact finger **94** out of engagement with the contact finger **93** to hold the switch open when the circuit breaker mechanism of the casing portion **22** is in the tripped condition. Thus the switch **92** is held open by the second crank member **66** when the circuit breaker is in the tripped condition and the switch **92** remains open regardless of the position of the switch operating lever **95**.

A second embodiment of the present invention is disclosed in FIGS. **8** and **9** in which a casing portion **101**, a wall portion **102**, and a casing portion **103** are secured together. The casing portion **103** houses a circuit breaker mechanism such as that disclosed in U.S. Pat. No. 3,061,697. The casing portion **101** has a switch **104** therein having normally open contacts **108** and **109**. A switch operating lever **110** includes a plate **111** having a front surface and a rear surface (the terms "front" and "rear" refer specifically to the orientation of the lever as shown in FIG. **9**), a driving pin **111***a* extending perpendicularly from the front surface of the plate **111** at a vertex thereof, and a switch operating pin **111***b* and a mounting pin **111***c* extending from the rear surface of the plate **111** at respective vertices thereof. The mounting pin **111***c* is pivotally mounted in a hole in the casing portion **101**. The switch operating pin **111***b* is engageable with the contact **108** of the switch **104**. The driving pin **111***a* extends through an opening (not shown) in the wall portion **102** to engage a surface of one of a pair of toggle links (not shown) of the operating mechanism of the circuit breaker in the casing portion **103**.

When the circuit breaker handle is moved to the ON position, the driving pin **111***a* cooperates with the toggle link of the circuit breaker mechanism in the casing portion **103** to pivot the plate **111** about the mounting pin **111***c*, the switch operating pin **111***b* moving the

contact **108** into engagement with the contact **109** to close the switch **104.** Thus when the handle of the circuit breaker in the casing portion **103** is in the ON position, the switch **104** is closed.

With the switch **104** closed, a current path exists from a terminal **112** on the casing portion **101,** through the switch **104** and a coil **115,** to a second terminal **114** on the casing portion **101.** When a circuit is completed at a remote location, current flow through the coil **115** actuates a reciprocable actuating core member **116** which unlatches a trip lever (not shown) of the circuit breaker in the casing portion **103** to mechanically trip the circuit breaker in a manner similar to that described above for the circuit breaker in the casing portion **22.**

When the circuit breaker in the casing portion **103** is mechanically tripped, a trip bar **117,** similar to the trip bar **76** in the casing portions **20** and **22,** is pivotally rotated to effect pivotal movement of a crank member **118** in the casing portion **101.** The pivotal movement of the crank member **118** moves the contact **109** out of engagement with the contact **108** and holds the switch open when the circuit breaker in the casing portion **103** is in the tripped condition. Thus the switch **104** is held open by the crank member **118** when the circuit breaker is in the tripped condition and the switch **104** remains open regardless of the position of the switch operating lever **110.**

The switch actuating levers **95** and **110** may also be used to operate auxiliary switches similar to the switches **92** and **104** but modified to activate an alarm, in a system without a shunt trip coil, as a signal that the circuit breaker is OFF or TRIPPED. Such a modified switch **120** is shown in FIGS. **10** and **11** in conjunction with the switch operating lever **95.** The switch **120** includes a pair of flexible resilient contact fingers **122** and **124,** the contact **124** having a generally U-shaped free end portion including a leg portion **125** and the free end portion of the contact **122** being disposed within the U-shaped portion of the contact **124** and normally engaging the inner side of the leg portion **125.**

Operation of the switch **120** is as follows. When the circuit breaker is closed to ON condition, the driving pin **96***a* of the lever **95** is driven by the surface **97** (FIG. **2**) on the breaker handle **30,** which causes the switch operating pin **96***b* to deflect the contact **122** away from the leg portion **125** of the contact **124,** thus opening the switch **120.** When the circuit breaker is tripped, the crank member **66** pushes the contact **124** downwardly as viewed in FIG. **10** to re-establish contact between the leg portion **125** and the contact **122,** which closes the switch **120** to complete an alarm circuit, regardless of the position of the lever **95.** When the circuit breaker is reset and left in OFF condition, the lever **95** is returned to its normal position by the resiliency of the contact **122,** allowing the contact **122** to resume its normal engagement with the leg portion **125** of the contact **124,** which also closes the switch **120** to complete an alarm circuit.

The switch **120** could be designed to be closed only when the circuit breaker of the casing portion **22** is in the tripped condition. The contact **122** could be formed so that in its normal or free position it would not touch any part of the contact **124,** particularly the leg portion **125,** and the switch lever **95** could be omitted. Then the operation of the switch would consist only of the crank member **66** pushing the contact **124** downwardly as viewed in FIG. **10** when the breaker trips. This would cause the contact **122** to engage the leg portion **125** of the contact **124,** closing the switch **120.** In ON and OFF conditions of the circuit breaker, there would be no contact between contacts **122** and **124.**

Various modifications may be made in the structure disclosed without departing from the spirit and scope of the invention as set forth in the appended claims.

We claim:

1. An electric circuit breaker comprising:

a. a molded case having a plurality of compartments;

b. a circuit breaker mechanism in one of the compartments including a pair of separable contacts, a releasably latchable trip lever releasable from a latched position to effect separation of the contacts, and thermally and electromagnetically operable tripping means operable to effect release of the trip lever and separation of the contacts;

c. an operating handle pivotally mounted in the case, operatively connected to the contacts, and movable to an ON position to close the contacts and to an OFF position to open the contacts;

d. an auxiliary switch including a pair of resiliently flexible contact fingers disposed in another of the compartments and having one operating condition in which the contact fingers are in engagement with each other and another operating condition in which the contact fingers are out of engagement with each other;

e. a switch operating member pivotally mounted in said other of the compartments, operatively engaged with a first of the contact fingers, and operatively engageable with the operating handle;

f. a trip bar mounted for pivotal movement in the case and traversing the compartments;

g. a first crank member mounted on the trip bar in said one of the compartments for rotary movement unitarily therewith upon operation of the tripping means; and

h. a second crank member mounted on the trip bar in said other of the compartments for rotary movement unitarily therewith and operatively engageable with a second of the contact fingers, the first contact finger being flexed by the switch operating member to place the auxiliary switch in one of the operating conditions upon movement of the operating handle to the ON position, and the second contact finger being flexed by the second crank member to place the auxiliary switch in the other of the operating conditions upon operation of the tripping means.

2. An electric circuit breaker as claimed in claim **1** wherein the contact fingers are constructed and arranged in a manner such that the switch operating member flexes the first contact finger out of engagement with the second contact finger upon movement of the operating handle to ON position and the second crank member flexes the second contact finger into engagement with the first contact finger upon operation of the tripping means.

3. An electric circuit breaker as claimed in claim **1** wherein the contact fingers are constructed and arranged in a manner such that the switch operating member flexes the first contact finger into engagement

with the second contact finger upon movement of the operating handle to ON position and the second crank member flexes the second contact finger out of engagement with the first contact finger upon operation of the tripping means.

4. An electric circuit breaker as claimed in claim 3 including a shunt trip coil in said other of the compartments and an actuating core member disposed within the coil and mounted for reciprocal movement, the coil being serially connected to the auxiliary switch and the actuating core member being operatively connected to the tripping means in said one of the compartments.

5. An electric circuit breaker as claimed in claim 1 wherein the switch operating member includes a plate portion having a driving pin extending from one side into operative engagement with the operating handle, and a mounting pin and a switch operating pin extending from the other side, the mounting pin being pivotally mounted in the case and the switch operating pin being operatively engaged with the first contact finger.

* * * * *