Oct. 16, 1934. H. C. GRAVES, JR 1,976,934

CIRCUIT CONTROLLING DEVICE

Filed Oct. 11, 1932 2 Sheets-Sheet 1

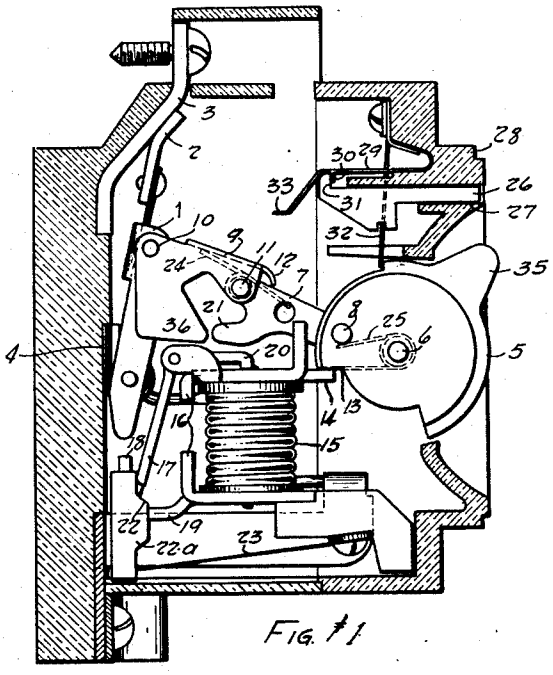


FIG. 1

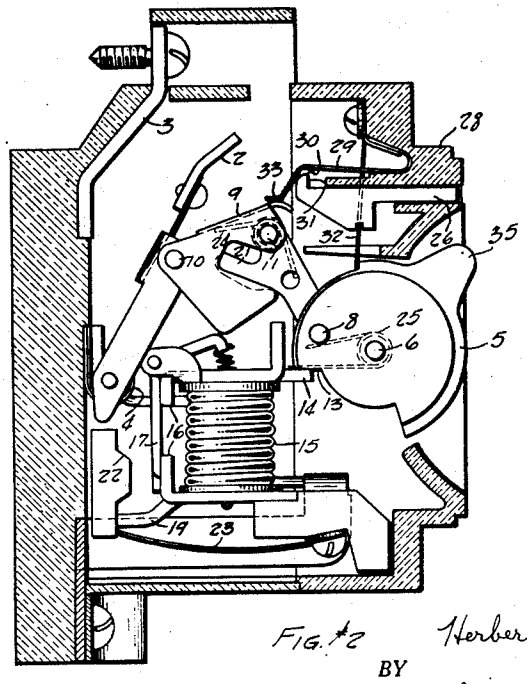


FIG. 2

INVENTOR.
Herbert C. Graves Jr.
BY
Cornelius D. Elliott
his ATTORNEY.

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CIRCUIT CONTROLLING DEVICE

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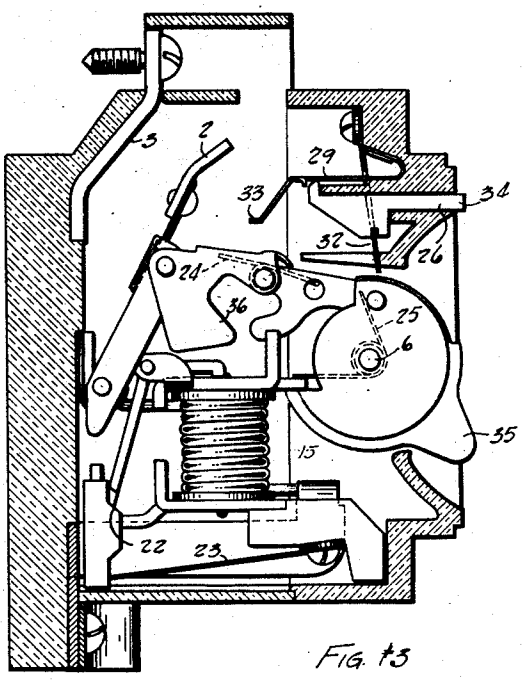


FIG. #3

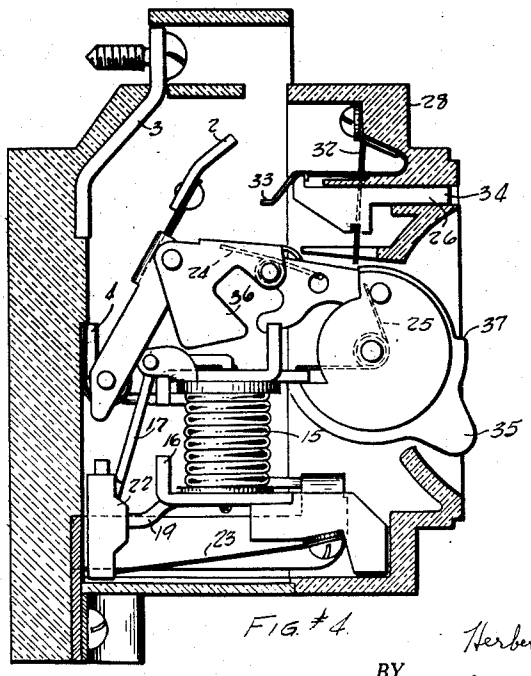


FIG. #4

INVENTOR.
Herbert C. Graves Jr.
BY Cornelius D. Ethret
his ATTORNEY.

Patented Oct. 16, 1934

1,976,934

UNITED STATES PATENT OFFICE

1,976,934

CIRCUIT CONTROLLING DEVICE

Herbert C. Graves, Jr., East Bradford Township, Chester County, Pa., assignor to I-T-E Circuit Breaker Company, Philadelphia, Pa., a corporation of New Jersey

Application October 11, 1932, Serial No. 637,220

26 Claims. (Cl. 200—89)

My invention relates to circuit-controlling devices which may be manually or automatically actuated, and particularly to circuit-breakers.

In accordance with my invention, there is provided an indicating arrangement which discloses whether the contacts are separated or in engagement, and whether the relation of the contacts is the result of automatic or manual actuation; more specifically, the position of the setting member or handle of the breaker indicates whether the contacts are open or closed, and a supplemental device indicates whether the breaker has opened manually or in response to abnormal circuit conditions.

More particularly, a toggle between the operating handle and the movable contact structure is broken only upon automatic tripping, and the breaking movement of the toggle is utilized to effect actuation of the supplemental indicator, as by release of latching mechanism therefor.

Further in accordance with my invention, the toggle members are constructed to preclude accidental breaking of the toggle upon manual tripping, and more specifically, the distribution of mass or weight of at least one of the toggle members is such that rebounding of the handle, if any, is incapable of breaking the toggle to give a false indication.

My invention also resides in the features of construction and arrangement hereinafter described and claimed.

For an understanding of my invention, and for illustration of one form thereof, reference is to be had to the accompanying drawings, in which:

Fig. 1 is a sectional view showing the positions of the parts when the breaker is in closed circuit position.

Figs. 2 and 3 respectively illustrate intermediate and final positions of the parts shown in Fig. 1 for automatic tripping.

Fig. 4 illustrates the positions of the parts when the breaker has been opened manually.

Referring to Fig. 1, the movable contact member 1 having a tip or contact 2 for engaging the fixed contact 3 is biased toward open circuit position, as by the spring 4. The operating handle or setting member 5 which is pivotally mounted upon pin 6 is connected to toggle link 7 as by pin 8. The toggle member 9 is connected at one end by pin 10 to the movable contact member and at its other end by pin 11 to toggle link 7.

In effect there are two toggles, one formed by members 9 and 7, and the other by member 7 and handle 5. With the contacts in closed position, as shown in Fig. 1, both toggles are preferably slightly overtravelled. Downward movement of pin 11 of the first or main toggle by spring 4 is prevented by the stop member 12 and downward movement of pin 8 of the second toggle is prevented by the engagement between shoulder 13 of the handle 5 and the stop member 14.

The attraction of the main poles 16 of the tripping coil 15 tends to move the armature 17 in counter-clockwise direction but for normal values of current the magnetic restraint imposed by the auxiliary pole 18 prevents the armature from moving. For high current values, the section 19 connecting the auxiliary pole piece 18 to the lower main pole becomes saturated so that the attraction of the main poles predominates, swinging the armature so that its upper end 20 engages the finger 21 of toggle member 7 and raises the pin 11 over center to break the main toggle.

For lighter sustained overloads, the armature 17 is forced away from the magnetic stop or auxiliary pole by the cam 22 carried by or integral with the slide 22*a* which is guided by the auxiliary pole piece 18 and is movable by the bimetallic strip 23, or equivalent. The strip may be heated either by passage of current through it or by transfer of heat from a coil or heating unit adjacent thereto.

The distance through which the armature is moved from the stop 18 before the attraction of the main poles moves the armature to toggle-breaking position is a function of the overload. For light overloads, the distance through which the armature is moved by cam 22 before the attraction of the main poles is sufficient to actuate the armature is greater than for heavier overloads, and the time is greater the lighter the overload.

Upon breaking of the main toggle whether instantaneously for heavy overloads, or after a time delay for lighter overloads, the spring 4 moves the movable contact 2 to open circuit position, as shown in Fig. 2. The automatic opening of the contacts is effected even though the handle 5 is held in the closed circuit position, Figs. 1 and 2.

Assuming that the handle is free and that the contacts have been opened automatically, the handle swings to the open circuit position shown in Fig. 3 with concurrent resetting of the main toggle. To assist this action, there may be utilized the straightening spring 24 at the pin 11, and spring 25 at the handle pivot

6. In the arrangement shown, the pivot 6 is so displaced from the center of gravity of the handle that one or both of these springs may be omitted.

To reclose the breaker, the handle 5 is swung upwardly to the position shown in Fig. 1 which resets the second toggle.

To open the breaker manually the handle is pushed or flipped downwardly to raise the pin 8 over center breaking the second toggle whereupon the spring 4 separates the contacts and moves the handle to open circuit-position, Fig. 4.

Thus far described, the circuit-breaker corresponds to the apparatus described and claimed in my copending application Serial No. 632,527, filed September 10, 1932, and although the position of the handle indicates whether the breaker is open or closed, there is no indication of whether the breaker has been opened automatically or manually.

Circuit breakers of the aforesaid type are used on distribution panels and it is desirable that the operator should be able to tell at a glance which circuits are closed, which circuits are open, and whether the open circuits have been opened automatically in response to abnormal circuit conditions, or manually. It is the main purpose of the present invention to supply that need.

Referring again to Fig. 1, when the circuit breaker is in closed circuit position, the indicator 26, which is slidable in the slot 27 of the cover plate 28 of the breaker, is held in the retracted position by the spring catch 29 having a tip 30 engaging the shoulder 31 of the indicator slide to preclude its movement by the spring 32.

When the armature is attracted to the main pole pieces, either instantaneously for heavy overloads or after a time for lighter overloads, as above described, the latch 29 is lifted permitting the spring 32 to move the slide 26 so that it projects outside of or beyond the cover 28, Fig. 3. In the particular circuit-breaker shown, when the armature breaks the main toggle, one of the toggle members, as shown in Fig. 2, strikes the end 33 of latch member 29, raising the tip 30 free of the shoulder 31 of the indicator. If desired, the indicator may be directly actuated by the electro-responsive means instead of through the intermediary of the contact system.

Then as the main toggle resets and handle 5 moves to open circuit position, Fig. 3, the spring 32 forces the slide 26 outwardly so that its end 34, which may be colored for contrast, projects beyond the cover to afford a visible indication externally of the housing that the breaker has opened in response to abnormal circuit conditions. The projecting end of the slide can be felt by the operator, affording an indication under conditions of insufficient light for visual observation.

When the circuit-breaker is tripped manually, the main toggle does not break and latch 29 continues to hold the slide 34 in retracted position (Fig. 4). The position of the handle affords an external indication that the breaker is open and the lack of appearance of slide tip 34 indicates that it was opened manually.

As above mentioned, the breaker is tripped manually by pressing downwardly, as with a finger, upon the projection 35 of the setting member 5. As soon as the toggle pin 8 moves over center, the spring 4 opens the contacts and throws the handle 5 to the lower position, Fig. 4. As for quick separation of the contacts, the spring 4 should be quite powerful, there is a tendency for the handle to rebound, and if the pin 11 of the main toggle chances to be under center at that instant, the main toggle breaks and releases the indicator 26, giving a false indication. To prevent this the main toggle is maintained in overtravelled condition, or at least prevented from breaking, during the opening movement following manual tripping, one of the toggle members, preferably link 9, is provided with the depending arms 36 giving a mass distribution which increases the stability of the toggle. The spring 24 also assists in holding the main toggle straight during its movement after tripping by hand.

To reclose the breaker, it is only necessary to push upwardly on the tip 35 to reset the second or latching toggle, i. e., until the handle is restored to the position shown in Fig. 1. If the breaker is reset after automatic tripping, the shoulder 37 of the handle during its movement to the "on" position engages the lower end of spring 32 and forces it back, the spring in turn pulling back the indicator 26 so that its tip no longer projects from the front of the breaker housing. The curved rear end of the slide 26 at first cams up the latching tip 30 and as the slide continues to move back the tip snaps down in front of shoulder 31, as in Fig. 1, to complete the resetting of the device.

If when the breaker is closed, a heavy overload exists, the armature at once breaks the main toggle to separate the contacts and to release latch 29 even though the handle is still held by the operator, the parts assuming the positions shown in Fig. 2. Upon release of the handle, it at once moves to its lower or open-circuit position and the indicator 26 slides outwardly to indicate that the breaker has tripped because of abnormal circuit conditions. The spring 32 which actuates the slide 26 may also effect or assist movement of the handle 5 to "open" position.

For multi-circuit use, a plurality of breakers as shown may be disposed adjacent one another with their operating handles connected to a common actuator bar or equivalent. With this arrangement, all circuits may be manually opened or manually closed simultaneously, and any one or more of the breakers may open automatically without affecting the remaining breakers. Upon such automatic tripping, the indicator of the particular breaker is released to indicate the abnormal condition of the circuit including it.

Or the armatures for several coils, as 15, disposed in different legs of a circuit, or different circuits, may upon abnormal current conditions trip all poles and indicate in which circuit, or leg of the circuit that the abnormal condition exists.

While for purposes of explanation, I have illustrated a specific form of circuit breaker, it is to be understood that my invention is not limited in its application thereto, but is co-extensive in scope with the appended claims.

What I claim is:

1. A circuit-controlling device comprising separable contacts, manually operable means for effecting actuation of said contacts, electro-responsive means for effecting actuation of said contacts, structure whose position indicates the circuit relation of said contacts, and means for

indicating whether the position of said structure is the result of manual or automatic actuation of said contacts comprising means responsive solely to one of said actuating means.

2. A circuit-controlling device comprising separable contacts, manually operable means for effecting engagement or separation of said contacts, electro-responsive means for effecting separation of said contacts, structure movable to one position during engagement of said contacts by said manually operable means and movable to a second position upon separation of said contacts by either said manually operable means or said electro-responsive means, and means for indicating whether said second position of said structure is the result of manual or automatic actuation comprising means responsive to actuation by said electro-responsive means.

3. A circuit-controlling device comprising contacts, manually operable means for opening and closing said contacts, electro-responsive means for opening said contacts, and indicating structure mechanically actuated upon opening of said contacts solely by said electro-responsive means and reset only by contact-closing movement of said manually operable means.

4. A circuit-controlling device comprising separable contacts, means for holding said contacts in engagement, a visual indicating structure biased to an indicating position, means for restraining movement of said indicating structure, and electro-responsive means for releasing said holding means and substantially concurrently releasing said restraining means.

5. A circuit-controlling device comprising separable contacts, means for holding said contacts in engagement, a visual indicating structure biased to an indicating position, means for restraining movement of said indicating structure, electro-responsive means for releasing said holding means and substantially concurrently releasing said restraining means, and manually operable means for reclosing said contacts and substantially simultaneously resetting said indicator.

6. A circuit-controlling device comprising separable contacts, manually operable means for opening and closing said contacts including a toggle which remains unbroken for operation of said contacts by said means, electro-responsive means for breaking said toggle to effect opening of said contacts, and an indicator actuated by breaking of said toggle.

7. A circuit-controlling device comprising separable contacts, toggles for holding said contacts in closed position, manually operable means for breaking one of said toggles to effect separation of said contacts, electro-responsive means for breaking another of said toggles to effect separation of said contacts, and an indicator responsive to breaking of said second toggle only.

8. A circuit-controlling device comprising separable contacts, toggles for holding said contacts in closed position, manually operable means for breaking one of said toggles to effect separation of said contacts, electro-responsive means for breaking another of said toggles to effect separation of said contacts, and an indicator responsive to breaking of said second toggle only and reset during resetting of said first toggle by said manually operable means.

9. A circuit-controlling device comprising separable contacts, serially connected toggles for holding said contacts in closed position, structure movable to open circuit indicating position upon breaking of either of said toggles, electro-responsive means for breaking one of said toggles, manually operable means for breaking the other of said toggles, and an indicator for indicating whether said contacts were separated automatically or manually comprising means actuated by breaking of one only of said toggles.

10. A circuit-controlling device comprising separable contacts, means for holding said contacts in engagement, manually operable means for tripping said holding means, electro-responsive means for tripping said holding means, a visual indicating structure biased to an indicating position, and restraining means therefor released upon tripping of said holding means by one only of said tripping means.

11. A circuit-controlling device comprising separable contacts, means for holding said contacts in engagement, manually operable means for tripping said holding means, electro-responsive means for tripping said holding means, a visual indicating structure biased to an indicating position, restraining means therefor released upon tripping of said holding means by said electro-responsive means, and restoring means for said indicating structure actuated by said manually operable means only during reclosure of said contacts after automatic tripping.

12. A circuit-controlling device comprising separable contacts, structure for manually opening and closing said contacts including a toggle which remains unbroken for actuation of said contacts by said structure, electro-responsive means for breaking said toggle to effect separation of said contacts, an indicator actuated by breaking of said toggle to indicate automatic tripping of the device, and means for preventing the rebound of said structure upon manual operation thereof from breaking said toggle thereby to preclude a false indication by said indicator.

13. A circuit-controlling device comprising separable contacts, structure for manually separating said contacts comprising a toggle which remains unbroken during said separation, electro-responsive means for breaking said toggle to effect separation of said contacts, and an indicator actuated by breaking of said toggle to indicate automatic tripping, said toggle having the characteristic that its mass distribution precludes breaking of the toggle by rebound of said structure upon manual separation of said contacts.

14. A circuit-controlling device comprising separable contacts, manually operable actuating means therefor including handle structure movable to one position to effect engagement of said contacts and to another position to effect separation thereof and a toggle remaining unbroken for said manual actuation of said contacts, electro-responsive means for breaking said toggle to effect separation of said contacts, means for resetting said toggle when broken and for moving said handle structure to said second position, and an indicator actuated upon breaking of said toggle.

15. An enclosed automatic circuit-breaker having a manual control and contact-position indicating member outside of enclosure, and another member giving indication only when the circuit breaker has opened automatically.

16. A circuit controlling device having separable contacts, means for holding the contacts

in closed position comprising a system of toggles with two knees, manual means for breaking solely the first knee, and electro-responsive means for breaking the second knee, and means operative upon separation of said contacts for indicating which toggle knee was broken first.

17. A circuit-breaker comprising separable contacts, means for manually moving said contacts into and out of engagement, means for holding said contacts in engagement, electro-responsive tripping means, an indicator, means for restraining said indicator in inoperative position releasable only by said electro-responsive means, and means for resetting said indicator normally out of the path of said first means and engageable thereby only subsequent to release of said restraining means by said electro-responsive tripping means.

18. A circuit controlling device comprising separable contacts, manually operable means for opening and closing said contacts, electro-responsive means for independently controlling the opening of said contacts, and visual indicating structure biased to an indicating position and normally latched in a non-indicating position, said indicating structure being unlatched solely in response to operation of said electro-responsive means.

19. A circuit controlling device comprising separable contacts, manually operable means for opening and closing said contacts, electro-responsive means for independently controlling the opening of said contacts, and visual indicating structure biased to an indicating position and normally restrained in a non-indicating position, said indicating structure being released solely in response to operation of said electro-responsive means and being reset by movement of said manually operable means.

20. A circuit controlling device comprising separable contacts, manually operable means for opening and closing said contacts, a thermal element for independently controlling the opening of said contacts, and visual indicating structure biased to an indicating position and normally restrained in a non-indicating position, said indicating structure being released in response to operation of said thermal element.

21. A circuit controlling device comprising separable contacts, manually operable means for opening and closing said contacts, a thermal element for independently controlling the opening of said contacts, and visual indicating structure biased to an indicating position and normally restrained in a non-indicating position, said indicating structure being released in response to operation of said thermal element, and being reset by movement of said manually operable means.

22. A circuit controlling device comprising separable contacts, means for normally holding said contacts in engagement, a visual indicating structure biased to an indicating position and normally restrained in a non-indicating position, and means including an electro-responsive device for initiating separation of said contacts and movement of said indicating structure to indicating position.

23. A circuit controlling device comprising separable contacts, means for normally holding said contacts in engagement, a visual indicating structure biased to an indicating position and normally restrained in a non-indicating position, and means including a thermal element for rendering said holding means ineffective and effecting separation of said contacts and substantially simultaneously releasing said indicating structure.

24. An enclosed automatic circuit breaker having an external manual control member operative to close and open said breaker, a visual overload indicating structure biased to an indicating position and normally restrained in a non-indicating position, and electro-responsive means including an overload thermal element effective to initiate opening of said breaker and movement of said indicating structure to indicating position.

25. An enclosed automatic circuit breaker including overload responsive means, and a visual overload indicating structure biased to an indicating position but normally restrained in a non-indicating position and released solely in response to operation of said overload responsive means.

26. An enclosed automatic circuit breaker including an external manual control member operative to open and close said breaker, overload responsive means for independently initiating opening of said breaker, a visual overload indicating structure biased to an indicating position but normally restrained in a non-indicating position, and released in response to opening of said breaker upon operation of said overload responsive means but unaffected by manual opening of said breaker.

HERBERT C. GRAVES, JR.