Jan. 14, 1969 R. W. FILCHAK ET AL 3,422,384

ELECTROMECHANICAL REMOTELY CONTROLLABLE CIRCUIT BREAKER

Filed July 18, 1966

FIG.1

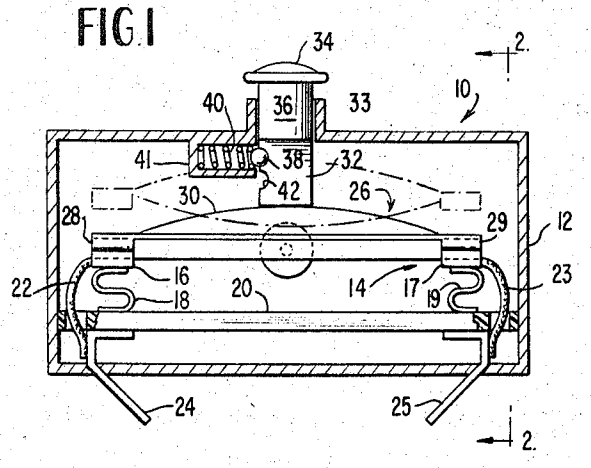


FIG.2

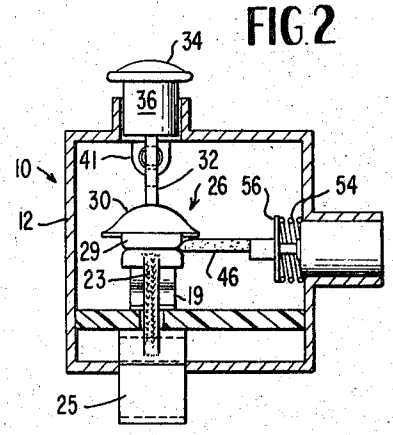


FIG.3

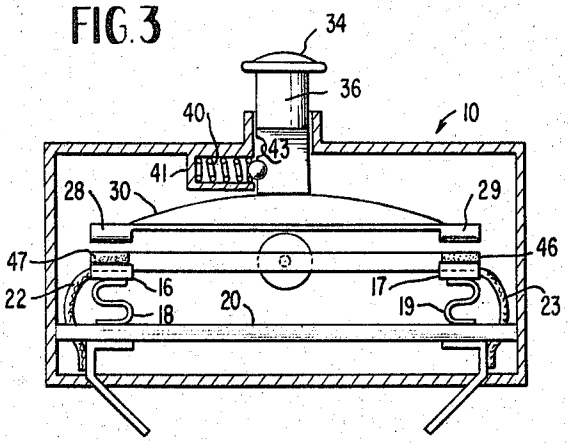


FIG.4

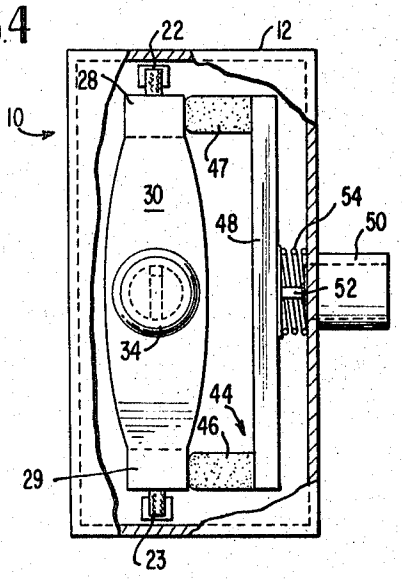


FIG.6

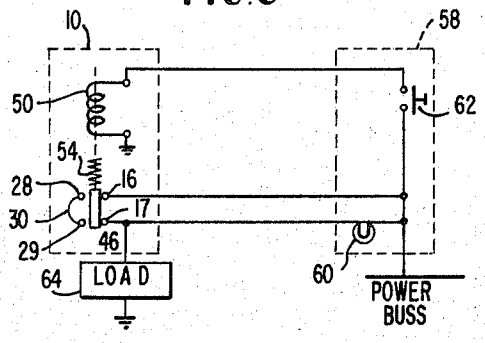
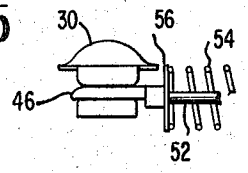


FIG.5



INVENTORS
ROBERT W. FILCHAK
DANIEL L. NEILL

BY
Seyfarth, Rothwell, Mion, Zinn & Macpeak

ATTORNEYS

United States Patent Office 3,422,384 Patented Jan. 14, 1969

3,422,384

ELECTROMECHANICAL REMOTELY CONTROLLABLE CIRCUIT BREAKER

Robert W. Filchak and Daniel L. Neill, Jackson, Mich., assignors to Aiken Industries, Inc., a corporation of Delaware

Filed July 18, 1966, Ser. No. 565,814
U.S. Cl. 337—37 4 Claims
Int. Cl. H01h 61/00; H01h 71/16; H01h 75/00

ABSTRACT OF THE DISCLOSURE

A circuit breaker having a thermally responsive contact blade cooperating with a substantially fixed contact assembly and a remotely controlled insulating barrier. Opening of the contacts occurs due to the reaction of the thermally responsive blade when heated by an overload current passing through the contact assembly. The insulating barrier is inserted between the open contact blade and contact assembly due to the force supplied by a light spring cooperating with the barrier. Closing of the contacts upon cooling of the contact blade is prevented until the insulation barrier is retracted from between the contacts. The barrier is retracted by energizing a solenoid, cooperating with the barrier, by a remotely controlled electrical switch.

This invention relates to improvements in circuit breakers and particularly to an electromechanical circuit breaker of the snap action thermal trip type providing indication and reset control at a location remote from the circuit breaker itself.

Remotely controlled circuit breakers have been known in the art, particularly relatively large circuit breakers utilizing heavy resetting solenoids, motors and/or pneumatic or hydraulic actuators. Such circuit breakers are not, however, applicable for environments where weight is a problem, for example in aircraft and aerospace vehicles. The reset forces using conventional remote reset means require an amount of force to be provided by the reset means which requires an actuator which would be too large, too heavy, too costly and consume too much power.

The present invention, while still providing the use of a remote reset means for reset function, utilizes a solenoid which provides forces of low magnitude well within acceptable weight, size and power consumption requirements of aircraft and aerospace vehicles. The circuit breaker of this invention utilizes an automatic resetting thermal element in combination with a remotely controlled restraint or barrier which prevents contact closure. An auxiliary indicator light for remote indication is an additional feature. Ambient temperature compensation of the bimetal may also be provided, and the circuit breaker can be operated as a manual switch.

The foregoing and other features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention, as illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a side sectional elevation view of the circuit breaker embodying the present invention;

FIG. 2 is an end sectional elevation view taken along line 2—2 of FIG. 1;

FIG. 3 is a side sectional elevation view similar to FIG. 1 with the circuit breaker shown in its manually opened condition;

FIG. 4 is a top plan view with a portion broken away for the sake of clarity illustrating the circuit breaker of this invention;

FIG. 5 is a detail view showing the barrier device of this invention inserted between the contacts after the contacts open; and

FIG. 6 is a simplified circuit diagram of the device of this invention.

Referring to the drawings, a circuit breaker **10** of this invention includes a housing **12** which houses a fixed contact assembly **14**. This fixed contact assembly preferably includes a pair of fixed contacts **16** and **17** mounted on top of ambient temperature compensating bimetals **18** and **19** which in turn are supported from an insulating ledge **20**. Each stationary contact is connected by means of pigtail conductors **22** and **23** to corresponding terminals **24** and **25** of a typical type.

Cooperating with the stationary contact assembly is a movable contact assembly **26** including a pair of corresponding movable contacts **28** and **29** for selectively making or breaking a circuit with contacts **16** and **17**, respectively. Movable contacts **28** and **29** are mounted on the ends of a temperature responsive device **30** which may be a bimetal blade, either a creeper or a snap blade, and may or may not be of the cupped sheet type illustrated. A snap blade is illustrated in the open condition in phantom lines in FIG. 1.

For manually operating the switch made by contacts **16, 17, 28** and **29** a manual operator **32** extending through opening **33** in housing **12** is attached to the movable contact assembly **26**. The operator **32** includes a top knob **34** and an indicating stem **36**. Adjacent the stem **36** is a ball **38** and spring **40** detent arrangement with the spring positioned in detent housing **41** so that the ball cooperates with detent notches **42** and **43** in the stem of the manual operator **32**. In normal operation of the device as an over load current sensing circuit breaker the detent is in the position of FIG. 1. However, to operate the circuit breaker as an ordinary manual switch the circuit may be opened by pulling up on knob **34** so that the detent is in notch **42** in the position of FIG. 3, at this time indicating stem **36** will indicate that the breaker is open.

A barrier assembly **44** is provided for preventing automatic reset of the thermal responsive device **30** after the device opens contacts **28** and **29** and then cools off. This barrier assembly includes insulating barriers **46** and **47** mounted on a support bar **48** at a distance apart corresponding to the distance between the stationary and movable contacts **16, 17** and **28, 29**. The support bar **48** is movable toward the contacts under the bias of spring **54** and is movable away from the contacts under power provided by a solenoid **50** connected to the bar through solenoid plunger **52**. A collar **56** is provided around the bar for the spring support. The spring normally biases the insulating barriers **46** and **47** into position abutting the closed contacts, such as **17, 29** shown in FIG. 2. When current sufficient to cause an overload passes through the terminals **24, 25**, stationary contacts **16, 17** and movable contacts **28, 29**, it heats up the thermal responsive device **30** which may be a bimetal and the thermal responsive device opens the movable contacts **28** and **29**. The urging of spring **54** moves the insulating barriers **46** and **47** into position between the opened contacts, FIG. 5. After a period of time with the circuit open thermal responsive device **30** will cool off and under normal operation the thermal responsive device would tend to move the contacts **28** and **29** to reclose the circuit. However, the contacts cannot close the circuit with the stationary contacts **16** and **17** due to the fact that the insulating barriers **46** and **47** are still in position between the contacts. To remove the insulating barrier from its position between the contacts solenoid **50** must be energized. Since only a light force need be utilized to place the insulating barriers **46** and **47** between the stationary movable con-

tacts when the thermal responsive device **30** opens the circuit, the spring **54** may be a light spring. Also, if the insulating barriers **46** and **47** are of a low friction material, such as plastic, the power to remove them by solenoid **50** may be small and thus a lightweight solenoid may also be used.

The circuit breaker of this invention is particularly useful in a remote indication and reset control application and the circuit for such an application is shown in FIG. 6. In FIG. 6 a remote indicator-reset means **58** may be a great distance from the circuit breaker **10**. The circuit breaker **10** may be adjacent a load **64** that it is desired to protect while the indicator-reset means may be in a remote position. For example, the indicator-reset means may be in a pilot's compartment of an aircraft or aerospace vehicle while the circuit breaker **10** is located adjacent the load device, allowing the conductors connecting the indicator-reset means to be light, thus saving weight and expense.

In operation of the circuit in FIG. 6 power from power bus is applied to the stationary contacts **16**, **17** and ordinarily would complete the circuit to load device **64**. However, if the circuit is overloaded the temperature responsive device **30** opens the movable contacts **28** and **29** and insulating barriers **46** and **47** automatically move between the contacts under the bias of spring **54**. At this time the circuit is broken and indicator lamp **60** is energized in series with the load. This is effected as the load impedance is much lower than the indicator lamp impedance. If the operator desires to reset the circuit breaker **10** he can close manual switch **62**, energizing solenoid **50**, retracting barriers **46**, **47** and allowing the movable contacts **28**, **29** to reset under the inherent bias of the snap blade or thermal responsive device **30**. When the circuit is again made this effectively short circuits lamp **60** extinguishing it.

Compensating bimetals **18** and **19** are utilized to compensate for ambient temperature variation by maintaining constant the relative position of the movable contacts at the end of the blade **30** with the center of the blade. That is, the center of the blade **30** will be fixed by the position of the manual operator **32** and will be constant as determined by the detent ball **38** in notch **43** in normal operation. Should, however, the ambient temperature increase or decrease, the bimetal compensators **18** and **19** will expand or contract varying the position of the ends of the bimetal blade **30** relative to its center to vary the prestress in the blade **30** and hence compensate for the temperature variation.

While the invention has been particularly shown and described with reference to preferred embodiments, it will be understood by those skilled in the art that various changes in form and details may be made without departing from the spirit and scope of the invention. For example, other types of reset restraint are envisaged within the scope of this invention. Other restraint devices could include preventing the thermal motor from resetting by

applying heat, mechanical latching or other means. Ambient temperature compensation may be obtained by varying the position of the thermal responsive blade directly by thermal responsive device connected thereto. The thermal responsive device or blade could be a snap blade, a creep blade or other device known in the circuit breaker art, and could utilize only one set of contacts.

What is claimed is:

1. An electromechanical circuit breaker comprising: a housing, a thermally responsive contact blade movably mounted within the housing, a contact assembly mounted within the housing in a substantially fixed position, ambient temperature responsive mounting means positioning the contact assembly into engageable relation with the movable contact blade, a remotely controlled insulating barrier movably mounted within the housing, resilient biasing means causing insertion of the barrier between the open contacts thereby preventing closing of the contacts, and a remote electrical control means located externally of the housing, including means coupled to the barrier for retracting the insulation barrier from between the contacts thereby allowing reclosing of the contacts, wherein the thermally responsive blade opens and closes the contacts in response to variations in temperature.

2. An electromechanical circuit breaker as in claim **1** wherein the means coupled to the barrier is a solenoid, the solenoid when energized by the remote electrical control means causes retraction of the barrier from between the contacts.

3. An electromechanical circuit breaker as in claim **1** wherein the ambient temperature responsive compensating means are bimetallic and position the contact assembly in engagement with the movable contact blade so as to hold the relative position of the center and ends of the blade constant during variations in ambient temperature.

4. An electromechanical circuit breaker as in claim **1** further comprising: a manual actuator attached to the blade within the housing for operating the circuit breaker manually as a common electrical switch.

References Cited

UNITED STATES PATENTS

2,220,978	11/1940	Shakespeare et al.	200—138 X
2,307,776	1/1943	Grant et al.	335—145 X
2,696,538	12/1954	O'Neill	200—113
2,743,333	4/1956	Epstein	200—138
2,911,501	11/1959	Baker	200—113
3,174,012	3/1965	Siiberg	200—122
3,184,727	5/1965	Miessner	335—145 X
3,187,145	6/1965	Grabinski	200—138 X
3,209,104	9/1965	Malone	200—138 X

GEORGE HARRIS, *Primary Examiner.*

U.S. Cl. X.R.

335—156; 337—56, 68, 91, 98, 101, 348